### Programs for Demographic Calculations

1. Population analysis by age and sex
2. Construction of life tables

### Programs for Indirect Estimation

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**PANDEM**

**User’s Manual**

**Latin American Demographic Centre (CELADE)**

Economic Commission for Latin America and the Caribbean (ECLAC)

United Nations
PACKAGE FOR DEMOGRAPHIC ANALYSIS BY MICROCOMPUTER
(PANDEM)

Version 2.00  (August 1988)

USER'S MANUAL

ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN (ECLAC)

LATIN AMERICAN DEMOGRAPHIC CENTRE (CELADE)
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Chapter I: INTRODUCTION

A. Introduction to PANDEM

The "PACKAGE FOR DEMOGRAPHIC ANALYSIS BY MICROCOMPUTER" (PANDEM) was created with the objective of helping demographers and users with related knowledge in the carrying out of common demographic calculations and facilitating the estimation of mortality and fertility using a series of indirect methods. The methods included in the present version represent a collection of those which are most widely used in Latin America and have proven to be of great utility.

Although the package uses a microcomputer (an IBM Personal Computer or compatible machines such as EPSON, COMPAQ, etc.), it can be operated with a minimum or even no training by users with no previous knowledge or experience. It has also been designed to permit a high degree of interaction between the user and the package, permitting, for example, rapid and easy experimentation with different procedures and the carrying out of modifications to the input data.

We request the co-operation of PANDEM users to help us improve and expand the package, by sending to CELADE comments on the system in general, on specific routines, or on new techniques which could be incorporated into future versions. Correspondence should be addressed to the Latin America and the Caribbean Population Information Programme, CELADE, Casilla 91, Santiago, Chile.

B. Target audience for this manual

This Manual is directed mainly at persons who are familiar with the techniques of demographic analysis, particularly the application of indirect procedures for demographic estimation. It is not designed to introduce indirect techniques to non-demographers.

The Manual presents sufficient information on each technique to permit the user to decide whether it is appropriate for the available data; in addition, it gives bibliographic references which describe the procedure and give concrete examples of its use.

Users of the Manual do not need to have previous experience in the use of microcomputers.

C. Contents of PANDEM

The PANDEM package contains a series of routines or programs for demographic analysis which are divided into two categories:

1. Routines for demographic calculations

With the aim of introducing PANDEM, there follows a brief description of each of the available routines. More detailed information and the exact manner of using each routine is given in Chapter III of this Manual.

1. Routines for demographic calculations

   a) **Analysis of the population by sex and age.** This program calculates a series of indicators of the population by sex and age (single years of age or five-year age groups), among them: sex ratios by age group, relative distribution by age, indices of Myers and Whipple, dependency ratio, mean and median age, etc.

   b) **Construction of life tables** based on different available inputs; for example: population and deaths, central mortality rates or probabilities of death.

2. Routines for indirect estimation of fertility and mortality

   a) **Estimation of fertility by the P/F method,** if births are available from a census or survey (children born in the year preceding the census or survey) or from vital registers.

   b) **Estimation of fertility by the P(1+)/F(1) method** in which information is used on births of first order obtained from a census, survey or register, instead of all children as in the previous routine.

   c) **Estimation of infant and childhood mortality** using Brass' method (Coale-Trussell variant) which converts the proportion of dead children by five-year age groups of mothers into probabilities of death between birth and exact age 1.

   d) Estimation of female adult mortality using the method of maternal orphanhood developed by Brass. This method converts the proportions of persons whose mother is not dead into survival probabilities from age 25.

   e) Estimation of male adult mortality using Brass' method of paternal orphanhood, which converts the proportions of children whose father is not dead into survival probabilities from age 32.5 or 37.5.

   f) Estimation of male adult mortality using the method of female widowhood, which converts the proportions of women who are not widows of their first spouse or partner, with respect to those women ever married or in a union, into probabilities of survival from age 20.

   g) Estimation of female adult mortality using the method of male widowhood. This method converts the proportions of men who are not widowers of their first spouse or partner, with respect to those men ever married or in a union, into probabilities of survival from age 20.

   h) Estimation of a factor for the correction of observed mortality rates by age (beginning at age 5 or higher) and a rate of natural increase, using Brass' method of the distribution of deaths by age.
D. Basic information for use of the microcomputer and this Manual

It is not necessary to have much knowledge of the way a computer works to use PANDEM successfully. However, the following information will facilitate the efficient use of the computer with PANDEM and will help in the use of this manual.

Keys: In this manual, square brackets "[ ]" are used to refer to a key according to the letter or symbol written on it, for example: [2], [PrtSc], [Enter].

Special function keys [Fx]: To the left of the main keyboard (or, for some machines, above the row of numeric keys at the top the basic keyboard) are a set of special keys labelled [F1] through [F10] (or more on some machines). PANDEM uses some of these keys for its own special functions, as follows:

[F1]: Has the same function as the "Left" arrow key (4 on the numeric keypad), and moves the cursor to the left along a row of data independently of the status of the "Num Lock" key.

[F2]: Has the same function as the "Right" arrow key (6 on the numeric keypad), and moves the cursor to the right along a row of data independently of the status of the "Num Lock" key.

[F3]: Has the same function as the "Up" arrow key (8 on the numeric keypad), and moves the cursor up a column of data independently of the status of the "Num Lock" key.

[F4]: Has the same function as the "Down" arrow key (2 on the numeric keypad), and moves the cursor down a column of data independently of the status of the "Num Lock" key.

[F8]: This key is used by PANDEM to permit the user to return to either the previous screen, the previous menu option in the routine being used, or to the main menu as the case may be, in order to change selections without having to abandon the run.

[F9]: This key is used by PANDEM to permit the user to make a new choice among the options available in the routine being used.

[F10]: This key is used by PANDEM to permit the user to return to the First Menu within each routine to begin a new run with the routine just used, or from the First Menu to the Main Menu to select another routine, without exiting from PANDEM.

Note: Keys [F1], [F2], [F3] and [F4] are always operational when the user is entering or correcting data. The other special function keys are only available within the menus, and at certain points in some or all of the routines; when [F8], [F9] and/or [F10] are available, and not part of a menu, they should appear, highlighted and with the appropriate key-words (e.g., "Previous Menu") at the bottom of the screen.
Note: Whenever a key is struck "illegally" (that is, when a command is requested by PANDEM and the key struck is not one of the possible responses), the computer will "beep", indicating that you must choose one of the available commands.

Screen: To facilitate the interaction between the user and the computer, the "dialogue" between the two is displayed on a screen. In this manual, the exhibits are shown in a form as near as possible to that which appears on the screen. For example, the menus appear in boxes defined by double or single horizontal lines and single vertical lines, similar to the solid lines which appear on the actual screen. Other parts of certain screen displays are not outlined in this way, and in the manual are simply shown separated from the text by blank lines, or together with menu boxes if they appear on the screen simultaneously. To print what appears on the screen, press the [Shift] and [PrtSc] keys at the same time.

E. Equipment needed to use PANDEM

PANDEM will work on an IBM PC microcomputer or other compatible model such as EPSON, COMPAQ, etc. All its programs are written in the language Quickbasic, Version 3.0, of Microsoft.

512 Kb of memory are needed, 1 hard disk, 1 floppy disk drive and a monitor (color or monochrome). It is very convenient to have a printer.

F. Installation of PANDEM

The PANDEM programs are written on three two-sided, double density diskettes, with 360 Kb capacity each. To work with the PANDEM routines, it is necessary to install the PANDEM programs on the hard disk, and prepare a work disk, either on the hard disk or on a floppy disk, to store the data and the results. The following steps must be used:

1. Turn on the microcomputer. On the screen will appear the following:

    C>

2. Position yourself in any hard disk drive in which you want to store the system (for example C:). Make sure that the selected drive has 1.3 Mb free for the PANDEM files.

3. Insert PANDEM disk 1 in drive A: and then enter:

    A:INSTALL [ENTER]

4. Follow carefully the instructions given by the program.

Note: It is imperative to use the INSTALL procedure because the files come in a compressed form in the system diskettes.
5. Establish a "path" to the PANDEM directory.

If you have an AUTOEXEC.BAT, edit it with any editor available like EDLIN, SIDEKICK, or similar, and put the following command:

    PATH=C:\PANDEM

If the AUTOEXEC.BAT file already has a PATH command, just append to the end of it the following:

    C:\PANDEM

Be sure to save the AUTOEXEC.BAT file and to "reboot" the system again (using [CTRL-ALT-DEL]), in order for the new path to be effective. After this PANDEM should be ready to be used.

6. Last updates and/or changes.

Please, read the file README, or print it using the command

    C> PRINT C:\PANDEM\README

This file contains the last minute changes and/or user notes concerning the PANDEM operation.

7. Installation check.

The installation procedure should have created the directory C:\PANDEM for the system programs and auxiliary files, and C:\PANTEST with the example files. This directory should be used as the working directory for the examples that go with the system.

8. Executing PANDEM.

8.1 Using floppy disks.

In this case, be sure that the diskette is formatted. If not, refer to the DOS manual on how to format a floppy disk. Please, be very careful with the FORMAT command to avoid formatting the hard disk, which would destroy all the programs and data on it (and essentially "kill" your computer).

Insert the already formatted disk in the drive you want to use (generally "A" or "B") and position yourself in this drive, by executing the command:

    C> A: [ENTER] or C> B: [ENTER]

The system should answer by changing the "prompt", to

    A> or B>

After that, please execute the command
8.2 Using a hard disk.

In this case, it is better if you work inside a directory. If you do not have one, create one with any name (USERWORK in this example), and position yourself inside it, with the following commands:

C> MD USERWORK [ENTER]

C> CD USERWORK [ENTER]

If you already have a working directory, please position yourself inside it by executing just the last command.

After that, please execute the command

C> PANDEM [ENTER] and good luck!

Note: Do not use the directory C:\PANDEM as your working directory.
Chapter II: GENERAL OPERATION OF PANDEM

A. Starting a PANDEM session

If PANDEM is not already installed on your computer, go through the seven steps described in Section F of Chapter I above. If PANDEM is already installed, simply turn on the machine, and when the DOS prompt (C>) appears, go through either step 8.1 of Section F above, if your workfile is to be on diskette, or step 8.2, if your workfile is in your working directory on the hard disk.

B. The PANDEM menus

PANDEM works with various menus, and several options in each menu. When PANDEM is loaded for the first time (with no options, or defaults, ever having been saved) the first screen will appear as follows, always in Spanish:

```
PANDEM V02.00, Agosto 1988
PAQUETE PARA ANALISIS DEMografico POR MICROCOMPUTADOR
Centro Latinoamericano de Demografia (CELADE)

Sí desea Castellano
Ingresé C

If you wish English
Enter E
```

If you enter E the remaining screens will appear in English; if C is entered, the session will be conducted in Spanish. From here on, in this manual, it will be supposed that English has been selected; for the corresponding Spanish instructions and screens, please see the Spanish version of this manual.

When E has been entered, there will appear, below the display already on the screen, an additional box asking you to indicate where the work disk is to be found:

```
Indicate work unit[d:]\[directory], if blank
assumes [d:] \working directory
```

If you strike [ENTER] without specifying anything further, PANDEM will assume that you are using the working directory from which you entered the package (that is, a diskette in drive A or B, or your own directory on the hard disk. If you wish, you may instead specify another work unit and then strike [ENTER].

Note: In order to specify a disk drive it is necessary to place a ":" after the corresponding letter (for example, "A:"). To specify a hard disk sub-directory you must enter the full path (for example, "C:\TEST\WORK").
When this indication has been given, a further box will appear below those already present:

Indicate Y if you have a graphics screen
if blank assumes NO

with the indication that this option has not yet been implemented, and at the same time there appears on the screen the choice of saving the options defined so far as defaults to be used automatically for future runs, or not:

Save these options (Y/N)

If you indicate N, and if there is not already a defaults file saved in the working directory, when you next load PANDEM it will again present all the above choices.

If you indicate Y, the options chosen from the same working directory in this run will be saved as defaults, and the next time you load PANDEM it will assume that you want the same choices again. In this case, the first screen will be the main menu.

Once all the initial options have been indicated, PANDEM shows, on a fresh screen, the main menu:

PANDEM V02.00, August 1988

PAQUETE PARA ANALISIS DEMOGRÁFICO POR MICROCOMPUTADOR
Centro Latinoamericano de Demografía (CELADE)

MAIN MENU

<table>
<thead>
<tr>
<th>Enter</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Menu of Demographic Calculations</td>
</tr>
<tr>
<td>2</td>
<td>Menu of Indirect Estimation</td>
</tr>
<tr>
<td>4</td>
<td>Working definitions (SET-UP)</td>
</tr>
<tr>
<td>F10</td>
<td>END</td>
</tr>
</tbody>
</table>

disk for data and results : [d:\directory]
Graphics option : NO graphs

where [d:\directory] shows your work disk. Note that the identification "PANDEM V02.00, August 1988" always appears at the top right-hand corner of the screen, wherever you are in PANDEM.

The value 1 or 2 may be selected from the left-hand column to work with one of the sets of demographic routines: e.g. the value 1 to see the Menu with the "Demographic Calculations". Then, an option may be selected from this second menu to do calculations with a specific routine.
The value 4 may be selected to change the definition of the work disk and/or language, in the case that the defaults last saved are not appropriate for the present user. Once these have been chosen, the main menu is again presented so that one of the two sets of routines may be chosen.

If any other value outside the range of valid values on a menu is entered nothing happens; the system will not accept such a value and will "beep" and wait for a valid value.

With [F10] in the Main Menu you will return to the DOS operating system and be outside the PANDEM system. With all the menus the function key [F10] means that you want to return to the routine's first menu. (Note: if there is no Defaults file saved in the working directory, you will first have to go through the steps of entering choice of language, work directory and saving (or not) these choices, before you are sent to the Main Menu.)

At most points in the various routines, [F8] takes you back to the previous option of the same routine, while the choice [F9] is frequently presented to allow you to choose any one of the routine's options.

C. General operation of PANDEM

All the routines of PANDEM have a common basic structure. From the package's Main Menu the user chooses one of the two basic sets of routines, then within the Menu for that set of routines chooses the specific routine required. Each of the routines in turn has its own Options Menu which lists all the routine's sub-menus, which can be accessed directly in certain circumstances (see step 2. below); the first time a set of data are analyzed with a given routine, the package guides the user through the sub-menus in the appropriate order.

The general operation of all the routines will be illustrated by way of an example. In this example we will work with Option 2, that is, "Indirect Estimates", from the Main Menu, from which one enters [2] and the menu for indirect estimates appears.

<table>
<thead>
<tr>
<th>Programs for indirect estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>F8</td>
</tr>
</tbody>
</table>
Note that as an exception to the "[F10]" rule, in this menu and its companion menu for choice of routines (Programs for demographic calculations), only, [F8] is used to return to the Main Menu.

To select the desired routine, enter the number which appears at the left.
To continue with the example, enter [4] for "Maternal Orphanhood".

Note: When you make this selection, or a selection from the Menu of Demographic Calculations, the message "File not found" appears briefly below the menu. This message should be ignored: it quickly disappears and the menu for the selected routine appears.

Data Entry

1. All the routines begin by asking for a decision on the data to be used:
if they are data which are already stored in the working directory, or if new data are to be entered. In both cases you must give the name (without extension) of the file where the data are stored.

The First Menu of each routine is as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

2. If option 2 or 3 is chosen (that is, a suitable data set already exists), below the menu are displayed the names (with extension) of all the data files already existing on the working directory which are in the right format for this routine (that is, they have the PANDEM extension for the routine being used), as follows:

file name (without extension) ////////// ENTER end entry
List of Data Files from [d:\directory]
filexxxx.ext fileyyyy.ext filezzzz.ext

One of these filenames, without extension, must be entered in the highlighted space provided. To the right of the list of files, appear the instructions "ENTER end entry" and "ESC cancel", indicating that you should press [ENTER] when you have finished typing the desired filename, or [ESC] to cancel the choice and select another.

You can use [F9] to access the Options Menu of the routine which permits you to go to any part of the sub-menus to make the modifications or corrections you wish.
In the case of the "Maternal orphanhood" routine, the Options Menu appears as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>2</td>
<td>Enter Mean Age of Mother</td>
</tr>
<tr>
<td>3</td>
<td>Date</td>
</tr>
<tr>
<td>4</td>
<td>Coale Demeny model</td>
</tr>
<tr>
<td>5</td>
<td>Results option</td>
</tr>
</tbody>
</table>

In this example, and in the description of each routine in its corresponding chapter, the Options Menu will be shown but the steps of the routine will be described as the package would present them in the case of the selection of option 1 from the First Menu, for entry of new data.

3. If option 1 is chosen from the First Menu (e.g., to enter new data), you must go as far as the results of the routine before being able to go to the Options Menu. Before asking for the principal input quantities, the simple parameters or options to be used are requested. In the case of the "Maternal orphanhood" routine, the system asks whether the mean age of the mothers will be entered directly, or the data for the calculation of this age.

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enter the mean age of the mothers</td>
</tr>
<tr>
<td>2</td>
<td>Have the program calculate it</td>
</tr>
</tbody>
</table>

At this point the bottom line of the screen shows:

[F8] Previous Option  [F10] First Menu

to indicate that these choices are available. This or similar lines (for example, including [F9] for the Options Menu as well if you are working with a previously-created data file) will appear at many steps in the different routines, and will not be repeated in this manual.

4. The basic information is entered using the numbered keys on the top row of the main keyboard. New data may be entered or data already entered and stored on a file may be used.

The cursor initially places itself automatically in the first cell of the table to be filled with data, and at the bottom of the table appears the bright field (shown here by /////////) where the number is to be input into the cell marked by the cursor, as in the following figure:
Once the information has been entered, strike a displacement key (an arrow key or one of the function keys [F1] - [F4]) and the entered number will appear in the cell indicated by the cursor, which will move in the direction indicated by the displacement key and thus step by step the table of basic information is filled in. The [ENTER] key also serves as a displacement key, moving the cursor to the next logical cell, but only works this way when you are entering NEW data.

5. When all information, or a self-contained part of it (i.e., a full column), has been entered, press [ENTER] and the option will be given of correcting any incorrectly entered value or continuing.

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

If you wish to make corrections, use the displacement keys to place the cursor over the value to be corrected; when all corrections have been made, the new data are fixed with an [ENTER] and the previous (above) option will appear once again. When the data are all correct, press [2] to continue.

The routine will then ask for the mean age of the mothers, if you indicated that it would be entered; otherwise it will compute this value from the data. Next, the year of the study is requested, followed by the choice of one or all of the Coale-Demeny families of model life tables. (See Section III.B.4 for full details of these steps.)

6. For the titles of tables of results two lines are available:

<table>
<thead>
<tr>
<th>Title</th>
</tr>
</thead>
</table>
| line 1 | //\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\n
The title is entered into the highlighted fields, each line being finished with an [ENTER].

7. The form in which you want the results shown is asked as follows:
<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

At this point, [F8], [F9] and [F10] are all available in case you want to change something before the actual calculations are done.

If you wish, option 2 will create a file, which will then allow you to obtain additional copies of the results without re-processing the data. PANDEM will write a file in the work directory, with the file name (without extension) already given by the user, automatically adding the appropriate extension. (See next section.)

Next, the program does the calculations (showing "CALCULATING" on the screen) and presents the results. Once it has provided the final table, you are given the choice of pressing [F8] to return to the previous option, [F9] to go to the routine's Options Menu, or [F10] to return to the First Menu of the routine.

Note that it is possible to print what appears on the screen at any moment, pressing [Shift] and [PrtSc] simultaneously.

8. Finally, it should be noted that several of the routines have various error messages which appear on the screen when there is a problem, for example if you have entered data which cannot be used to give sensible results with the routine in question, or if a division by zero occurs, and so on. An error message may also appear in some cases where the Options Menu includes a large number of choices, some of which are incompatible with others. This last happens especially in the routine which constructs life tables.

D. Creation of data files and output

For each of PANDEM's routines, there are two situations in which new files are created: (a) when new data are entered and (b) when the results of the routine are listed on a disk. In case (a), the user will be asked to give the name of the file where the information is to be stored, that is, the first part of the complete file name (e.g. BRASIL88.EXT, where BRASIL88 is the name and EXT is the extension).

When the file name has been given, PANDEM automatically adds the extension. Depending on the routine and on whether the file is for input data or output of a listing on a disk, the following extensions are used:
## Extension used by PANDEM for

<table>
<thead>
<tr>
<th>ROUTINE</th>
<th>Input data</th>
<th>Listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demographic calculations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Pop. by age and sex</td>
<td>AND</td>
<td>ANL</td>
</tr>
<tr>
<td>2. Constr. mort. tables</td>
<td>TMD</td>
<td>TML</td>
</tr>
<tr>
<td>2. Indirect Estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. P/F</td>
<td>FAD</td>
<td>FAL</td>
</tr>
<tr>
<td>2. P(1+)/F(1)</td>
<td>FBD</td>
<td>FBL</td>
</tr>
<tr>
<td>3. Inf. &amp; child mort.</td>
<td>MOD</td>
<td>MOL</td>
</tr>
<tr>
<td>4. Maternal orphanhood</td>
<td>OMD</td>
<td>OML</td>
</tr>
<tr>
<td>5. Paternal orphanhood</td>
<td>OPD</td>
<td>OPL</td>
</tr>
<tr>
<td>6. Female widowhood</td>
<td>VFD</td>
<td>VFL</td>
</tr>
<tr>
<td>7. Male widowhood</td>
<td>VMD</td>
<td>VML</td>
</tr>
<tr>
<td>8. Dist. death by age</td>
<td>BRD</td>
<td>BRL</td>
</tr>
</tbody>
</table>

Note that, for a given routine, the same name is used for both files, as PANDEM will assign different extensions for the input data and listing files. For example, when working with the Maternal Orphanhood routine with data for 1988 from Brasil, the name assigned by the user to the input data file could be BRASIL88. PANDEM will call the input data file BRASIL88.OMD and the output file BRASIL88.OML.

As mentioned above (Chapter I, Point F, No. 7), in the directory C:\PANTEST there is a set of example data sets, one for each routine (and three for distinct variants of the construction of mortality tables). These data sets may be used to practice using the various options of each routine.
Chapter III: DESCRIPTION AND USE OF EACH ROUTINE

This chapter describes in detail the methodology and the procedures of each routine. Approximately the following format is used for each routine:

a. Objectives of the routine  
b. Basic information  
c. Description of the method  
d. Options of the routine  
e. Results provided by the routine  
f. Form of operation of the routine  
g. Bibliographical references

The list of routines in PANDEM is shown in Table III-1. The descriptions of each routine appear in the same order.

Table III-1

LIST OF ROUTINES IN PANDEM

A. DEMOGRAPHIC CALCULATIONS

1. Population analysis by age and sex  
2. Construction of life tables

B. INDIRECT ESTIMATION

1. Estimation of fertility by the P/F method  
2. Estimation of fertility by the P(l+)/F(l) method  
3. Infant and childhood mortality  
4. Maternal orphanhood  
5. Paternal orphanhood  
6. Female widowhood  
7. Male widowhood  
8. Distribution of deaths by age
A. **DEMOGRAPHIC CALCULATIONS**

1. **Population analysis by age and sex**

   a. **Objectives**

   The purpose of this program is to carry out a series of useful demographic calculations using only information on the population by age and sex. In this sense the program allows the calculation of:

   - Population by five-year age groups from the information on the population by single year of age.
   - Relative distribution of the population, by age groups.
   - Sex ratio for the total population and by age groups.
   - Mean age of the population.
   - Median age of the population.
   - Indices of digit preference: Myers and Whipple.
   - Dependency ratio.
   - Percentage of women of child-bearing age, out of the total number of women.
   - Child-woman ratio.

   b. **Basic information**

   The program can work with any of the following information:

   i) Male population by single year of age or by five-year age groups.

   ii) Female population by single year of age or by five-year age groups.

   iii) Total population by single year of age or by five-year age groups.

   c. **Description of the method**

   The procedure followed by each of the demographic calculations of the program is described below.

   (a) **Population by five-year age groups**

   This calculation is done in the case that the population data are entered by single year of age. When the initial age \( u \) is not zero or a multiple of five, the first group will not be for five years. Rather, ages will be grouped from \( u \) to the nearest value with the digit 4 or 9. For example, if \( u = 12 \), the first group will be 12-14. If the initial age of the final open interval \( v \) is not a multiple of 5, the final open group will begin with the immediately preceding multiple of 5.
(b) Population by broad age groups

Whatever the grouping of the input population, the following groups are calculated: 0-14, 15-64, 65+. If \( u \) is different from 0 or \( v < 65 \), this calculation is not done.

(c) Relative distribution of the population by age groups

i) Five-year grouping. The relative distribution of the corresponding population is calculated:

\[ C(x, 5) = \left( \frac{N(x, 5)}{N} \right) \times 100 \]

where:

- \( C(x, 5) \) is the relative distribution for the five-year age groups \((x, x+4)\).
- \( N(x, 5) \) is the population aged \( x \) to \( x+4 \).
- \( N \) is the total input population that is aged \( u \) years or more.

ii) Broad age groups. The relative distribution of the population aged 0-14, 15-64, 65+ is calculated when appropriate.

(d) Sex ratio for total population and by age groups

For this calculation the male and female populations must be provided. The calculation of the sex ratio by five-year age groups is as follows:

\[ IM(x, 5) = \left( \frac{NM(x, 5)}{NF(x, 5)} \right) \times 100 \]

where:

- \( IM(x, 5) \) is the sex ratio for the five-year group \( x, x+4 \).
- \( NM(x, 5) \) is the male population for the five-year group \( x, x+4 \).
- \( NF(x, 5) \) is the female population for the five-year group \( x, x+4 \).

Sex ratios are also calculated for the broad age groups when the information necessary for their formation is provided.

(e) Mean age of the population

The mean age of the input population is calculated, from \( u \) onward. Depending on the form in which the population data are input, the following formulae apply:

i) Population by single year of age:

\[ \bar{x} = \frac{[(100+\nu) \times N(\nu+)+ \Sigma_{x=u}^{x=\nu-1} (x+0.5) \times N(x)]}{N} \]

ii) Population by five-year age groups:

\[ \bar{x} = \frac{[(100+\nu) \times N(\nu+)+ \Sigma_{x=\nu-5}^{x=\nu-1} (x+2.5) \times N(x, 5)]}{N} \]
iii) Population by five-year age groups when \( u \) is not a multiple of 5.

\[
\bar{x} = \frac{((u+z)/2) \times N(u, z-u) + (100+v) \times N(v^+) / 2 + \sum_{x=0}^{u} (x+2.5) \times N(x, 5)}{N}
\]

where \( z \) is the initial age of the first five-year age group.

(f) Median age of the population

As indicated by the statistical definition, this corresponds to the age at which the accumulated population reaches 50 per cent of the total. There is again a difference in the form of the calculation, according to the form in which the data are entered.

i) For the population by single year of age: suppose that the 50 per cent point of the accumulated population is in the age group between the exact ages \( y \) and \((y+1)\). Let \( P(y) \) be the percentage accumulated up to age \( y \); the median age is then:

\[
x = y + [(50-P(y))/(P(y+1)-P(y))]\]

ii) For population by five-year age groups: suppose that the 50 per cent point of the accumulated population is in the age group between the exact ages \( y \) and \((y+5)\). In this case the median age is:

\[
x = y + [(50-P(y))/(P(y+5)-P(y))] \times 5
\]

(g) Myers' index of digit preference

This index, which measures the intensity of digit preference in declaration of age, can only be calculated from the population by single year of age from 10 to 79 years. The methodology used in the present program is described in the document:


This procedure gives as its result an index of the preference or avoidance of each digit, and a combined summary index.

i) Index of preference or avoidance of each digit: the procedure consists of calculating the sum of the population for each digit independently, modifying it in such a way that, if one had the right information, the modified sum should represent 10 per cent of the total. Thus the index is calculated using the deviations from 10 of the relative distribution of the sum of each digit. Hence a positive value indicates a preference for the digit in question and a negative value indicates avoidance.

ii) The overall summary index is calculated as the sum of the absolute values of the indices for each digit. In theory, it varies between 0 (correct information) and 180 (when the entire population declares a single digit).
(h) Whipple's index of preference for the digits 0 and 5

For this index it is necessary to have the population by single year of age from 23 to 62, otherwise it cannot be calculated. The procedure is described in the document:


The formula for the calculation of the index is the following:

\[
WI = 100 \times \left[ 5 \times \frac{\sum_{x=5}^{12} N(x)}{\sum_{x=5}^{62} N(x)} \right]
\]

This index equals 100 when the data are correct, its maximum value is 500 when the entire population declare ages ending in 0 or 5, and its minimum is zero when nobody declares those digits.

(i) Dependency ratio

This is the quotient of the number of children aged 0 to 14 plus old people aged 65 and up, divided by the population of working age (15 to 64 years) for the population of both sexes.

\[
DR = \frac{[N(0,15) + N(65+)]}{N(15,50)}
\]

(j) Percentage of women of fertile age (15 to 49 years) out of the total number of women

\[
100 \times \frac{NF(15,35)}{NF}
\]

(k) Child-woman ratio

Three formulae are given:

\[
CWR(1) = \frac{N(0,5)}{NF(15,30)}
\]

\[
CWR(2) = \frac{N(5,5)}{NF(20,30)}
\]

\[
CWR(3) = \frac{N(10,5)}{NF(25,30)}
\]

The numerator corresponds to children of both sexes. These formulae are an adaptation of those using only girls, as proposed in the document:


d. Options of the routine

The options for the analysis of the population by age and sex are given during the data input and condition the possibility of carrying out certain demographic calculations. Thus the user has the following options:

1) He can work with the male or female population or both sexes independently.
ii) He can enter the population by single year of age, \( N(x) \), or by five-year age groups, \( N(x,5) \).

iii) He may fix the values corresponding to the earliest age \( u \) in the input population and the initial age of the final open interval \( v \). In the case that the total population is input, \( u = 0 \).

e. Results provided by the routine

The output of the routine varies according to the information which is input. When an indicator does not appear in the output, it is because the information provided did not permit its calculation. The examples given below are complete outputs.

i) When population by single year of age is input, the printed output appears on two pages:

ANALYSIS OF THE POPULATION BY AGE AND SEX

PANDEM V02.00, August 1988

first line of title
second line of title

STRUCTURE BY AGE AND SEX

<table>
<thead>
<tr>
<th></th>
<th>Both sexes</th>
<th>Males</th>
<th>Females</th>
<th>Sex ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population %</td>
<td>Population %</td>
<td>Population %</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>303535         100.00</td>
<td>151972          100.00</td>
<td>151563          100.00</td>
<td>100.27</td>
</tr>
<tr>
<td>0 to 4</td>
<td>44695   15.32</td>
<td>23792    15.66</td>
<td>22703   14.98</td>
<td>104.80</td>
</tr>
<tr>
<td>5 to 9</td>
<td>39975   13.17</td>
<td>20548    13.52</td>
<td>19427   12.82</td>
<td>105.77</td>
</tr>
<tr>
<td>10 to 14</td>
<td>38147  12.57</td>
<td>19451    12.80</td>
<td>18696   12.34</td>
<td>104.04</td>
</tr>
<tr>
<td>15 to 19</td>
<td>33165  10.93</td>
<td>16291    10.72</td>
<td>16874   11.13</td>
<td>96.54</td>
</tr>
<tr>
<td>20 to 24</td>
<td>28868  9.51</td>
<td>14302    9.41</td>
<td>14566   9.61</td>
<td>98.19</td>
</tr>
<tr>
<td>25 to 29</td>
<td>23317  7.68</td>
<td>11683    7.69</td>
<td>11634   7.68</td>
<td>100.42</td>
</tr>
<tr>
<td>30 to 34</td>
<td>18192  5.99</td>
<td>9335     6.14</td>
<td>8857    5.84</td>
<td>105.40</td>
</tr>
<tr>
<td>35 to 39</td>
<td>18529  6.12</td>
<td>7861     4.98</td>
<td>7731    5.10</td>
<td>97.80</td>
</tr>
<tr>
<td>40 to 44</td>
<td>13264  4.37</td>
<td>6680     4.40</td>
<td>6584    4.34</td>
<td>101.46</td>
</tr>
<tr>
<td>45 to 49</td>
<td>10163  3.35</td>
<td>4941     3.25</td>
<td>5222    3.45</td>
<td>94.62</td>
</tr>
<tr>
<td>50 to 54</td>
<td>10158  3.35</td>
<td>5019     3.30</td>
<td>5139    3.39</td>
<td>97.66</td>
</tr>
<tr>
<td>55 to 59</td>
<td>7277   2.40</td>
<td>3657     2.41</td>
<td>3620    2.39</td>
<td>101.02</td>
</tr>
<tr>
<td>60 to 64</td>
<td>6256   2.06</td>
<td>2954     1.94</td>
<td>3302    2.18</td>
<td>89.46</td>
</tr>
<tr>
<td>65 to 69</td>
<td>4749   1.56</td>
<td>2199     1.45</td>
<td>2550    1.68</td>
<td>86.24</td>
</tr>
<tr>
<td>70 to 74</td>
<td>3578   1.18</td>
<td>1661     1.09</td>
<td>1917    1.26</td>
<td>86.65</td>
</tr>
<tr>
<td>75 to 79</td>
<td>2270   0.75</td>
<td>964      0.63</td>
<td>1306    0.86</td>
<td>73.81</td>
</tr>
<tr>
<td>80 to 84</td>
<td>1374   0.45</td>
<td>606      0.40</td>
<td>766     0.51</td>
<td>78.91</td>
</tr>
<tr>
<td>85 to 89</td>
<td>532    0.18</td>
<td>192      0.13</td>
<td>340     0.22</td>
<td>56.47</td>
</tr>
<tr>
<td>90 to 94</td>
<td>265    0.09</td>
<td>90       0.06</td>
<td>175     0.12</td>
<td>51.43</td>
</tr>
<tr>
<td>95 and up</td>
<td>198    0.07</td>
<td>46       0.03</td>
<td>152     0.10</td>
<td>30.26</td>
</tr>
</tbody>
</table>

Mean Age : 23.866 23.416 24.356
Median Age : 18.994 18.595 19.397
### DIGIT PREFERENCE

<table>
<thead>
<tr>
<th>DIGIT</th>
<th>Both sexes</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>11.43</td>
<td>1.43</td>
<td>11.07</td>
</tr>
<tr>
<td>1</td>
<td>8.21</td>
<td>-1.79</td>
<td>8.34</td>
</tr>
<tr>
<td>2</td>
<td>11.90</td>
<td>1.90</td>
<td>12.32</td>
</tr>
<tr>
<td>3</td>
<td>9.74</td>
<td>-0.26</td>
<td>9.81</td>
</tr>
<tr>
<td>4</td>
<td>9.55</td>
<td>-0.45</td>
<td>9.64</td>
</tr>
<tr>
<td>5</td>
<td>10.19</td>
<td>0.19</td>
<td>10.13</td>
</tr>
<tr>
<td>6</td>
<td>9.78</td>
<td>-0.22</td>
<td>9.83</td>
</tr>
<tr>
<td>7</td>
<td>9.74</td>
<td>-0.26</td>
<td>9.77</td>
</tr>
<tr>
<td>8</td>
<td>10.26</td>
<td>0.26</td>
<td>10.00</td>
</tr>
<tr>
<td>9</td>
<td>9.20</td>
<td>-0.80</td>
<td>9.10</td>
</tr>
<tr>
<td>Myers (Summary):</td>
<td>7.56</td>
<td></td>
<td>7.05</td>
</tr>
<tr>
<td>Whipple:</td>
<td>111.60</td>
<td></td>
<td>109.26</td>
</tr>
</tbody>
</table>

### OTHER INDICATORS

- Dependency ratio: 0.829
- Percentage of women aged 15 to 49 years: 47.154

### Child/Woman ratio (CWR)

- CWR 0-4 /15-44: 70.185
- CWR 5-9 /20-49: 73.222
- CWR 10-14/25-54: 84.458
ii) For the population by five-year age groups the results fit on a single page.

**ANALYSIS OF THE POPULATION BY AGE AND SEX**

**PANDEM V02.00, August 1988**

<table>
<thead>
<tr>
<th>STRUCTURE BY AGE AND SEX</th>
<th>Both sexes Population</th>
<th>%</th>
<th>Males Population</th>
<th>%</th>
<th>Females Population</th>
<th>%</th>
<th>Sex ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>3035350</td>
<td>100.00</td>
<td>1519720</td>
<td>100.00</td>
<td>1515630</td>
<td>100.00</td>
<td>100.27</td>
</tr>
<tr>
<td>0 to 4</td>
<td>464950</td>
<td>15.32</td>
<td>237920</td>
<td>15.66</td>
<td>227030</td>
<td>14.98</td>
<td>104.80</td>
</tr>
<tr>
<td>5 to 9</td>
<td>399750</td>
<td>13.17</td>
<td>205640</td>
<td>13.52</td>
<td>194270</td>
<td>12.82</td>
<td>105.77</td>
</tr>
<tr>
<td>10 to 14</td>
<td>381470</td>
<td>12.57</td>
<td>194510</td>
<td>12.80</td>
<td>186960</td>
<td>12.34</td>
<td>104.04</td>
</tr>
<tr>
<td>15 to 19</td>
<td>331650</td>
<td>10.93</td>
<td>162910</td>
<td>10.72</td>
<td>168740</td>
<td>11.13</td>
<td>96.54</td>
</tr>
<tr>
<td>20 to 24</td>
<td>288680</td>
<td>9.51</td>
<td>143020</td>
<td>9.41</td>
<td>145660</td>
<td>9.61</td>
<td>98.19</td>
</tr>
<tr>
<td>25 to 29</td>
<td>233170</td>
<td>7.68</td>
<td>116830</td>
<td>7.69</td>
<td>116340</td>
<td>7.68</td>
<td>100.42</td>
</tr>
<tr>
<td>30 to 34</td>
<td>181920</td>
<td>5.99</td>
<td>93350</td>
<td>6.14</td>
<td>88570</td>
<td>5.84</td>
<td>105.40</td>
</tr>
<tr>
<td>35 to 39</td>
<td>152920</td>
<td>5.04</td>
<td>75610</td>
<td>4.98</td>
<td>77310</td>
<td>5.10</td>
<td>97.80</td>
</tr>
<tr>
<td>40 to 44</td>
<td>132640</td>
<td>4.37</td>
<td>66800</td>
<td>4.40</td>
<td>65840</td>
<td>4.34</td>
<td>101.46</td>
</tr>
<tr>
<td>45 to 49</td>
<td>101630</td>
<td>3.35</td>
<td>49410</td>
<td>3.25</td>
<td>52220</td>
<td>3.45</td>
<td>94.62</td>
</tr>
<tr>
<td>50 to 54</td>
<td>101580</td>
<td>3.35</td>
<td>50190</td>
<td>3.39</td>
<td>51390</td>
<td>3.49</td>
<td>97.66</td>
</tr>
<tr>
<td>55 to 59</td>
<td>72770</td>
<td>2.40</td>
<td>36570</td>
<td>2.41</td>
<td>36200</td>
<td>2.39</td>
<td>101.02</td>
</tr>
<tr>
<td>60 to 64</td>
<td>62560</td>
<td>2.06</td>
<td>29560</td>
<td>1.94</td>
<td>33020</td>
<td>2.18</td>
<td>89.46</td>
</tr>
<tr>
<td>65 to 69</td>
<td>47490</td>
<td>1.56</td>
<td>21990</td>
<td>1.45</td>
<td>25500</td>
<td>1.68</td>
<td>86.24</td>
</tr>
<tr>
<td>70 to 74</td>
<td>35780</td>
<td>1.18</td>
<td>16610</td>
<td>1.09</td>
<td>19170</td>
<td>1.26</td>
<td>86.65</td>
</tr>
<tr>
<td>75 to 79</td>
<td>22700</td>
<td>0.75</td>
<td>9640</td>
<td>0.63</td>
<td>13060</td>
<td>0.86</td>
<td>73.81</td>
</tr>
<tr>
<td>80 and up</td>
<td>23690</td>
<td>0.78</td>
<td>9340</td>
<td>0.61</td>
<td>14350</td>
<td>0.95</td>
<td>65.09</td>
</tr>
</tbody>
</table>

0 to 14                  | 1266170               | 41.06 | 637910          | 41.98 | 608260          | 40.13 | 104.87 |
15 to 64                  | 1659520               | 54.67 | 824230          | 54.24 | 835290          | 55.11 | 98.68  |
65 and up                 | 129860                | 4.27  | 57580           | 3.79  | 72080           | 4.76  | 79.88  |

Mean Age : 24.007  Median Age : 19.095

**OTHER INDICATORS**

Dependency ratio: 0.829

Percentage of women aged 15 to 49 years: 47.154

Child/Woman ratio (CWR)

CWR 0-6 /15-44: 70.185
CWR 5-9 /20-49: 73.222
CWR 10-14/25-54: 84.458

**f. Form of operation of the routine**

1. From the main menu of PANDEM select the "Menu of Demographic Calculations" option.

2. Select the program "1. Population analysis by age and sex" within this sub-menu.
### Programs for demographic calculations

<table>
<thead>
<tr>
<th>Enter</th>
<th>For program of</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Population analysis by age and sex</td>
</tr>
<tr>
<td>2</td>
<td>Construction of life tables</td>
</tr>
<tr>
<td>F8</td>
<td>Return to Main Menu</td>
</tr>
</tbody>
</table>

3. Indicate if you want to use one of the following options:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

File name (without extension) /* */ ENTER and entry
List of Data Files from [directory] ESC cancel
filexxx.xxx fileyyyy.yy filezzzz.zz

In the case that 1 to 3 is selected, you must supply the name of the file to be created, modified or used, as the case may be. After entering the name of the file, press the [ENTER] key.

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First menu</td>
</tr>
<tr>
<td>2</td>
<td>Provide total for both sexes</td>
</tr>
<tr>
<td>3</td>
<td>Provide Males</td>
</tr>
<tr>
<td>4</td>
<td>Provide females</td>
</tr>
<tr>
<td>5</td>
<td>Single year of age</td>
</tr>
<tr>
<td>6</td>
<td>Initial age</td>
</tr>
<tr>
<td>7</td>
<td>Final open interval</td>
</tr>
<tr>
<td>8</td>
<td>Data</td>
</tr>
<tr>
<td>9</td>
<td>Results option</td>
</tr>
</tbody>
</table>

If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. Concerning the data to be entered, the following questions appear one at a time on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>if</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Providing total both sexes</td>
</tr>
<tr>
<td>2</td>
<td>Not providing total both sexes</td>
</tr>
</tbody>
</table>
Note: If you enter "2" three times running, indicating that you are not providing either sex, nor the total for both sexes, the microcomputer will "beep" to indicate that you are trying to do an analysis with no data at all. It will automatically show you again the first of the three screens (i.e. for total of both sexes) so that you can select "1" in at least one case.

Note: If you enter "2", then you must use 5-year age groups. PANDEM will accept, for initial age and/or initial age of final open interval, a value which is not a multiple of 5, but will still use five-year age groups, where the first (or last) group has a non-standard size. For example, if you indicate an initial age of 3 years, the first group will be 3-4, followed by 5-9 and so on. If the final age is not a multiple of 5, PANDEM will begin the final open interval at the next lower multiple of 5, e.g. 60 if you indicate 62.

Enter initial age:
Enter initial age of final open interval:

The question on whether or not the "total for both sexes" is given refers to the population of "both sexes together" by age. After giving the initial age, you must press [ENTER], and the same after entering the initial age of the final open interval.

Note: If you are using old data, PANDEM will not allow you to change either of these ages, even if you want to modify your data with option 2 in the First Menu, or even when you use [F9] and go to the options corresponding to these ages.

5. Depending on the options selected, the basic data are entered in different ways.

1) Population by single year of age. The data are entered in a matrix of 15 rows and the necessary number of columns, according to the value of the initial age \( u \) and the final age \( v \). Thus, beginning with the population aged \( u \), the complete groups of fifteen years are entered first. After each complete fifteen-year group has been entered, the possibility of correcting values or of continuing is given.
The information may be entered into the matrix in any order, locating the cursor in the desired cell by using the function keys [F1] - [F4] or the keys with arrows at the right of the keyboard. Each time a number is entered, you must advance with one of these keys.

Males

<table>
<thead>
<tr>
<th>Age Group</th>
<th>0-14</th>
<th>15-29</th>
<th>30-44</th>
<th>45-59</th>
<th>60-74</th>
<th>75-89</th>
<th>90+</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5202</td>
<td>3393</td>
<td>2394</td>
<td>1194</td>
<td>818</td>
<td>252</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4390</td>
<td>3466</td>
<td>1556</td>
<td>963</td>
<td>647</td>
<td>187</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4977</td>
<td>3423</td>
<td>2183</td>
<td>965</td>
<td>707</td>
<td>164</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4636</td>
<td>3214</td>
<td>1750</td>
<td>848</td>
<td>513</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4587</td>
<td>2795</td>
<td>1452</td>
<td>977</td>
<td>469</td>
<td>141</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4362</td>
<td>3017</td>
<td>1703</td>
<td>1171</td>
<td>474</td>
<td>165</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>4179</td>
<td>2487</td>
<td>1494</td>
<td>780</td>
<td>504</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4253</td>
<td>3398</td>
<td>1664</td>
<td>1240</td>
<td>405</td>
<td>187</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3994</td>
<td>2703</td>
<td>1557</td>
<td>941</td>
<td>494</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3760</td>
<td>2697</td>
<td>1343</td>
<td>886</td>
<td>322</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4047</td>
<td>2568</td>
<td>1567</td>
<td>875</td>
<td>457</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3858</td>
<td>2392</td>
<td>1111</td>
<td>847</td>
<td>268</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>4312</td>
<td>2306</td>
<td>1787</td>
<td>723</td>
<td>400</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>3619</td>
<td>2333</td>
<td>1135</td>
<td>690</td>
<td>292</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>3615</td>
<td>2084</td>
<td>1080</td>
<td>522</td>
<td>244</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

If you wish to continue you must enter the values corresponding to the last column, which are always fewer than fifteen. At the end you will again have the option of correcting or continuing.

Males

<table>
<thead>
<tr>
<th>Age Group</th>
<th>0-14</th>
<th>15-29</th>
<th>30-44</th>
<th>45-59</th>
<th>60-74</th>
<th>75-89</th>
<th>90+</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5202</td>
<td>3393</td>
<td>2394</td>
<td>1194</td>
<td>818</td>
<td>252</td>
<td>36</td>
</tr>
<tr>
<td>1</td>
<td>4390</td>
<td>3466</td>
<td>1556</td>
<td>963</td>
<td>647</td>
<td>187</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>4977</td>
<td>3423</td>
<td>2183</td>
<td>965</td>
<td>707</td>
<td>164</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>4636</td>
<td>3214</td>
<td>1750</td>
<td>848</td>
<td>513</td>
<td>220</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>4587</td>
<td>2795</td>
<td>1452</td>
<td>977</td>
<td>469</td>
<td>141</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>4362</td>
<td>3017</td>
<td>1703</td>
<td>1171</td>
<td>474</td>
<td>165</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>4179</td>
<td>2487</td>
<td>1494</td>
<td>780</td>
<td>504</td>
<td>113</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>4253</td>
<td>3398</td>
<td>1664</td>
<td>1240</td>
<td>405</td>
<td>187</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>3994</td>
<td>2703</td>
<td>1557</td>
<td>941</td>
<td>494</td>
<td>73</td>
<td>22</td>
</tr>
<tr>
<td>9</td>
<td>3760</td>
<td>2697</td>
<td>1343</td>
<td>886</td>
<td>322</td>
<td>68</td>
<td>47</td>
</tr>
<tr>
<td>10</td>
<td>4047</td>
<td>2568</td>
<td>1567</td>
<td>875</td>
<td>457</td>
<td>47</td>
<td>46</td>
</tr>
<tr>
<td>11</td>
<td>3858</td>
<td>2392</td>
<td>1111</td>
<td>847</td>
<td>268</td>
<td>46</td>
<td>37</td>
</tr>
<tr>
<td>12</td>
<td>4312</td>
<td>2306</td>
<td>1787</td>
<td>723</td>
<td>400</td>
<td>37</td>
<td>42</td>
</tr>
<tr>
<td>13</td>
<td>3619</td>
<td>2333</td>
<td>1135</td>
<td>690</td>
<td>292</td>
<td>42</td>
<td>20</td>
</tr>
<tr>
<td>14</td>
<td>3615</td>
<td>2084</td>
<td>1080</td>
<td>522</td>
<td>244</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Enter To
1 correct
2 continue
ii) Population by five-year age groups. First the first fifteen values are entered, and then after the possibility of making corrections, the final values are entered, on the same principle as was seen for single years of age (Chapter II, point C).

<table>
<thead>
<tr>
<th>Males</th>
<th>0-74</th>
<th>75 and up</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>237920</td>
<td>75 to 79</td>
</tr>
<tr>
<td>5 to 9</td>
<td>205480</td>
<td>80 and up</td>
</tr>
<tr>
<td>10 to 14</td>
<td>194510</td>
<td></td>
</tr>
<tr>
<td>15 to 19</td>
<td>162910</td>
<td></td>
</tr>
<tr>
<td>20 to 24</td>
<td>143020</td>
<td></td>
</tr>
<tr>
<td>25 to 29</td>
<td>116830</td>
<td></td>
</tr>
<tr>
<td>30 to 34</td>
<td>93350</td>
<td></td>
</tr>
<tr>
<td>35 to 39</td>
<td>75610</td>
<td></td>
</tr>
<tr>
<td>40 to 44</td>
<td>66800</td>
<td></td>
</tr>
<tr>
<td>45 to 49</td>
<td>49410</td>
<td></td>
</tr>
<tr>
<td>50 to 54</td>
<td>50190</td>
<td></td>
</tr>
<tr>
<td>55 to 59</td>
<td>36570</td>
<td></td>
</tr>
<tr>
<td>60 to 64</td>
<td>29540</td>
<td></td>
</tr>
<tr>
<td>65 to 69</td>
<td>21990</td>
<td></td>
</tr>
<tr>
<td>70 to 74</td>
<td>16610</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Males</th>
<th>0-74</th>
<th>75 and up</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>237920</td>
<td>9640</td>
</tr>
<tr>
<td>5 to 9</td>
<td>205480</td>
<td>9340</td>
</tr>
<tr>
<td>10 to 14</td>
<td>194510</td>
<td></td>
</tr>
<tr>
<td>15 to 19</td>
<td>162910</td>
<td></td>
</tr>
<tr>
<td>20 to 24</td>
<td>143020</td>
<td></td>
</tr>
<tr>
<td>25 to 29</td>
<td>116830</td>
<td></td>
</tr>
<tr>
<td>30 to 34</td>
<td>93350</td>
<td></td>
</tr>
<tr>
<td>35 to 39</td>
<td>75610</td>
<td></td>
</tr>
<tr>
<td>40 to 44</td>
<td>66800</td>
<td></td>
</tr>
<tr>
<td>45 to 49</td>
<td>49410</td>
<td></td>
</tr>
<tr>
<td>50 to 54</td>
<td>50190</td>
<td></td>
</tr>
<tr>
<td>55 to 59</td>
<td>36570</td>
<td></td>
</tr>
<tr>
<td>60 to 64</td>
<td>29540</td>
<td></td>
</tr>
<tr>
<td>65 to 69</td>
<td>21990</td>
<td></td>
</tr>
<tr>
<td>70 to 74</td>
<td>16610</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

This method of data entry is valid for each sex and for both sexes together.

6. After entering the data, the title of the table of results is entered on two lines, giving an [ENTER] after each line:
7. The last step is again a general step referring to the form in which the results are to be presented:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.anl" will appear very briefly on the screen, where "filename" is the name of your file.

8. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen, with the instruction:

Press any key to continue

When this instruction is followed, the remaining results appear.

9. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three función keys again so that you may now continue with this analysis.

g. Bibliographical references

Chackiel, J. and Maccio, G., Evaluación y corrección de datos demográficos, Chapter VI: Análisis de la población por edades, CELADE, Santiago, Chile, October 1978, Series B, No. 39.

2. Construction of life tables

a. Objectives

The objective of this routine is the construction of abbreviated life tables.

b. Basic information

The basic information necessary for the calculation of the abbreviated life table varies for each of the options offered by this routine. The input may be:

i) Central mortality rates, \( m(x,n) \).

ii) Population and deaths.

iii) A set of probabilities of death, \( q(x,n) \), for a given moment.

iv) Two sets of probabilities of death, \( q(x,n) \), for two moments in time.

In cases i and ii, there exists the possibility of giving a factor, \( f \), if you wish to correct or adjust the original information.

c. Description of the method

(a) The life table

The life table is an instrument which allows the user to measure the incidence of mortality at the different ages via its different functions, one of which allows the measurement of the mean life of the population. There are two types of life tables, those which are given by detailed ages, or complete life tables, and those which refer only to selected ages, or abbreviated life tables.

The principal functions of the life table are defined as follows:

\( m(x,n) \): is the central rate of mortality between age \( x \) and age \( x+n \).

\( g(x,n) \): is the probability of dying between exact ages \( x \) and \( x+n \).

\( l(x) \): are the survivors at exact age \( x \) of an initial group of births \( l(0) \), which in this routine is 100,000 persons.

\( d(x,n) \): are the deaths among the survivors to exact age \( x \), \([l(x)]\), between exact ages \( x \) and \( x+n \).

\( l(x,n) \): is the time lived by the survivors \( l(x) \) between exact ages \( x \) and \( x+n \). This function also has the interpretation of a stationary population (a population with constant rates of birth and
mortality and with a zero rate of growth, in which the age structure is maintained constant over time). In this case it represents the population aged between \(x\) and \(x+n\) years, that is, a concept similar to that of the population census.

\(T(x)\): represents the time lived by the survivors of exact age \(x\) \([l(x)\)] between that age and the age \(x\) at which no survivor remains.

\(e(x)\): is the life expectancy at exact age \(x\); this is the mean number of years of life which remain to each survivor at exact age \(x\) \([l(x)\)]. It is one of the most used indicators of the table, especially the life expectancy at birth, \(e(0)\).

\(P(x,x+n)\): this function, used especially to realize projections of the population, represents the probability that a person aged between \(x\) and \(x+n\) years will survive for 5 years. Of particular interest here are the values: \(5P(b)\), which is the probability of a new-born in a five-year period surviving to the end of that period, and \(5P(x+)\), which represents the probability of surviving five years of those persons aged \(x\) and up.

(b) Relations among the functions of the life table

The calculation of the probability of death \(q(x,n)\) from central mortality rates is done in this routine using the relationship of Reed and Merrill:

\[
q(x,n) = 1 - \exp \left[ -n \times m(x,n) - 0.008 \times n^3 \times m^2(x,n) \right]
\]

(1)

where \(n\) is the width of the age interval.

Next the deaths \(d(x,n)\) and the survivors \(l(x)\) are determined. Recall that the initial value or root of the table is \(l(0) = 100,000\).

\[
d(x,n) = l(x) \times q(x,n)
\]

(2)

\[
l(x+n) = l(x) - d(x,n)
\]

(3)

From age five onward, the time lived between ages \(x\) and \(x+n\) is determined using integration by the trapezium method:

\[
L(x,n) = (n/2) \times (l(x) + l(x+n))
\]

(4a)

For children under 5, the time lived may be calculated by individual ages, or for those under 1 year of age and the group aged 1 to 4 years. If the calculation is done by individual ages, the relation

\[
L(x,1) = f(x) \times l(x) + (1-f(x)) \times l(x+1)
\]

(4b)

is used, where \(f(x)\) is the separation factor at age \(x\). The factor \(f(0)\) may be input directly or may be obtained within the same routine, from the model life tables of Coale and Demeny. The values and relations used in those tables are shown below:
Construction of life tables

<table>
<thead>
<tr>
<th>Families</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For $q(0,1)\geq .100$</td>
<td></td>
</tr>
<tr>
<td>West, North and South</td>
<td>.33</td>
<td>.35</td>
</tr>
<tr>
<td>East</td>
<td>.29</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td>For $q(0,1)&lt;.100$</td>
<td></td>
</tr>
<tr>
<td>West, North and South</td>
<td>$0.0425+2.875q(0,1)$</td>
<td>$0.05+3q(0,1)$</td>
</tr>
<tr>
<td>East</td>
<td>$0.025+2.875q(0,1)$</td>
<td>$0.01+3q(0,1)$</td>
</tr>
</tbody>
</table>

The factors used for ages 1, 2, 3 and 4 are those of Glover:

$f(1)=.41 \quad f(2)=.47 \quad f(3)=.48 \quad f(4)=.48$

A similar relation is used to determine the time lived between ages 1 and 5:

$L(1,4) = K\times l(1) + (4-K)\times l(5)$ \hspace{1cm} (4c)

where the values of $K$ can be input directly or calculated within the routine, using the following values and relations from the tables of Coale and Demeny:

<table>
<thead>
<tr>
<th>Families</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For $q(0,1)\geq .100$</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>1.352</td>
<td>1.361</td>
</tr>
<tr>
<td>North</td>
<td>1.558</td>
<td>1.570</td>
</tr>
<tr>
<td>East</td>
<td>1.313</td>
<td>1.324</td>
</tr>
<tr>
<td>South</td>
<td>1.240</td>
<td>1.239</td>
</tr>
<tr>
<td></td>
<td>For $q(0,1)&lt;.100$</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>$1.653-3.013q(0,1)$</td>
<td>$1.524-1.627q(0,1)$</td>
</tr>
<tr>
<td>North</td>
<td>$1.859-3.013q(0,1)$</td>
<td>$1.733-1.627q(0,1)$</td>
</tr>
<tr>
<td>East</td>
<td>$1.614-3.013q(0,1)$</td>
<td>$1.487-1.627q(0,1)$</td>
</tr>
<tr>
<td>South</td>
<td>$1.541-3.013q(0,1)$</td>
<td>$1.402-1.627q(0,1)$</td>
</tr>
</tbody>
</table>

For the open group $x^+$, regressions of the form

$L(x^+) = a\times l(x) + b\times l^2(x)$ \hspace{1cm} (4d)

are used, where $a$ and $b$ are parameters. These regressions depend on the value of the initial age of the open interval.

If the central mortality rate is available it is also possible to calculate the time lived using the following relation:
L(x,n) = m(x,n) * d(x,n) for x >= 5 \hfill (4e)

The central mortality rate is calculated from the following relation:

\[ m(x,n) = \frac{d(x,n)}{L(x,n)} \] \hfill (5)

This calculation only makes sense, of course, if the central mortality rate was not given as input nor the relation (4e) used to determine the time lived.

The time lived from x onward, T(x), is calculated using the relation

\[ T(x) = \sum_{x}^{w} L(x,n) \] \hfill (6)

where w is the age at which no survivor remains.

The life expectancy at exact age x is the ratio of T(x) to l(x):

\[ e(x) = \frac{T(x)}{l(x)} \] \hfill (7)

The last relation to be calculated is the survival ratio P(x,x+n), which is obtained as the following quotient:

\[ P(x,x+n) = \frac{L(x+5,n)}{L(x,n)} \] \hfill (8a)

where n is as before the width of the age interval and 5 is the period of time over which the survival of the population aged between x and x+n is calculated. There are two exceptions which correspond to the calculation of this ratio at the extreme ages; on the one hand the survival from birth, P(b), and on the other hand that for the final open interval, P(x+):

\[ P(b) = \frac{L(0,n)}{n} * l(0) \] \hfill (8b)

\[ P(x+) = \frac{T(x+5)}{T(x)} \] \hfill (8c)

\[ d. \ Options\ of\ the\ routine \]

The routine has various options related to the type of data input. Within each option, there are various alternatives depending on the form of calculation of the different functions of the table. Each of the options and alternatives offered by this routine is described below, in the order in which they appear when it is applied.

(a) Type of data

1. Central mortality rates m(x,n).
2. Population and deaths.
3. A set of probabilities of death q(x,n) for a given moment.
4. Two sets of probabilities of death for two distinct moments, for determining an intermediate life table.
Independently of the type of input data, this routine requires that the probabilities of death \( q(x,n) \) be given for children under five, either by single year of age or grouped for children aged 0 to 1 and 1 to 4 years.

Option 4 consists of giving two sets of probabilities of death to permit interpolations between them and the construction of a table. This is particularly important when it is desired to project mortality when the first set is the initial mortality calculated for the projection and the second set is the limiting mortality.

(b) **Correction of the \( m(x,n) \)**

In options (a).1 and (a).2 there is also the alternative of multiplying the central mortality rates by the factor \( f \) which comes from the application of the method of distribution of deaths by age.

(c) **Weight for linear interpolation of \( q(x,n) \)**

In option (a).4, the user must enter the value of the weighting factor required for the calculation of the linear interpolation of the probabilities of death.

(d) **Age grouping for children under 5**

This information may be given by single year of age or in two groups (0-1 and 1-4 years). These groupings define the form in which the \( q(x,n) \) will be entered for children under five years of age and consequently the format of the output table for children of this age.

(e) **Final group**

The user must input the initial age of the final open interval.

(f) **Sex**

There are three possibilities: males, females, and both sexes. This input is necessary for the selection of the model life table within the families of Coale and Demeny, necessary for the calculation of the values of \( f(0) \) and \( K \).

(g) **Calculation of \( L(0,1) \)**

To calculate this value it is necessary to have the separation factor \( f(0) \), which may be input directly or calculated using the model life table of Coale and Demeny.

(h) **Calculation of \( L(1,4) \)**

The calculation of this value requires the value of \( K \), which may be input directly or calculated from the model life tables of Coale and Demeny.

(i) **Selection of the Coale and Demeny Family**

When option (g) or (h) is selected, or both, one of the four Families of the Coale and Demeny tables must be selected.
(j) **Calculation of \( L(x,n) \)**

If option (a).1 or (a).2 is used, there are two alternatives. The first consists of the empirical integration of the survival function by the trapezium method; the second uses the ratio of the deaths in the table to the central mortality rates provided as input. In the second case the output \( m(x,n) \) will be those which come from the input.

If options (a).3 and (a).4 are used, the calculation of the \( L(x,n) \) is done by the trapezium method. For children under 5, formula (4c) is always used.

(k) **Calculation of \( L(x+) \)**

Here there are 7 alternatives which depend on the calculation formula used as well as the initial age of the final open interval.

(l) **Value of \( w \)**

One of the alternatives of (k) requires that the age \( w \) be input.

e. **Results provided by the routine**

The output of the routine is the following:

<table>
<thead>
<tr>
<th>Age</th>
<th>( n )</th>
<th>( m(x,n) )</th>
<th>( q(x,n) )</th>
<th>( l(x) )</th>
<th>( d(x,n) )</th>
<th>( L(x,n) )</th>
<th>( T(x) )</th>
<th>( e(x) )</th>
<th>( P(x,x+n) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>0.00090</td>
<td>0.00900</td>
<td>100000</td>
<td>90</td>
<td>99919</td>
<td>7600108</td>
<td>76.00</td>
<td>0.99989</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.00105</td>
<td>0.0015</td>
<td>99910</td>
<td>15</td>
<td>99901</td>
<td>7500189</td>
<td>75.07</td>
<td>0.99999</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0.00014</td>
<td>0.0014</td>
<td>99895</td>
<td>14</td>
<td>99888</td>
<td>7400238</td>
<td>74.08</td>
<td>0.99999</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.00013</td>
<td>0.0013</td>
<td>99881</td>
<td>13</td>
<td>99874</td>
<td>7300401</td>
<td>73.09</td>
<td>0.99999</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.00012</td>
<td>0.0012</td>
<td>99868</td>
<td>12</td>
<td>99862</td>
<td>7200526</td>
<td>72.10</td>
<td>0.99999</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0.00011</td>
<td>0.00057</td>
<td>99856</td>
<td>27</td>
<td>499138</td>
<td>7100664</td>
<td>71.11</td>
<td>0.99945</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>0.00010</td>
<td>0.00052</td>
<td>99799</td>
<td>52</td>
<td>498866</td>
<td>6601526</td>
<td>66.15</td>
<td>0.99930</td>
</tr>
<tr>
<td>15</td>
<td>5</td>
<td>0.00018</td>
<td>0.00088</td>
<td>99747</td>
<td>88</td>
<td>498517</td>
<td>6102660</td>
<td>61.18</td>
<td>0.99864</td>
</tr>
<tr>
<td>20</td>
<td>5</td>
<td>0.00029</td>
<td>0.00144</td>
<td>99659</td>
<td>144</td>
<td>497939</td>
<td>5604143</td>
<td>56.23</td>
<td>0.99807</td>
</tr>
<tr>
<td>25</td>
<td>5</td>
<td>0.00048</td>
<td>0.00242</td>
<td>99516</td>
<td>241</td>
<td>496978</td>
<td>5106205</td>
<td>51.31</td>
<td>0.99679</td>
</tr>
<tr>
<td>30</td>
<td>5</td>
<td>0.00088</td>
<td>0.00407</td>
<td>99275</td>
<td>397</td>
<td>495383</td>
<td>4669227</td>
<td>46.43</td>
<td>0.99470</td>
</tr>
<tr>
<td>35</td>
<td>5</td>
<td>0.00133</td>
<td>0.00661</td>
<td>98878</td>
<td>654</td>
<td>492756</td>
<td>4113844</td>
<td>41.61</td>
<td>0.99123</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
<td>0.00220</td>
<td>0.01094</td>
<td>98224</td>
<td>1075</td>
<td>488436</td>
<td>3621088</td>
<td>36.87</td>
<td>0.98555</td>
</tr>
<tr>
<td>45</td>
<td>5</td>
<td>0.00363</td>
<td>0.01800</td>
<td>97150</td>
<td>1749</td>
<td>481378</td>
<td>3132652</td>
<td>32.25</td>
<td>0.97633</td>
</tr>
<tr>
<td>50</td>
<td>5</td>
<td>0.00598</td>
<td>0.02944</td>
<td>95401</td>
<td>2809</td>
<td>469984</td>
<td>2651275</td>
<td>27.79</td>
<td>0.96159</td>
</tr>
<tr>
<td>55</td>
<td>5</td>
<td>0.00976</td>
<td>0.04765</td>
<td>92593</td>
<td>4412</td>
<td>451933</td>
<td>2181290</td>
<td>23.56</td>
<td>0.93852</td>
</tr>
<tr>
<td>60</td>
<td>5</td>
<td>0.01580</td>
<td>0.07601</td>
<td>88181</td>
<td>6703</td>
<td>424146</td>
<td>1729358</td>
<td>19.61</td>
<td>0.90356</td>
</tr>
<tr>
<td>65</td>
<td>5</td>
<td>0.02520</td>
<td>0.11853</td>
<td>81478</td>
<td>9659</td>
<td>383242</td>
<td>1305212</td>
<td>16.02</td>
<td>0.85291</td>
</tr>
<tr>
<td>70</td>
<td>5</td>
<td>0.03943</td>
<td>0.17946</td>
<td>71819</td>
<td>12889</td>
<td>326672</td>
<td>921970</td>
<td>12.84</td>
<td>0.78336</td>
</tr>
<tr>
<td>75</td>
<td>5</td>
<td>0.06029</td>
<td>0.26195</td>
<td>58930</td>
<td>15437</td>
<td>256059</td>
<td>595098</td>
<td>10.10</td>
<td>0.69305</td>
</tr>
<tr>
<td>80</td>
<td>5</td>
<td>0.09018</td>
<td>0.36793</td>
<td>43493</td>
<td>20003</td>
<td>177441</td>
<td>339039</td>
<td>7.80</td>
<td>0.58145</td>
</tr>
<tr>
<td>85</td>
<td>5</td>
<td>0.13285</td>
<td>0.49864</td>
<td>27491</td>
<td>13708</td>
<td>103184</td>
<td>161579</td>
<td>5.88</td>
<td>0.44993</td>
</tr>
<tr>
<td>90</td>
<td>5</td>
<td>0.19376</td>
<td>0.65265</td>
<td>13783</td>
<td>8995</td>
<td>46426</td>
<td>58394</td>
<td>4.24</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>w</td>
<td>0.40000</td>
<td>1.00000</td>
<td>4787</td>
<td>4787</td>
<td>11969</td>
<td>11969</td>
<td>2.50</td>
<td></td>
</tr>
</tbody>
</table>

\( P(b): 0.99889 \)

\( f(0)=0.1000 \) \( f(1)=0.4100 \) \( f(2)=0.4700 \) \( f(3)=0.4800 \) \( f(4)=0.4800 \)
which includes:

- an optional two-line title.
- columns with the life-table functions: age, age interval, central mortality rate, probability of death, survivors at exact age \( x \), deaths, time lived between \( x \) and \( x+m \), time to live from \( x \) to \( w \), expectation of life and survival ratio.
- at the end appears a line with the factors used for the calculation of time lived for children under five.

f. Form of operation of the routine

(a) General steps

1. From the main PANDEM menu, select the "Menu for Demographic calculations" option.

2. Selection of the program "Life Tables" within this sub-menu.

3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

file name (without extension) ///////// ENTER end entry
List of Data Files from d:\directory] ESC cancel
filexxx.tmd fileyyy.tmd filezzz.tmd

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in b)1. below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:
Construction of life tables

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First menu</td>
</tr>
<tr>
<td>2</td>
<td>Initial age of open interval</td>
</tr>
<tr>
<td>3</td>
<td>If using children under 5</td>
</tr>
<tr>
<td>4</td>
<td>Weight for linear interpolation</td>
</tr>
<tr>
<td>5</td>
<td>Apply correction factor to the $m(x,n)$</td>
</tr>
<tr>
<td>6</td>
<td>Enter $m(x,n)$ $q(x,n)$ $M(x,n)$ $D(x,n)$</td>
</tr>
<tr>
<td>7</td>
<td>Sex of study</td>
</tr>
<tr>
<td>8</td>
<td>Calculation of $L(0,t)$</td>
</tr>
<tr>
<td>9</td>
<td>$K$ for calculation of $L(1,4)$</td>
</tr>
<tr>
<td>A</td>
<td>Want to interpolate</td>
</tr>
<tr>
<td>B</td>
<td>Calculation of $L(x,n)$</td>
</tr>
<tr>
<td>C</td>
<td>Calculation of $L(x^*)$</td>
</tr>
<tr>
<td>D</td>
<td>Data</td>
</tr>
<tr>
<td>E</td>
<td>Results option</td>
</tr>
</tbody>
</table>

If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

(b) **Steps specific to the routine**

1. The first step is to indicate the type of data.

<table>
<thead>
<tr>
<th>Enter</th>
<th>If</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>entering $m(x,n)$ and $q(x,n)$ for under 5 years</td>
</tr>
<tr>
<td>2</td>
<td>entering $M(x,n)$ $D(x,n)$ and $q(x,n)$ for under 5 years</td>
</tr>
<tr>
<td>3</td>
<td>entering $q(x,n)$ for the whole table</td>
</tr>
<tr>
<td>4</td>
<td>entering $q(x,n)$ for two dates to interpolate</td>
</tr>
</tbody>
</table>

2. Depending on the option selected, the following is requested.

2.1) For options 1 and 2:

<table>
<thead>
<tr>
<th>Enter</th>
<th>If</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>applying correction factor to the $m(x,n)$</td>
</tr>
<tr>
<td>2</td>
<td>NOT applying correction factor</td>
</tr>
</tbody>
</table>

If alternative 1 is chosen, you must provide the factor and then hit [ENTER].

2.2) For option 4:

Provide weight for linear interpolation of $q(x)$ $p=$

$q(x) = p \cdot q_0(x) + (1-p) \cdot q_1(x)$

You must enter the weight and then hit [ENTER].
3. Next, the routine asks for the type of grouping wanted for children under five years of age:

<table>
<thead>
<tr>
<th>Enter</th>
<th>If using children under 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>by single year of age</td>
</tr>
<tr>
<td>2</td>
<td>by groups 0 and 1 to 4 years</td>
</tr>
</tbody>
</table>

4. The initial age of the final age group is requested:

Provide initial age of final open interval

give the age and then [ENTER].

5. Sex is requested:

<table>
<thead>
<tr>
<th>Enter</th>
<th>If corresponds to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Both sexes</td>
</tr>
<tr>
<td>2</td>
<td>Males</td>
</tr>
<tr>
<td>3</td>
<td>Females</td>
</tr>
</tbody>
</table>

6. The separation factor for children under one year of age is requested:

<table>
<thead>
<tr>
<th>Enter</th>
<th>If</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Entering f(0) for calculation of L(0,1)</td>
</tr>
<tr>
<td>2</td>
<td>Calculating f(0) using Coale-Demény</td>
</tr>
</tbody>
</table>

if 1 is chosen, you must provide the factor and strike [ENTER].

7. In the case that you work with the group 1-4, the routine requests:

<table>
<thead>
<tr>
<th>Enter</th>
<th>If</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Entering K for calculation of L(1,4)</td>
</tr>
<tr>
<td>2</td>
<td>Calculating K using Coale-Demény</td>
</tr>
</tbody>
</table>

if 1 is chosen, you must provide the value and then hit [ENTER].

8. If in at least one of the two previous points you have chosen to work with models:

<table>
<thead>
<tr>
<th>Enter</th>
<th>If you want to interpolate with model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>West</td>
</tr>
<tr>
<td>2</td>
<td>North</td>
</tr>
<tr>
<td>3</td>
<td>East</td>
</tr>
<tr>
<td>4</td>
<td>South</td>
</tr>
</tbody>
</table>

9. If in point 1 option 1 or 2 was chosen, the routine asks:
10. The form of the calculation of $L(x+)$ is requested:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To calculate $L(x,n)$ using</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$L(x,n) = ((x+x)/(x+y)) \times n/2$</td>
</tr>
<tr>
<td>2</td>
<td>$L(x,n) = d(x,n)/m(x,n)$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enter</th>
<th>To calculate $L(x+)$ using</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ortega:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$L(70+) = 6.632 \cdot (70) + 0.0000383 \cdot (70)^2$</td>
</tr>
<tr>
<td>2</td>
<td>$L(75+) = 5.05 \cdot (75) + 0.0000272 \cdot (75)^2$</td>
</tr>
<tr>
<td>3</td>
<td>$L(80+) = 4.624 \cdot (80) + 0.0000167 \cdot (80)^2$</td>
</tr>
<tr>
<td>4</td>
<td>$L(85+) = 3.584 \cdot (85) + 0.0000158 \cdot (85)^2$</td>
</tr>
<tr>
<td>Coale-Demeny:</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$L(80+) = 3.275 \cdot (80) + 0.0000625 \cdot (80)^2$</td>
</tr>
<tr>
<td>6</td>
<td>enter $L(x+)$ directly</td>
</tr>
<tr>
<td>7</td>
<td>$L(x+) = (w-x)/2 \times (x)$</td>
</tr>
</tbody>
</table>

Note that the choice of initial age of the final open interval limits your choice of options for the calculation of $L(x+)$: for example, if you indicated 80 years in point 4 above, only options 3, 5, 6 and 7 make sense now. If you try to use another value, PANDEM will show a warning message to this effect, and similarly for the other possible cases.

11. In the case that you choose relation 7 in point 10, you will be asked to give the value of $w$ and [ENTER].

12. Next, you must enter the input data. An example of option 3 is shown.

<table>
<thead>
<tr>
<th>Age</th>
<th>$q(x,n)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>35</td>
</tr>
<tr>
<td>7</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td>45</td>
</tr>
<tr>
<td>9</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>55</td>
</tr>
<tr>
<td>11</td>
<td>60</td>
</tr>
<tr>
<td>12</td>
<td>65</td>
</tr>
<tr>
<td>13</td>
<td>70</td>
</tr>
<tr>
<td>14</td>
<td>75</td>
</tr>
<tr>
<td>15</td>
<td>80</td>
</tr>
<tr>
<td>16</td>
<td>85</td>
</tr>
<tr>
<td>17</td>
<td>90</td>
</tr>
<tr>
<td>18</td>
<td>95</td>
</tr>
<tr>
<td>19</td>
<td>100</td>
</tr>
</tbody>
</table>

After entering the basic data, hit [ENTER] and the following appears on the screen:
13. Next the title of the table is entered on two lines, with an [ENTER] after each line:


<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

14. The final step refers to the form of presentation of the results:


<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.tml" will appear very briefly on the screen, where "filename" is the name of your file.

15. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen, with the instruction:

Press any key to continue

When this instruction is followed, the remaining results appear.

16. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.
g. Bibliographical references


B. INDIRECT ESTIMATION

1. Estimation of fertility by the P/F method

   a. Objectives

   This method allows the calculation of estimates of fertility (age-specific fertility rates and total fertility) using information obtained from questions on the number of children ever born and the number of children born in the year preceding the survey or census (or date of birth of the last child).

   b. Basic information

   i) Number of women by five-year age groups between 15 and 49 years of age.

   ii) Number of children ever born classified by five-year age groups of the mothers.

   iii) Number of children born in the year preceding the survey or census, by five-year age groups of the mothers. Another possibility is to work with the births in the calendar year of the census, obtained from registers of vital statistics.

   c. Description of the method

   The original methodology was developed by W. Brass and the version utilized in this routine is described in:


   It is well known that estimates of fertility obtained from registers or from special questions in surveys or censuses (number of children born in the previous year), are generally affected by omissions and/or by mis-reporting of the date of birth, so that the level of fertility is underestimated. However, the relative structure of fertility by age of mother remains satisfactory in most cases.

   A more reliable estimate of the level of fertility may be obtained from the number of live-born children declared by the women between 20 and 29 years of age.

   The P/F method consists of relating the following two estimates of fertility. Based on current fertility, viz. the number of children born in the year preceding the census or survey, the hypothetical mean parity by five-year age groups, \( \tilde{F}(i) \), is estimated. The retrospective fertility (number of children ever borne by the women) is directly converted into mean parities by five-year age group, \( P(i) \).
Now relating these two estimates of the level of fertility via the quotient \( P(i)/F(i) \), a factor is obtained which allows correction of the present fertility rates.

For the calculation of \( F(i) \), the following relation is used:

\[
F(i) = @(i-1) + a(i) f(i) + b(i) f(i+1) + c(i) @(7) \text{ for } i=1,2,\ldots,6
\]
\[
F(7) = @(6) + a(7) f(7) + b(7) f(6) + c(7) @(7)
\]

where:

- \( i \) indicates the five-year age groups of the women
  \( 1:15-19, 2:20-24, \ldots, 7:45-49 \).
- \( F(i) \) is hypothetical mean parity of age group \( i \).
- \( f(i) \) is the present fertility rate of age group \( i \).
- \( @(i) \) is the cumulative fertility rate up to the upper limit of the age group \( i \), calculated as follows:
  \[ @(i) = 5 \times \text{the sum of the } f(j), \text{ } j \text{ running from } 1 \text{ to } i. \]
- \( a(i), b(i) \) and \( c(i) \) are the parameters of the equation, which depend on \( i \). Their values also depend on the type of information on current fertility (whether one is dealing with births during the previous year, or registered births).

From the ratios \( P(i)/F(i) \), a value must be selected which is then taken as a correction factor for the current fertility rates. Generally \( P(2)/F(2) \), \( P(3)/F(3) \), or an average of these two values, is chosen, as they reflect the fertility level of the recent past and because the quality of the information from these age groups (women aged 20 to 29) is better.

If current fertility corresponds to births in the year previous to the survey or census, the women were on average half a year younger, so that an adjustment must be made to the fertility rates to obtain estimates which refer to conventional five-year age groups. For this adjustment the following relation is used:

\[
f'(i) = [1-w(i-1)] f(i) + w(i) f(i+1) \quad \text{for } i=1,2,\ldots,6
\]
\[
f'(7) = [1-w(6)] f(7)
\]

where:

- \( f'(i) \) and \( f(i) \) represent the adjusted rates and the observed rates, respectively.
- \( w(i) \) is a weighting factor, which is calculated as follows:
  \[
w(i) = x(i) + y(i)f(i)/@(7) + z(i)f(i+1)/@(7)
\]

where:

- \( x(i), y(i) \) and \( z(i) \) are parameters of this regression equation which depend on \( i \).

Finally to obtain the adjusted and corrected fertility rates the adjusted rates \( f'(i) \) are multiplied by the selected correction factor \( K \).
d. Options of the routine

This program contains the following options:

1) To work with births which occurred in the year previous to the survey or census, or to work with the births registered in the same year as the census.

2) The selection of the ratio \( P(1)/P(1) \) which is to be used as a correction factor \( (K) \).

e. Results provided by the routine

The output of this routine for the option with current fertility coming from censuses or surveys is the following:

```
ESTIMATION OF FERTILITY USING THE P/F METHOD

AGE        TOTAL       CHILDREN         BORN LAST YEAR
           WOMEN       EVER BORN      FROM CENSUS

15-19      3487        811            359
20-24      2960        4121           787
25-29      2253        6556           580
30-34      1766        7475           365
35-39      1515        8636           265
40-44      1198        7771           105
45-49      1035        7338           10

AGE        PARITY        FERT RATE   CUMUL FERT    EST. PARITY   RATIO   FERT. RATE   CORRECTED
           P(i)          f(i)         FA(i)         F(i)          P/F      5fx       FERT. RATE

15-19      0.2326       0.1030      0.5148        0.2239        1.0390   0.1240      0.1352
20-24      1.3922       0.2659      1.8642        1.2926        1.0771   0.2719      0.2966
25-29      2.9099       0.2574      3.1313        2.6352        1.1042   0.2540      0.2770
30-34      4.2327       0.2067      4.1647        3.7603        1.1256   0.2030      0.2214
35-39      5.7003       0.1749      5.0393        4.7165        1.2086   0.1690      0.1843
40-44      6.4866       0.0876      5.4776        5.3538        1.2116   0.0764      0.0833
45-49      7.0899       0.0097      5.5259        5.5148        1.2856   0.0069      0.0075

TOTAL      1.1052

TOTAL FERT. 5.5259

Correction factor: \((P2/P2 + P3/P3)/2\)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL FERT.</td>
</tr>
<tr>
<td>5.5259</td>
</tr>
<tr>
<td>6.0268</td>
</tr>
</tbody>
</table>
```

where the following elements are shown:

- a standard title on two lines, which also indicate the option selected (with or without displacement of half a year, in the case where current fertility comes from census/surveys or registers, respectively).
- two optional title lines.
- basic information provided: number of women, total children ever born and born in the last year according to the census or registered births. This part of the output does not appear on the screen.
Estimation of the fertility by the P/F method

- mean parity by age group of mother, P(i).
- current fertility rates, f(i), (when the rates were calculated based on births in the year of the census or survey, these rates correspond to women who on average were half a year younger).
- cumulative fertility up to the upper limit of each age group, FA(i).
- theoretical parity estimated from current fertility, F(i).
- the P(i) ratios for each age group.
- the current fertility rates corrected for the displacement of half a year of age, 5fx. This column only appears with the option in which the current fertility was obtained from the children born in the year before the census or survey. In the option in which current fertility comes from registers, the rates by five-year age group (without the displacement of half a year) are presented in the second column, f(i).
- the last column gives the fertility rates by (conventional) five-year age groups using the selected correction factor.
- below the columns of fertility rates by age, are given their sum and the corresponding total fertility rate.
- at the foot of the table, the selected correction factor P/F and its value are shown.

f. Form of operation of the routine

1. From the main PANDEM menu, select the "Menu of Indirect Estimation" option.

2. Selection of the program "F/F" within this sub-menu.

3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

file name (without extension) //******/ ENTER end entry
list of Data files from [d:\directory] ESC cancel
filexxxx.fad fileyyyy.fad filezzzz.fad

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:
### Estimation of the fertility by the P/F method

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>2</td>
<td>Births</td>
</tr>
<tr>
<td>3</td>
<td>Correction factor</td>
</tr>
<tr>
<td>4</td>
<td>Data</td>
</tr>
<tr>
<td>5</td>
<td>Results option</td>
</tr>
</tbody>
</table>

If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. Indicate the type of information available:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter births from census</td>
</tr>
<tr>
<td>2</td>
<td>enter births from vital registers</td>
</tr>
</tbody>
</table>

The first option corresponds to births to mothers whose age in reality is half a year less than the conventional five-year age groups. In the second case, the age of the women is not displaced.

5. Enter the code of the selected option for the correction factor P/F to be used:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To use correction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P2/F2</td>
</tr>
<tr>
<td>2</td>
<td>P3/F3</td>
</tr>
<tr>
<td>3</td>
<td>(P2/F2*P3/F3)/2</td>
</tr>
</tbody>
</table>

6. This step consists of entering the basic data: women, children ever born and children born in the year preceding the census or survey (or children born according to the registers, depending on the option selected). These data should be entered as it is indicated in the previous chapter.

<table>
<thead>
<tr>
<th>Age</th>
<th>Women</th>
<th>Children ever born</th>
<th>Children born according to register</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** If the children born come from registers, the women and their children ever born must come from a census.

When all the data have been entered, hit [ENTER] and the following will appear on the screen:
Next you must input the title of the table on two lines:

Title
line 1  \\
line 2  \\

7. When this information has been provided the calculation process can begin, but first it is necessary to indicate the form in which the output is desired:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.fal" will appear very briefly on the screen, where "filename" is the name of your file.

8. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen.

9. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.

In this routine only, the key [F7] "Data" is also offered, to allow you to go directly to the data instead of going first to the Options Menu.
5. Bibliographical references


2. Estimation of fertility by the P(1+)/F(1) method

   a. Objectives

   This method allows the estimation of fertility (fertility rates and total fertility rate) using the estimation of a correction factor, using information on the number of women who have borne at least one child and the number of first births in the year preceding the census, or according to registers. (This method is a variant of the P/F method described above.)

   b. Basic information

   i) Number of women by five-year age group between 15 and 49 years of age.

   ii) Number of women who have borne at least one child (mothers) classified by five-year age groups.

   iii) Number of children born in the year preceding the survey or census, by five-year age groups of the mothers. Another possibility is to work with the births of the year in which the census was held, taken from vital statistics.

   iv) Number of first births in the year preceding the survey or census, by five-year age groups of the mothers. Another possibility is to work with the births of the year in which the census was held, taken from vital statistics.

   c. Description of the method

   This is a variant of the P/F method and was also developed by W. Brass. The methodology used in this routine is that described in:


   Instead of calculating the correction factor based on all births, this variant estimates the factor by comparing the proportions of women who are mothers (that is, the proportion of women who have had at least one live-born child) by five-year age groups, with the proportions which may be obtained using information on first births to women during the year preceding the census or survey. In this way the ratios P(1+)/F(1) are obtained for each age group, and the most appropriate correction factor may be chosen from among them.

   The basic assumption of this method is that the proportions of mothers by five-year age groups are not affected by changes in the level of fertility. However, they are sensitive, for example, to changes in the pattern of marriage. The correction factor obtained with this variant serves as a control for the estimates obtained with the P/F method, and should be applied as well to the current fertility rates derived from the information on the total of live-born children born in the year preceding the census or survey.
Estimation of the fertility by the P(1+)/F(1) method

The proportions of mothers are calculated from the births as follows:

\[ F_l(i) = @l(i-1) + a(i) \cdot f_l(i) + b(i) \cdot f_l(i+1) + c(i) \cdot @l(7) \text{ for } i = 1, 2, \ldots, 6 \]

\[ F_l(7) = @l(6) + a(7) \cdot f_l(7) + b(7) \cdot f_l(6) + c(7) \cdot @l(7) \]

where:

- \( i \) indicates the five-year age group of the women (1:15-19, 2:20-24, \ldots, 7:45-49).

- \( F_l(i) \) is the hypothetical proportion of mothers of age group \( i \).

- \( f_l(i) \) is the current fertility rate of first births for age group \( i \).

- \( @l(i) \) is the proportion of mothers at the upper age limit of group \( i \), calculated in the following way:
  \[ @l(i) = 5 \times \text{the sum of } f_l(j), \text{ for } j \text{ running from } 1 \text{ to } i. \]

- \( a(i), b(i), c(i) \) are the parameters of the equation, depending on \( i \). Their values also depend on the type of information on current fertility (whether one is dealing with first births in the previous year, or referring to registered first births).

Now dividing the observed proportions of mothers by the \( F_l(i) \), one obtains a series of ratios which usually do not differ very much (except perhaps the first which comes from information for the age group 15-19), and may choose the factor with which to correct the observed fertility rates.

If the fertility rates (for all children) were obtained from children born in the year preceding the survey or census, it is necessary to make an adjustment for the displacement of half a year in the age of the mother. See the \( P/F \) method for this adjustment.

d. Options of the routine

This program contains the following options:

i) To work with births (all and the first) which occurred in the year preceding the survey or census, or to work with registered births.

ii) Selection of the ratios \( F_l+(i)/F_l(i) \) which one wants to use as the correction factor (K).

e. Results provided by the routine

The output of this routine for the option using current fertility from censuses or surveys is the following:
**Estimation of the fertility by the P(1+)/F(1) method**

**ESTIMATION OF FERTILITY USING THE P1+/F1 METHOD**

(with half year displacement)

<table>
<thead>
<tr>
<th>AGE</th>
<th>TOTAL WOMEN</th>
<th>TOTAL MOTHERS</th>
<th>CHILDREN EVER BORN FROM CENSUS</th>
<th>FIRST CHILDREN FROM CENSUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>3487</td>
<td>602</td>
<td>359</td>
<td>237</td>
</tr>
<tr>
<td>20-24</td>
<td>2960</td>
<td>1910</td>
<td>787</td>
<td>225</td>
</tr>
<tr>
<td>25-29</td>
<td>2253</td>
<td>1950</td>
<td>540</td>
<td>37</td>
</tr>
<tr>
<td>30-34</td>
<td>1766</td>
<td>1639</td>
<td>369</td>
<td>13</td>
</tr>
<tr>
<td>35-39</td>
<td>1515</td>
<td>1443</td>
<td>265</td>
<td>4</td>
</tr>
<tr>
<td>40-44</td>
<td>1198</td>
<td>1140</td>
<td>105</td>
<td>1</td>
</tr>
<tr>
<td>45-49</td>
<td>1035</td>
<td>980</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AGE</th>
<th>PROPORTION MOTHERS</th>
<th>RATE OF 1ST BIRTHS</th>
<th>CUMULATIVE RATE</th>
<th>EST PROPORTION MOTHERS</th>
<th>P1+/F1 RATIO</th>
<th>FERTILITY RATE 5fx</th>
<th>CORRECTED FERT. RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>0.1726</td>
<td>0.0680</td>
<td>0.3398</td>
<td>0.1598</td>
<td>1.0804</td>
<td>0.1260</td>
<td>0.1376</td>
</tr>
<tr>
<td>20-24</td>
<td>0.6653</td>
<td>0.0760</td>
<td>0.7199</td>
<td>0.5937</td>
<td>1.0869</td>
<td>0.2719</td>
<td>0.3017</td>
</tr>
<tr>
<td>25-29</td>
<td>0.8655</td>
<td>0.0164</td>
<td>0.8020</td>
<td>0.7813</td>
<td>1.1078</td>
<td>0.2540</td>
<td>0.2818</td>
</tr>
<tr>
<td>30-34</td>
<td>0.9281</td>
<td>0.0074</td>
<td>0.8388</td>
<td>0.8283</td>
<td>1.1204</td>
<td>0.2030</td>
<td>0.2253</td>
</tr>
<tr>
<td>35-39</td>
<td>0.9525</td>
<td>0.0026</td>
<td>0.8520</td>
<td>0.8480</td>
<td>1.1232</td>
<td>0.1690</td>
<td>0.1875</td>
</tr>
<tr>
<td>40-44</td>
<td>0.9516</td>
<td>0.0008</td>
<td>0.8562</td>
<td>0.8552</td>
<td>1.1127</td>
<td>0.0764</td>
<td>0.0848</td>
</tr>
<tr>
<td>45-49</td>
<td>0.9469</td>
<td>0.0000</td>
<td>0.8562</td>
<td>0.8560</td>
<td>1.1061</td>
<td>0.0693</td>
<td>0.0767</td>
</tr>
</tbody>
</table>

**TOTAL**

|                  | 1.1052          | 1.2262          |

**TOTAL FERTILITY**

|                  | 5.5259          | 6.1310          |

Correction factor - (average of 2 to 7)

|                  | 1.1095          |

where the following are given:

- a standard title on two lines, which also indicates the selected option (with or without displacement of half a year, for the cases where the current fertility comes from censuses/surveys or from registers, respectively).
- two optional lines of title.
- basic information provided: number of women, number of mothers, children born in the last year and births of order one in the past year (according to the census or registers). This part of the output does not appear on the screen.
- the proportion of mothers by age group of the women.
- the current rate of fertility of first births (when the rates were calculated based on births during the year of the census or survey, these rates correspond to women who on average are half a year younger).
- proportion of mothers at the upper limit of each age group.
- the theoretical proportion of mothers by age group estimated from current fertility of first births.
- the P1+(i)/F1(i) ratios for each age group.
- the current fertility rates (for all children) by conventional five-year age groups, that is, corrected for the half-year displacement if necessary.
- the last column gives the fertility rates by corrected ages using the selected correction factor.
- below the columns of fertility rates by age are present their sums and corresponding total fertility rate.
at the bottom of the table the selected correction factor $P(1+)/F(1)$ is shown along with its value.

f. Form of operation of the routine

1. From the main PANDEM menu, select the 'Menu of Indirect Estimation' option.

2. Selection of the program "$P(1+)/F(1)" within this sub-menu.

3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
</tbody>
</table>

F10 return to Main Menu

file name (without extension) ////////// ENTER end entry
List of Data Files from [d:\directory] ESC cancel
filexxxx.fbd   fileyyyy.fbd   filezzz.fbd

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>2</td>
<td>Births</td>
</tr>
<tr>
<td>3</td>
<td>Correction factor</td>
</tr>
<tr>
<td>4</td>
<td>Data</td>
</tr>
<tr>
<td>6</td>
<td>Results option</td>
</tr>
</tbody>
</table>

If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. Indicate the type of information available:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter births from census</td>
</tr>
<tr>
<td>2</td>
<td>enter births from vital registers</td>
</tr>
</tbody>
</table>
The first option corresponds to births (all, and of order one) to mothers whose ages are in reality half a year less than the conventional five-year age groups. In the second case the age of the mothers corresponds to their actual age at the time their children were born.

5. Enter the number of the first age group which should be taken into account in the calculation of the correction factor. The correction factor is calculated taking the average of all the P1+/P1 ratios from the first to the last group indicated.

<table>
<thead>
<tr>
<th>Enter</th>
<th>Initial index for correction factor (iz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P1/F1</td>
</tr>
<tr>
<td>2</td>
<td>P2/F2</td>
</tr>
<tr>
<td>3</td>
<td>P3/F3</td>
</tr>
<tr>
<td>4</td>
<td>P4/F4</td>
</tr>
<tr>
<td>5</td>
<td>P5/F5</td>
</tr>
<tr>
<td>6</td>
<td>P6/F6</td>
</tr>
<tr>
<td>7</td>
<td>P7/F7</td>
</tr>
</tbody>
</table>

Factor is calculated as average of P1/F1 to P7/F7

When the value of the initial index is entered, the line at the top part of the box changes to:

| Enter | Final index for correction factor (f=) |

6. This step consists of entering the basic data: women, children ever born, children born in the year preceding the census or survey (or children born according to registers, depending on the option selected) and children born of order one. The data must be entered as indicated in the previous chapter.

<table>
<thead>
<tr>
<th>Age</th>
<th>Women</th>
<th>Mothers</th>
<th>Children born from census</th>
<th>First children from census</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-69</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When all the data have been entered, hit [ENTER] and the following will appear on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

If you continue, you must input the title of the table on two lines:
Estimation of the fertility by the $P(1+)/F(1)$ method

7. When this information has been provided the calculation process can begin, but first it is necessary to indicate the form in which the output is desired:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.fbl" will appear very briefly on the screen, where "filename" is the name of your file.

8. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen.

9. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.

g. Bibliographical references

Brass, W., Métodos para estimar la fecundidad y la mortalidad en poblaciones con datos limitados, CELADE, Santiago, 1974, Series E, No. 14.

Brass, W., Seminario sobre métodos para medir variables demográficas (fecundidad y mortalidad), CELADE, San José, 1973, Series DS, No. 9.


3. Infant and childhood mortality

a. Objectives

This program allows the estimation of the level and trend of mortality in the first years of life using information on all live-born children and those still alive by age-groups of the women (Brass method, Coale-Trussell variant).

b. Basic information

i) Number of live-born children by five-year age groups of women between 15 and 49 years of age.

ii) Number of children currently alive for the same age groups of the women.

iii) Values of the ratios P(1)/P(2) and P(2)/P(3), or the basic information for their calculation (number of women and number of live-born for age groups 15-19, 20-24 and 25-29).

c. Description of the method

This method was developed by William Brass and later expanded and improved by various demographers. the version used by this routine is the variant of Coale and Trussell, whose methodology is described in:


The method basically consists of the conversion of the proportions of dead children, with respect to the total number of children born, classified by five-year age groups, into probabilities of death between birth and exact age $x$ ($\sim 1, 2, 3, 5, 10, 15, 20$). For this conversion the following relation is used:

$$q(x) = K(i) \times D(i)$$

$$K(i) = a(i) + b(i) \times \frac{P(1)}{P(2)} + c(i) \times \frac{P(2)}{P(3)}$$

where:

- $q(x)$ is the probability of dying between birth and exact age $x$.
- $D(i)$ is the proportion of dead children of mothers in age group $i$ ($i=1$ for the group 15-19, up to 7 for the age group 45-49).
- $K(i)$ is the multiplication factor to transform the $D(i)$ into $q(x)$.
- $a(i), b(i)$ and $c(i)$ are the parameters of this equation, which depend on $i$ and on the selected family of the model tables of Coale and Demeny.
- $P(1), P(2)$ and $P(3)$ are the mean parities of the women in age groups 15-19, 20-24 and 25-29 respectively.
For the estimation of the location in time of each \( q(x) \), the following equation is used:

\[
t(i) = a^t(i) + b^t(i) \frac{P(1)}{P(2)} + c^t(i) \frac{P(2)}{P(3)}
\]

where:

- \( t(i) \) represents the number of decimal years before the survey or census to which each estimated \( q(x) \) refers (corresponding to age group \( i \)).
- \( a^t(i), b^t(i) \) and \( c^t(i) \) are the parameters of this equation, which depend on \( i \) and on the selected family of the model tables of Coale and Demeny.

\[\text{d. Options of the routine}\]

i) The age groups for which the information will be input: the method may be applied to the 7 age groups (from 15-19 to 45-49) or only to certain related age groups.

ii) Input of the information: the basic data may be input (live-born children and children surviving), or the proportions of children dead.

iii) Input of the ratios \( P(1)/P(2) \) and \( P(2)/P(3) \): this may be done directly, or the basic information necessary for their calculation may be input (women and children ever born for the age groups 15-19, 20-24 and 25-29).

iv) The sex of the children born and children surviving: (male, female or both sexes).

v) Selection of the model table family: one of the four families of the model life tables of Coale and Demeny must be indicated for the calculation of \( q(x) \) and \( t(i) \), as well as for the interpolation of the values of \( q(x) \) in those tables to give estimates of \( q(i) \) and \( q(2) \).
e. **Results provided by the routine**

The output of this program is as follows:

**PANDEM V02.00, August 1988**

**INFANT AND CHILDHOOD MORTALITY. COALE-TRUSSELL SOUTH**

**Basic data**

<table>
<thead>
<tr>
<th>Age</th>
<th>live born</th>
<th>still alive</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>811</td>
<td>747</td>
</tr>
<tr>
<td>20-24</td>
<td>4122</td>
<td>3727</td>
</tr>
<tr>
<td>25-29</td>
<td>6556</td>
<td>5837</td>
</tr>
<tr>
<td>30-34</td>
<td>7475</td>
<td>6601</td>
</tr>
<tr>
<td>35-39</td>
<td>8636</td>
<td>7339</td>
</tr>
<tr>
<td>40-44</td>
<td>7771</td>
<td>6350</td>
</tr>
<tr>
<td>45-49</td>
<td>7338</td>
<td>5960</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>women</th>
<th>live born</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>3487</td>
<td>811</td>
</tr>
<tr>
<td>20-24</td>
<td>2960</td>
<td>4121</td>
</tr>
<tr>
<td>25-29</td>
<td>2233</td>
<td>6556</td>
</tr>
</tbody>
</table>

\[
\begin{array}{cccccc}
\text{I} & \text{D(I)} & \text{X} & \text{Q(X)} & \text{C&D L.} & \text{Year} & \text{Q(1)} & \text{Q(2)} \\
1 & 0.07891 & 1 & 0.07863 & 19.33 & 1982.69 & 0.07863 & 0.09233 \\
2 & 0.09583 & 2 & 0.09934 & 18.82 & 1961.42 & 0.08356 & 0.09934 \\
3 & 0.10967 & 3 & 0.11093 & 18.58 & 1979.51 & 0.08593 & 0.10289 \\
4 & 0.11692 & 5 & 0.11924 & 18.31 & 1977.22 & 0.08664 & 0.10395 \\
5 & 0.15019 & 10 & 0.15596 & 16.98 & 1974.65 & 0.10062 & 0.12560 \\
6 & 0.18286 & 15 & 0.18605 & 15.84 & 1971.84 & 0.11085 & 0.14173 \\
7 & 0.18779 & 20 & 0.18869 & 16.16 & 1968.72 & 0.10788 & 0.13705 \\
\end{array}
\]

\[
p_1/p_2 = 0.1671 \quad p_2/p_3 = 0.4784
\]

**Note:** This is the output which corresponds to the options in which the basic information is input for all age groups from 15-19 to 44-49, as well as the basic information for the calculation of the ratios P(1)/P(2) and P(2)/P(3).

where the following are shown:

- a standard one-line title, indicating as well the selected family from the Coale-Demeny model tables.
- an optional two-line title.
- basic data (with the options selected in this example: live-born children and children still alive by five-year age groups and the number of women and children ever born of the first three age groups). These basic data do not appear on the screen.
- \( D(i) \), the proportion of children dead for age group \( i \).
- \( X \), the exact age for which the probability of death is estimated.
- \( Q(x) \), the probability of dying between birth and exact age \( x \).
- \( C&D \; L. \), the level in the Coale-Demeny model tables (according to the selected family) corresponding to \( q(x) \). A value of 00.00 indicates that the estimated mortality is greater than that in level 1 of the model tables.
Infant and childhood mortality

for the selected family. A value of 99.99 represents a lower mortality than
that of level 24.
- \textit{Year} is the year corresponding to each estimate of $q(x)$ (obtained by
subtracting the calculated value of $t(i)$ from the date of the census or
survey).
- $Q(1)$ is the value of the infant mortality rate which corresponds to the
level of the Coale-Demeny table obtained by the estimation of $q(x)$.
- $Q(2)$ is the value of the probability of dying during the first two years
of life corresponding to the level obtained.
- the values of the ratios $P(1)/P(2)$ and $P(2)/P(3)$ are given at the foot of
the table.

f. Form of operation of the routine

1. From the main PANDEM menu, select the "Menu of Indirect Estimation"
option.

2. Selection of the program "Infant and Childhood Mortality" within this
sub-menu.

3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

Subsequently you must supply the name of the file (to be created, modified
or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in
point 4 below) will offer you the choice of using [F9] to go to the Options Menu
of this routine, which would appear as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>2</td>
<td>Age Interval</td>
</tr>
<tr>
<td>3</td>
<td>Enter $d(i)$ or basic data</td>
</tr>
<tr>
<td>4</td>
<td>Enter $p_1/p_2$ and $p_2/p_3$ or basic data</td>
</tr>
<tr>
<td>5</td>
<td>Coale Demeny model to use</td>
</tr>
<tr>
<td>6</td>
<td>Data</td>
</tr>
<tr>
<td>7</td>
<td>Results option</td>
</tr>
</tbody>
</table>
If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. Indicate if the basic information (children ever born and children surviving) corresponds to the male or female sex, or to both sexes:

<table>
<thead>
<tr>
<th>Enter</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Males</td>
</tr>
<tr>
<td>2</td>
<td>Females</td>
</tr>
<tr>
<td>3</td>
<td>Both Sexes</td>
</tr>
</tbody>
</table>

5. Enter the number of the first age group to be input, and then the number corresponding to the last group (groups 1 to 7 are shown):

<table>
<thead>
<tr>
<th>Enter</th>
<th>For age interval d(i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-19</td>
</tr>
<tr>
<td>2</td>
<td>20-24</td>
</tr>
<tr>
<td>3</td>
<td>25-29</td>
</tr>
<tr>
<td>4</td>
<td>30-34</td>
</tr>
<tr>
<td>5</td>
<td>35-39</td>
</tr>
<tr>
<td>6</td>
<td>40-44</td>
</tr>
<tr>
<td>7</td>
<td>45-49</td>
</tr>
</tbody>
</table>

6. Indicate if the proportions of children dead will be entered directly or if the basic data will be input:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter the d(i) directly</td>
</tr>
<tr>
<td>2</td>
<td>enter the basic data</td>
</tr>
</tbody>
</table>

7. Enter the appropriate code to indicate if the ratios P(1)/P(2) and P(2)/P(3) will be entered directly, or if the basic data will be provided:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter p1/p2 and p2/p3</td>
</tr>
<tr>
<td>2</td>
<td>enter the basic data</td>
</tr>
</tbody>
</table>

8. According to the options previously selected, the necessary information for the application of the method must be entered. In the case where it has been indicated that all the basic data will be entered, the screen will appear as follows:
Infant and childhood mortality

<table>
<thead>
<tr>
<th>live born</th>
<th>now alive</th>
<th>women</th>
<th>live born</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The input of the information consists of two parts:

1) In the first two columns, the values corresponding to the age groups indicated in step 5 are entered.

ii) The last two columns must be filled in only for the first three age groups.

When all the data have been entered, hit [ENTER] and the following will appear on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

If the options were for example to input the proportion of dead children and the ratios $P(1)/P(2)$ and $P(2)/P(3)$ directly, the screen would be the following:

<table>
<thead>
<tr>
<th>$d(i)$</th>
<th>$p_1/p_2$</th>
<th>$p_2/p_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this case the $d(i)$ are entered first and then the values of $p_1/p_2$ and $p_2/p_3$.

9. Next you must enter the code corresponding to the family of Coale-Demeny model tables which you wish to use for the calculation of the $q(x)$ and for interpolation in the model tables.

<table>
<thead>
<tr>
<th>Enter</th>
<th>Coale Demeny model to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North</td>
</tr>
<tr>
<td>2</td>
<td>South</td>
</tr>
<tr>
<td>3</td>
<td>East</td>
</tr>
<tr>
<td>4</td>
<td>West</td>
</tr>
<tr>
<td>5</td>
<td>All</td>
</tr>
</tbody>
</table>
10. Then the year of the study (year of the census or survey) must be entered.

11. Next you must input the title of the table on two lines:

Title
line 1  /////////////////////////////////////////////////////
line 2  /////////////////////////////////////////////////////

12. Next it is necessary to indicate the form in which the output is desired:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.mol" will appear very briefly on the screen, where "filename" is the name of your file.

13. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen.

**Note:** Keep in mind that the calculations are relatively long.

14. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.

g. Bibliographical references

Brass, W., Métodos para estimar la fecundidad y mortalidad en poblaciones con datos limitados, CELADE, Santiago, 1974, Series E, No. 14.

Brass, W., Seminario sobre métodos para medir variables demográficas (fecundidad y mortalidad), CELADE San José, 1973, Series DS, No. 9.

Brass, W. and E.A. Bamboye, The time location of reports of survivorship: estimates for maternal and paternal orphanhood and ever-widowed. Working Paper No. 81-1, London School of Hygiene and Tropical Medicine, Centre for Population Studies, 1981.
Infant and childhood mortality


4. Maternal orphanhood

a. Objectives

This method permits the calculation of estimates of female adult mortality, using information obtained from the question "Is your mother alive?" in a survey or a population census.

b. Basic information

i) Maternal orphans and non-orphans by five-year age groups between 15 and 49 years of age.

ii) The mean age of mothers directly or via the basic information: number of births in the year preceding the survey or census by five-year groups from 15 to 49 years of age.

iii) The year to which the basic information refers (year of the survey or census, expressed with decimals).

c. Description of the method

The methodology used in this routine is that proposed by Hill and Trussell and is described in:


This method consists of converting the proportions of non-orphans by five-year age groups into female survival probabilities from age 25 onwards, using the following relation:

\[
\frac{1(25+N)}{1(25)} = a(N) + b(N) \times M + c(N) \times NO(N-5)
\]

where:

- \( N \) is the upper limit of each five-year age group (\( N = 20, 25, \ldots, 50 \)).
- \( 1(25) \) and \( 1(25+N) \) represent the number of survivors at exact ages 25 and 25+N, respectively, in a life table.
- \( a(N) \), \( b(N) \) and \( c(N) \) are the parameters of the regression equation and vary according to the age group.
- \( M \) is the mean age of the mothers.
- \( NO(N-5) \) is the proportion of non-orphans in the age group \( N-5, N \).

To calculate the point in time referred to by each of the estimates of the probability of survival obtained by this method, the following relation (developed by Brass and Bamgboye) is used:

\[
t(N) = 0.5 \times (N-2.5) \times [1 - (1/3 \ln NO(N-5) + Z(N+M-2.5) + 0.0037(27-M))]
\]
where:

- $t(N)$ is the number of years before the survey or census referred to by the corresponding estimate.
- $N$ is the upper limit of each five-year age group.
- $M$ is the mean age of the mothers.
- $Z(N+M-2.5)$ is a value calculated based on a standard mortality model, and depends on $(N + M - 2.5)$.
- $N0(N-5)$ is the proportion of persons in age group $N-5,N$ whose mother is alive.

For the calculation of the mean age of the mothers from the births occurring during the years preceding the survey or census, the following formula is used:

$$M = \Sigma((x + 2.5) \times 5Bx) - 0.5$$

where:

- $(x+2.5)$ is the mid-point of each five-year age group.
- $5Bx$ is the number of births to the women in age group $x,x+5$ in the year preceding the survey or census.

Half a year is subtracted because the mothers were half a year younger when they gave birth. This implies that if the user has the births from the vital registers, $M$ should be calculated outside the program and input directly to this routine.

d. Options of the routine

This program contains the following options:

i) To input the mean age of the mothers directly or to input the basic data necessary for its calculation (births occurring the year preceding the survey or census by five-year age groups).

ii) Selection of the family from the model tables of Coale and Demeny (North, South, East, West or all families).
e. Results provided by the routine

The output of this routine is the following:

FEMALE ADULT MORTALITY FROM MATERNAL ORPHANHOOD  PANDEM V02.00, August 1988

Year of study  1983.75  Model  SOUTH

<table>
<thead>
<tr>
<th>AGE</th>
<th>NORPH</th>
<th>ORPH</th>
<th>N</th>
<th>NO(N-5)</th>
<th>L(25+N)/L(25)</th>
<th>C&amp;D L.</th>
<th>e(25)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>6259</td>
<td>268</td>
<td>20</td>
<td>0.9445</td>
<td>0.9384</td>
<td>17.60</td>
<td>47.37</td>
<td>1976.0</td>
</tr>
<tr>
<td>20-24</td>
<td>5005</td>
<td>467</td>
<td>25</td>
<td>0.9147</td>
<td>0.9097</td>
<td>17.16</td>
<td>46.90</td>
<td>1974.2</td>
</tr>
<tr>
<td>25-29</td>
<td>3644</td>
<td>594</td>
<td>30</td>
<td>0.8571</td>
<td>0.8548</td>
<td>15.81</td>
<td>45.48</td>
<td>1972.7</td>
</tr>
<tr>
<td>30-34</td>
<td>2744</td>
<td>707</td>
<td>35</td>
<td>0.7951</td>
<td>0.7969</td>
<td>15.42</td>
<td>45.06</td>
<td>1971.5</td>
</tr>
<tr>
<td>35-39</td>
<td>1928</td>
<td>824</td>
<td>40</td>
<td>0.7006</td>
<td>0.7052</td>
<td>14.85</td>
<td>44.46</td>
<td>1970.5</td>
</tr>
<tr>
<td>40-44</td>
<td>1315</td>
<td>981</td>
<td>45</td>
<td>0.5727</td>
<td>0.5729</td>
<td>14.22</td>
<td>43.81</td>
<td>1969.6</td>
</tr>
<tr>
<td>45-49</td>
<td>901</td>
<td>1069</td>
<td>50</td>
<td>0.4574</td>
<td>0.4465</td>
<td>15.27</td>
<td>44.91</td>
<td>1969.3</td>
</tr>
</tbody>
</table>

Mean age of mothers: 26.48

where the following is given:

- a standard title (first line), an optional two-line title, the date of the study and the selected family of model tables.
- basic information provided (number of maternal orphans and non-orphans by five-year age groups).
- N (the upper limit of each age group).
- NO(N-5) (the proportion of persons whose mother is alive by five-year age group).
- L(25+N)/L(25) is the probability of survival from exact age 25.
- C&D L. (level of the Coale-Demeny model tables corresponding to each estimated survival probability, according to the selected family, calculated by linear interpolation). A value of 0 indicates that the estimated mortality is higher than in the model tables. On the other hand, a value of 99 indicates a lower mortality than in the model tables.
- e(25) is the life expectancy at exact age 25, according to the calculated Coale-Demeny level.
- Year, is the calendar year to which each estimate refers, calculated by subtracting t(N) from the year of the study.
- at the bottom of the table appears the value of the mean age of the mothers (input or calculated from the basic data input).

f. Form of operation of the routine

1. From the main PANDEM menu, select the "Menu of Indirect Estimation" option.

2. Selection of the program "Maternal orphanhood" within this sub-menu.
3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>2</td>
<td>Enter Mean Age of Mothers</td>
</tr>
<tr>
<td>3</td>
<td>Data</td>
</tr>
<tr>
<td>4</td>
<td>Coale Demeny Model</td>
</tr>
<tr>
<td>5</td>
<td>Results option</td>
</tr>
</tbody>
</table>

If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. The first step consists of indicating the option for entering the mean age of the mothers:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enter the mean age of the mothers</td>
</tr>
<tr>
<td>2</td>
<td>Have the program calculate it</td>
</tr>
</tbody>
</table>

5. Depending on the option selected the basic data are entered.

5.1) Option 1:
### Maternal orpanhood

<table>
<thead>
<tr>
<th>Age</th>
<th>Non-orphaned Children</th>
<th>Orphaned Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The basic data must be entered as indicated in the previous chapter. After the last value has been entered, press [ENTER] and the following will appear on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

Continuing, there appears on the screen a request for the mean age of the mothers:

\[ M = \]

and the corresponding value is input, followed by an [ENTER] (go to step 6).

#### 5.2) Option 2:

If the option of calculating the mean age of the mothers with the program was selected, the following will appear on the screen:

<table>
<thead>
<tr>
<th>Age</th>
<th>Non-orphaned Children</th>
<th>Orphaned Children</th>
<th>Births by Age of Mother</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

which must be filled in with the corresponding data.

6. The following step, the same for both options, consists of entering the year of the study:

```
/ Year of study /
```

and then [ENTER].

7. Then the screen will show (at the right side, besides \( M = \) or besides the "Birth by Age of Mother" column, depending upon the option chosen):
8. After inputting the code of the model to be used with an [ENTER], the title of the table of results is input (on two lines, with an [ENTER] after each line):

<table>
<thead>
<tr>
<th>Enter</th>
<th>Coale Demeny model to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North</td>
</tr>
<tr>
<td>2</td>
<td>South</td>
</tr>
<tr>
<td>3</td>
<td>East</td>
</tr>
<tr>
<td>4</td>
<td>West</td>
</tr>
<tr>
<td>5</td>
<td>All</td>
</tr>
</tbody>
</table>

Title
line 1  ///////////////////////////////////////////////////
line 2  ///////////////////////////////////////////////////

9. The final step is once again a general step which refers to the form in which the output is desired:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.oml" will appear very briefly on the screen, where "filename" is the name of your file.

10. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen.

11. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

    Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.
g. Bibliographical references


Brass, W. and E.A. Bangboyé, *The time location of reports of survivorship: estimates for maternal and paternal orphanhood and ever-widowed*, Working Paper No. 81-1, London School of Hygiene and Tropical Medicine, Centre for Population Studies, 1981.


5. **Paternal orphanhood**

a. **Objectives**

This method permits the calculation of estimates of male adult mortality, using information obtained from the question "Is your father alive?" in a survey or a population census.

b. **Basic information**

i) Paternal orphans and non-orphans by five-year age groups between 15 and 49 years of age.

ii) The mean age of fathers.

iii) The year to which the basic information refers (year of the survey or census, expressed with decimals).

c. **Description of the method**

The methodology used in this routine is that proposed by Hill and Trussell and is described in:


This method consists of converting the proportions of non-orphans by five-year age groups into male survival probabilities from age 32.5 or 37.5 onwards, using the following relations:

\[
1(35+N)/1(32.5) = W(N) S(N-5) + [1-W(N)] S(N)
\]

\[
1(40+N)/1(37.5) = W(N) S(N-5) + [1-W(N)] S(N)
\]

where:

- \(1(35+N)/1(32.5)\) and \(1(40+N)/1(37.5)\) are the probabilities of survival from age 32.5 or 37.5 until age 35+N or 40+N, respectively.
- \(W(N)\) are weighting factors for the conversion of proportions with living father into male survival probabilities, which depend on the mean age of the fathers and on \(N\).
- \(S(N)\) is the proportion of non-orphans in the age group \(N, N+5\).
- \(N\) is the central age of the five-year age groups.

To calculate the location in time referred to by each of the estimates of the probability of survival, the following relations (developed by Brass and Bamgboye) are used:

\[
t(N) = (N + 0.75) [1.0 - U(N)]/2.0
\]

\[
U(N) = 0.3333 \ln 10 NO(N-5) + Z(M+N) + 0.0037(27 - M + 0.75)
\]
where:

- \( t(N) \) is the number of years before the survey or census referred to by the corresponding equation.
- \( N \) is the central age of the two five-year age groups.
- \( M \) is the mean age of the fathers.
- \( Z(M+N) \) is a value calculated from a standard model of mortality and depends on \( (N+M) \).
- \( \text{IONO}(N-5) \) is the proportion of persons with living father in the age group \( N-5, N+5 \).
- The value 0.75 is added into the equation to take into account the fact that the father must have been alive at the time of conception.

**Calculation of the mean age of the fathers \((M)\)**

Often there is no information available about the age of the father at the time of birth of his children which would permit obtaining its value directly. Hence the mean age of the fathers \((M)\) must often be estimated indirectly.

For this it is necessary to calculate the mean age at time of first marriage or union, by sex, \((\text{SMAMm} \text{ and SMAMf}; \text{see the methods of male and female widowhood for their calculation})\), take the difference and add it to the mean age of the mothers. That is to say, it is supposed that the difference between age at first marriage or union, by sex, is the same as that between the mean ages of the fathers and the mothers. (For the calculation of the mean age of the mothers, see the description of the method of maternal orphanhood.)

**d. Options of the routine**

This program contains the following option:

Selection of the family from the model tables of Coale and Demeny (North, South, East, West or all the families).

**e. Results provided by the routine**

The output of this routine is the following:

```
ADULT MALE MORTALITY BY PATERNAL ORPHANHOOD
PANDEM V02.00, August 1988

<table>
<thead>
<tr>
<th>Year of study</th>
<th>1986</th>
<th>Model</th>
<th>SOUTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>NORPH</td>
<td>ORPH</td>
<td>N</td>
</tr>
<tr>
<td>15-19</td>
<td>4405</td>
<td>587</td>
<td>15</td>
</tr>
<tr>
<td>20-24</td>
<td>2982</td>
<td>686</td>
<td>20</td>
</tr>
<tr>
<td>25-29</td>
<td>2089</td>
<td>838</td>
<td>25</td>
</tr>
<tr>
<td>30-34</td>
<td>1445</td>
<td>1046</td>
<td>30</td>
</tr>
<tr>
<td>35-39</td>
<td>1122</td>
<td>1298</td>
<td>35</td>
</tr>
<tr>
<td>40-44</td>
<td>754</td>
<td>1443</td>
<td>40</td>
</tr>
<tr>
<td>45-49</td>
<td>432</td>
<td>1421</td>
<td>45</td>
</tr>
</tbody>
</table>
```

Mean age of the fathers : 30.60
where the following is given:

- a standard title (first line), an optional two-line title, the date of the study and the selected family of model tables.
- basic information provided (number of paternal orphans and non-orphans by five-year age groups).
- \( N \) is the upper limit of each age group.
- \( NO(N) \) is the proportion of persons whose father is alive by five-year age group.
- \( 1(35+N)/1(32.5) \) is the probabilities of survival from age 32.5. If the mean age of the fathers is over 36 years, the estimated probability is \( 1(40+N)/1(37.5) \).
- \( C\&D \_L \) (level of the Coale-Demeny model tables corresponding to each estimated survival probability, according to the selected family, calculated by linear interpolation). A value of 0 indicates that the estimated mortality is higher than in the model tables. On the other hand, a value of 99 indicates a lower mortality than in the model tables.
- \( e(25) \) is the life expectancy at exact age 25, according to the calculated Coale-Demeny level.
- \( Year \) is the calendar year to which each estimate refers, calculated by subtracting t(N) from the year of the study.
- at the bottom of the table appears the value of the mean age of the fathers.

f. Form of operation of the routine

1. From the main PANDEM menu, select the "Menu of Indirect Estimation" option.

2. Selection of the program "Paternal orphanhood" within this sub-menu.

3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:
If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. Entry of the basic data:

<table>
<thead>
<tr>
<th>Age</th>
<th>Non-orphaned Children</th>
<th>Orphaned Children</th>
<th>M =</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The basic data must be entered as described in the previous chapter. When all the data have been entered, hit [ENTER] and the following will appear on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

5. The next step is to enter the year of the study and then [ENTER].

6. Then the screen will show at the right side of M:

<table>
<thead>
<tr>
<th>Enter</th>
<th>Coale Demyen model to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North</td>
</tr>
<tr>
<td>2</td>
<td>South</td>
</tr>
<tr>
<td>3</td>
<td>East</td>
</tr>
<tr>
<td>4</td>
<td>West</td>
</tr>
<tr>
<td>5</td>
<td>All</td>
</tr>
</tbody>
</table>

7. After inputting the code of the model to be used with an [ENTER], the title of the table of results is input (on two lines, with an [ENTER] after each line):

<table>
<thead>
<tr>
<th>Title</th>
</tr>
</thead>
</table>
| line 1 

<table>
<thead>
<tr>
<th>Title</th>
</tr>
</thead>
</table>
| line 2 

<table>
<thead>
<tr>
<th>Title</th>
<th>//////////////////////////////////////////////////////////</th>
</tr>
</thead>
</table>
8. The final step is again a general step which refers to the form in which the output is desired:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.opl" will appear very briefly on the screen, where "filename" is the name of your file.

9. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen.

10. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

"Abandon the session? Y/N"

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.

g. Bibliographical references

Brass, W., Métodos para estimar la fecundidad y mortalidad en poblaciones con datos limitados, CELADE, Santiago, 1974, Series E, No. 14.

Brass, W., Seminario sobre métodos para medir variables demográficas (fecundidad y mortalidad), CELADE, San José, 1973, Series DS, No. 9.

Brass, W. and E.A. Bamgboyed, The time location of reports of survivorship: estimates for maternal and paternal orphanhood and ever-widowed, Working Paper No. 82-1, London School of Hygiene and Tropical Medicine, Centre for Population Studies, 1981.


6. Female widowhood

a. Objectives

This method allows the estimation of male adult mortality, using information obtained with the question "Is your first spouse or partner alive?" in a survey or census of the female population.

b. Basic information

i) Female widowed and non-widowed population, by five-year age groups between 20 and 59 years of age.

ii) The mean age at first marriage or union of the female population (SMAMf) and of the male population (SMAMm), or the basic information necessary to calculate them: male and female single and non-single populations by five-year age groups between 15 and 54 years of age.

iii) Year referred to by the basic information (year of the survey or census, expressed with decimals).

c. Description of the method

The methodology used in this routine is that proposed by Hill and Trussell and is described in:


This method consists of converting the proportions of non-widowed women by five-year age groups into male survival probabilities from age 20 onward, using the following relation:

\[
\frac{1(N)}{1(20)} = a(N) + b(N) \cdot SMAMf + c(N) \cdot SMAMm + d(N) \cdot NW(N-5)
\]

where:

- \(N\) is the upper limit of each five-year age group (\(N = 20, 25, ..., 60\)).
- \(1(N)\) represents the probability of surviving from age 20 to age \(N\).
- \(1(20)\) represents the probability of surviving from age 20 to age 20.
- \(a(N)\), \(b(N)\), \(c(N)\), and \(d(N)\) are the parameters of the equation and vary according to the age group.
- \(SMAMf\) and \(SMAMm\) are the mean age of the female and male populations at the time of entering first marriage or union, respectively.
- \(NW(N-5)\) is the proportion of women who are not widows of their first spouse or partner in each age group.
To calculate the location in time referred to by each of the estimates of the probability of survival, the following relations (developed by Brass and Bamgboye) are used:

\[ U(N) = 0.3333 \ln NW(N-5) + Z(SMAMm+N-2.5-SMAMf) + 0.0037(27.0 - SMAMm) \]

\[ t(N) = (N - 2.5 - SMAMf) [1.0 - U(N)]/2.0 \]

where:

- \( t(N) \) is the number of years before the survey or census referred to by the estimate.
- \( NW(N-5) \) is the proportion of non-widowed women in the age group \( N-5, N \).
- \( Z \) is a value calculated based on a mortality model and depends on \( (SMAMm + N - 2.5 - SMAMf) \).
- \( N \) is the upper limit of each five-year age group.
- \( SMAMm \) and \( SMAMf \) are respectively the mean ages of the men and the women who enter their first marriage or union.

The \( SMAMm \) and \( SMAMf \) (the singulate mean age at marriage) is the mean age of the single and non-single population, less than 50 years old, which marries for the first time. Their calculation requires the single and non-single population by age and sex between 15 and 54 years of age.

d. Options of the routine

This program contains the following options:

i) To enter the mean age at first marriage or union, \( SMAMf \) and \( SMAMm \), directly, or provide the basic information for their calculation.

ii) Selection of the family from the model tables of Coale and Demeny (North, South, East, West or all families).

e. Results provided by the routine

The output of this routine is the following:

<table>
<thead>
<tr>
<th>Year of study</th>
<th>( SMAM(f) )</th>
<th>( SMAM(m) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976.5</td>
<td>23.539</td>
<td>26.143</td>
</tr>
</tbody>
</table>
where the following is given:

- a standard title (first line), an optional two-line title, the date of the study and the selected family of model tables.
- basic information provided (number of widows and non-widows by five-year age groups).
- \( N \) is the upper limit of each age group.
- \( NW(N-5) \) is the proportion of non-widowed women by five-year age group.
- \( l(N)/l(20) \) is the probabilities of survival from exact age 20.
- \( CD(T) \) is the level of the Coale-Demeny model tables corresponding to each estimated survival probability, according to the selected family, calculated by linear interpolation. A value of 0 indicates that the estimated mortality is higher than in the model tables. On the other hand, a value of 99 indicates a lower mortality than in the model tables.
- \( e(25) \) is the life expectancy at exact age 25, according to the calculated Coale-Demeny level.
- Year is the calendar year to which each estimate refers, calculated by subtracting \( t(N) \) from the year of the study.
- at the bottom of the table appear the values of SMAMf and SMAMm.

f. Form of operation of the routine

1. From the main PANDEM menu, select the "Menu of Indirect Estimation" option.

2. Selection of the program "Female widowhood" within this sub-menu.

3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

file name (without extension) //________ ENTER end entry
List of Data Files from [d:\directory] ESC cancel
filexxxx.vfd    fileyyyy.vfd    filezzzz.vfd

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>2</td>
<td>Enter SMAMM y SMAMF</td>
</tr>
<tr>
<td>3</td>
<td>Data</td>
</tr>
<tr>
<td>4</td>
<td>Coale Demeny Model</td>
</tr>
<tr>
<td>5</td>
<td>Results option</td>
</tr>
</tbody>
</table>
If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. The first step consists of indicating the option for the input of the mean age of the female and male populations at first marriage or union (SMAMf and SMAMm).

<table>
<thead>
<tr>
<th>Enter</th>
<th>If</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>entering the SMAM directly</td>
</tr>
<tr>
<td>2</td>
<td>the program will calculate it</td>
</tr>
</tbody>
</table>

5. Depending on the option selected, the basic data are entered.

5.1) Option 1:

<table>
<thead>
<tr>
<th>Age</th>
<th>Not Widows</th>
<th>Widows</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data must be entered as indicated in the previous chapter. When all the data have been entered, press [ENTER] and the following will appear on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

Continuing, the request for SMAMf and SMAMm appear on the screen in the following manner:

<table>
<thead>
<tr>
<th>Age</th>
<th>Not Widows</th>
<th>Widows</th>
<th>Provide SMAM(F)</th>
<th>Provide SMAM(M)</th>
</tr>
</thead>
</table>

and the values of the mean age of the female and male populations at time of first marriage or union are input, followed by an [ENTER]. (Step 6 follows.)
5.2) Option 2:

If the option of calculating the mean age of the female and male populations at time of first marriage or union with the program has been selected, the following will appear on the screen:

<table>
<thead>
<tr>
<th>Age</th>
<th>Not Widows</th>
<th>F</th>
<th>F Not M</th>
<th>M</th>
<th>Not Single</th>
<th>Single</th>
<th>Single</th>
<th>Single</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

and must be filled in with the corresponding data.

6. The following step, the same for both options, consists of entering the year of the study:

```
/ Year of study /
```

and then [ENTER].

7. Then there appears on the screen, beside SMAMf and SMAMm or beside the F Single, F Not Single, M Single and M Not Single populations, as the case may be:

<table>
<thead>
<tr>
<th>Enter</th>
<th>Coale Demeny model to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North</td>
</tr>
<tr>
<td>2</td>
<td>South</td>
</tr>
<tr>
<td>3</td>
<td>East</td>
</tr>
<tr>
<td>4</td>
<td>West</td>
</tr>
<tr>
<td>5</td>
<td>All</td>
</tr>
</tbody>
</table>

8. After inputting the code of the model to be used with an [ENTER], the title of the table of results is input (on two lines, with an [ENTER] after each line):

```
Title
line 1
line 2
```

9. The final step is again a general step which refers to the form in which the output is desired:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>
If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.vfl" will appear very briefly on the screen, where "filename" is the name of your file.

10. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen.

11. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.

g. Bibliographical references

Brass, W., Métodos para estimar la fecundidad y mortalidad en poblaciones con datos limitados, CELADE, Santiago, 1974, Series E, No. 14.

Brass, W., Seminario sobre métodos para medir variables demográficas (fecundidad y mortalidad), CELADE, San José, 1973, Series DS, No. 9.

Brass, W. and E.A. Bamgboye, The time location of reports of survivorship: estimates for maternal and paternal orphanhood and ever-widowed, Working Paper No. 81-1, London School of Hygiene and Tropical Medicine, Centre for Population Studies, 1981.


7. **Male widowhood**

a. **Objectives**

This method allows the estimation of female adult mortality, using information obtained with the question "Is your first spouse or partner alive?" in a survey or census of the male population.

b. **Basic information**

i) Male widowed and non-widowed population, by five-year age groups between 20 and 59 years of age.

ii) The mean age at first marriage or union of the female population (SMAMf) and of the male population (SMAMm), or the basic information necessary to calculate them: male and female single and non-single populations by five-year age groups between 15 and 54 years of age.

iii) Year referred to by the basic information (year of the survey or census, expressed with decimals).

c. **Description of the method**

The methodology used in this routine is that proposed by Hill and Trussell and is described in:


This method consists of converting the proportions of non-widowed men by five-year age groups into female survival probabilities from age 20 onward, using the following relation:

$$
\frac{1(N)}{1(20)} = a(N) + b(N) \times SMAMf + c(N) \times SMAMm + d(N) \times NW(N-5)
$$

where:

- **N** is the upper limit of each five-year age group ($N = 20, 25, \ldots, 65$).
- \(\frac{1(N)}{1(20)}\) represents the probability of surviving from age 20 to age **N**.
- \(a(N), b(N), c(N)\) and \(d(N)\) are the parameters of the equation and vary according to the age group.
- \(SMAMf\) and \(SMAMm\) are the mean age of the female and male populations at the time of entering first marriage or union, respectively.
- \(NW(N-5)\) is the proportion of men who are not widowers of their first spouse or partner in each age group.
To calculate the location in time referred to by each of the estimates of the probability of survival, the following relations (developed by Brass and Bangboye) are used:

\[ U(N) = 0.3333 \ln \frac{NW(N-5) + Z(SMAMm+N-2.5-SMAMf) + 0.0037(27.0 - SMAMm)}{t(N) - (N - 2.5 - SMAMf) \left[ 1.0 - U(N) \right]/2.0} \]

where:

- \( t(N) \) is the number of years before the survey or census referred to by the estimate.
- \( NW(N-5) \) is the proportion of non-widowed men in the age group \( N-5, N \).
- \( Z \) is a value calculated based on a mortality model and depends on \( SMAMm + N - 2.5 - SMAMf \).
- \( N \) is the upper limit of each five-year age group.
- \( SMAMm \) and \( SMAMf \) are respectively the mean ages of the men and the women who enter their first marriage or union.

The \( SMAMm \) and \( SMAMf \) (the singulate mean age at marriage) is the mean age of the single and non-single population, less than 50 years old, which marries for the first time. Their calculation requires the single and non-single population by age and sex between 15 and 54 years of age.

d. Options of the routine

This program contains the following options:

i) To enter the mean age at first marriage or union, \( SMAMf \) and \( SMAMm \), directly, or provide the basic information for their calculation.

ii) Selection of the family from the model tables of Coale and Demeny (North, South, East, West or all families).

e. Results provided by the routine

The output of this routine is the following:

FEMALE ADULT MORTALITY FROM MALE WIDOWHOOD

<table>
<thead>
<tr>
<th>Year of study</th>
<th>1976.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>NOT WIDOWED</td>
</tr>
<tr>
<td></td>
<td>NW(N-5)</td>
</tr>
<tr>
<td>25-29</td>
<td>920</td>
</tr>
<tr>
<td>30-34</td>
<td>1035</td>
</tr>
<tr>
<td>35-39</td>
<td>1001</td>
</tr>
<tr>
<td>40-44</td>
<td>929</td>
</tr>
<tr>
<td>45-49</td>
<td>750</td>
</tr>
<tr>
<td>50-54</td>
<td>592</td>
</tr>
<tr>
<td>55-59</td>
<td>471</td>
</tr>
</tbody>
</table>

\[ SMAM(f) = 23.539 \]
\[ SMAM(m) = 26.143 \]
where the following is given:

- a standard title (first line), an optional two-line title, the date of the study and the selected family of model tables.
- basic information provided (number of widowers and non-widowers by five-year age groups).
- \( N \) is the upper limit of each age group.
- \( NW(N-5) \) is the proportion of non-widowed men by five-year age group.
- \( l(N)/l(20) \) is the probabilities of survival from exact age 20.
- \( C\&D.L. \) is the level of the Coale-Demeny model tables corresponding to each estimated survival probability, according to the selected family, calculated by linear interpolation. A value of 0 indicates that the estimated mortality is higher than in the model tables. On the other hand, a value of 99 indicates a lower mortality than in the model tables.
- \( e(25) \) is the life expectancy at exact age 25, according to the calculated Coale-Demeny level.
- \( Y \) ear is the calendar year to which each estimate refers, calculated by subtracting \( t(N) \) from the year of the study.
- at the bottom of the table appear the values of SMAMf and SMAMm.

f. Form of operation of the routine

1. From the main PANDEM menu, select the "Menu of Indirect Estimation" option.
2. Selection of the program "Male widowhood" within this sub-menu.
3. Indicate if you want:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

file name (without extension) \(/\ldots/\)
List of Data Files from id: \(\ldots/\) ENTER end entry
filexxxx.vmd   fileyyyy.vmd   filezzzz.vmd

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>2</td>
<td>Enter SMAMf y SMAMm</td>
</tr>
<tr>
<td>3</td>
<td>Data</td>
</tr>
<tr>
<td>4</td>
<td>Coale Demeny Model</td>
</tr>
<tr>
<td>5</td>
<td>Results option</td>
</tr>
</tbody>
</table>
If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. The first step consists of indicating the option for the input of the mean age of the female and male populations at first marriage or union (SMAMf and SMAMm).

<table>
<thead>
<tr>
<th>Enter</th>
<th>If</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>entering the SMAM directly</td>
</tr>
<tr>
<td>2</td>
<td>the program will calculate</td>
</tr>
<tr>
<td></td>
<td>it</td>
</tr>
</tbody>
</table>

5. Depending on the option selected, the basic data are entered.

5.1) Option 1:

<table>
<thead>
<tr>
<th>Age</th>
<th>Not</th>
<th>Widowers</th>
<th>Widowers</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data must be entered as indicated in the previous chapter. When all the data have been entered, hit [ENTER] and the following will appear on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

Continuing, the request for SMAMf and SMAMm appear on the screen in the following manner:

<table>
<thead>
<tr>
<th>Age</th>
<th>Not</th>
<th>Widowers</th>
<th>Widowers</th>
<th>Provide SMAM(F)</th>
<th>Provide SMAM(M)</th>
</tr>
</thead>
</table>

and the values of the mean age of the female and male populations at time of first marriage or union are input, followed by an [ENTER]. (Step 6 follows.)

5.2) Option 2:

If the option of calculating the mean age of the female and male populations at time of first marriage or union with the program has been selected, the following will appear on the screen:
and must be filled in with the corresponding data.

6. The following step, the same for both options, consists of entering the year of the study:

/ Year of study /

and then [ENTER].

7. Then there appears on the screen, beside SMAMf and SMAMm or beside the F Single, F Not Single, M Single and M Not Single populations, as the case may be:

<table>
<thead>
<tr>
<th>Enter</th>
<th>Coale Demeny model to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North</td>
</tr>
<tr>
<td>2</td>
<td>South</td>
</tr>
<tr>
<td>3</td>
<td>East</td>
</tr>
<tr>
<td>4</td>
<td>West</td>
</tr>
<tr>
<td>5</td>
<td>All</td>
</tr>
</tbody>
</table>

8. After inputting the code of the model to be used with an [ENTER], the title of the table of results is input (on two lines, with an [ENTER] after each line):

Title line 1
Title line 2

9. The final step is again a general step which refers to the form in which the output is desired:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
</tbody>
</table>

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.wml" will appear very briefly on the screen, where "filename" is the name of your file.
10. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen.

11. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.

**g. Bibliographical references**

Brass, W., Métodos para estimar la fecundidad y mortalidad en poblaciones con datos limitados, Santiago, CELADE 1974, Series E, No. 14.

Brass, W., Seminario sobre métodos para medir variables demográficas (fecundidad y mortalidad), CELADE, San José, 1973, Series DS, No. 9.

Brass, W. and E.A. Bampboyé, The time location of reports of survivorship: estimates for maternal and paternal orphanhood and ever-widowed, Working Paper No. 81-1, London School of Hygiene and Tropical Medicine, Centre for Population Studies, 1981.


8. Application of the method of the distribution of deaths by age

a. Objectives

This method permits the estimation of the average annual rate of growth of the population (r) and the relation between the coverage of deaths with respect to that corresponding to the censal population (f).

b. Basic information

i) Population by five-year age groups.

ii) Deaths by five-year age groups for the same year to which the population refers, or close to it.

c. Description of the method

The methodology used corresponds to that proposed by W. Brass and points out that in any population, closed to migration, the rate of growth is equal to the difference between the rates of fertility and mortality. This may be generalized to any age interval and in particular to the population of age x and above, where the rate of entry into this age group (equivalent to the birth rate for the population aged 0 and above) and the corresponding partial mortality rate are:

$$r(x+) = \frac{N(x)}{N(x+)} - \frac{D(x+)}{N(x+)}$$

where:

- $N(x)$ is the population of exact age $x$
- $N(x+)$ is the population aged $x$ and above
- $D(x+)$ are the deaths aged $x$ and above.

In stable populations $r(x+)$ is constant for all values of $x$ and hence the following linear relation can be written:

$$\frac{N(x)}{N(x+)} = r + \frac{D(x+)}{N(x+)}$$

Accepting that in a real population the conditions for stability are approximately met, that the age structure of the censal population is correct and that the relative coverage of the register of deaths to the census (f) is constant with respect to age, this equation takes on the following form:

$$\frac{N'(x)}{N'(x+)} = r + f \frac{D'(x+)}{N'(x+)}$$

(where ' corresponds to the observed values)
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Application of the method of the distribution of deaths by age

and therefore the growth rates and the correction factor for the mortality rates can be estimated by fitting the observed values, if this is justified by the observed points showing an approximately linear trend.

d. Options of the routine

At the moment there is only one option which allows the input of the population by five-year age groups and a single set of deaths by five-year age groups, both series terminating with the open interval 80+.

Note: On this point, it would be worth extending the options so as to make the open interval more flexible, to pro-rate the category with unknown age and to allow the input of series of deaths.

e. Results provided by the routine

The output of the routine is as follows:

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Population</th>
<th>Deaths</th>
<th>N(x+)</th>
<th>D(x+)</th>
<th>N(x)</th>
<th>b(x+)</th>
<th>d(x+)</th>
<th>r(x+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5160221</td>
<td>70854</td>
<td>5160221</td>
<td>70854</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-9</td>
<td>870377</td>
<td>35360</td>
<td>870377</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>777735</td>
<td>4486</td>
<td>777735</td>
<td>4289844</td>
<td>35494</td>
<td>164811</td>
<td>0.0384</td>
<td>0.0083</td>
</tr>
<tr>
<td>15-19</td>
<td>678160</td>
<td>1770</td>
<td>678160</td>
<td>3512109</td>
<td>31008</td>
<td>145590</td>
<td>0.0415</td>
<td>0.0088</td>
</tr>
<tr>
<td>20-24</td>
<td>560279</td>
<td>1638</td>
<td>560279</td>
<td>2833949</td>
<td>29238</td>
<td>123844</td>
<td>0.0437</td>
<td>0.0103</td>
</tr>
<tr>
<td>25-29</td>
<td>470272</td>
<td>1912</td>
<td>470272</td>
<td>2275670</td>
<td>27600</td>
<td>103055</td>
<td>0.0453</td>
<td>0.0121</td>
</tr>
<tr>
<td>30-34</td>
<td>347260</td>
<td>1684</td>
<td>347260</td>
<td>1803398</td>
<td>25688</td>
<td>81753</td>
<td>0.0463</td>
<td>0.0142</td>
</tr>
<tr>
<td>35-39</td>
<td>282482</td>
<td>1733</td>
<td>282482</td>
<td>1456138</td>
<td>24004</td>
<td>62974</td>
<td>0.0432</td>
<td>0.0165</td>
</tr>
<tr>
<td>40-44</td>
<td>268313</td>
<td>1842</td>
<td>268313</td>
<td>1173656</td>
<td>22271</td>
<td>55080</td>
<td>0.0469</td>
<td>0.0190</td>
</tr>
<tr>
<td>45-49</td>
<td>229778</td>
<td>1899</td>
<td>229778</td>
<td>905343</td>
<td>20429</td>
<td>49809</td>
<td>0.0550</td>
<td>0.0226</td>
</tr>
<tr>
<td>50-54</td>
<td>184502</td>
<td>1776</td>
<td>184502</td>
<td>675565</td>
<td>18530</td>
<td>41428</td>
<td>0.0613</td>
<td>0.0274</td>
</tr>
<tr>
<td>55-59</td>
<td>147004</td>
<td>1931</td>
<td>147004</td>
<td>491063</td>
<td>16754</td>
<td>33151</td>
<td>0.0675</td>
<td>0.0341</td>
</tr>
<tr>
<td>60-64</td>
<td>99665</td>
<td>1928</td>
<td>99665</td>
<td>344059</td>
<td>14823</td>
<td>24667</td>
<td>0.0717</td>
<td>0.0431</td>
</tr>
<tr>
<td>65-69</td>
<td>75026</td>
<td>2540</td>
<td>75026</td>
<td>264394</td>
<td>12895</td>
<td>19469</td>
<td>0.0797</td>
<td>0.0528</td>
</tr>
<tr>
<td>70-74</td>
<td>56239</td>
<td>2321</td>
<td>56239</td>
<td>149568</td>
<td>10355</td>
<td>15127</td>
<td>0.1013</td>
<td>0.0693</td>
</tr>
<tr>
<td>75-79</td>
<td>44214</td>
<td>2668</td>
<td>44214</td>
<td>93120</td>
<td>8034</td>
<td>10045</td>
<td>0.1079</td>
<td>0.0863</td>
</tr>
<tr>
<td>80+</td>
<td>23756</td>
<td>2052</td>
<td>23756</td>
<td>48915</td>
<td>5366</td>
<td>6797</td>
<td>0.1390</td>
<td>0.1097</td>
</tr>
<tr>
<td>80+</td>
<td>25159</td>
<td>3314</td>
<td>25159</td>
<td>25159</td>
<td>3314</td>
<td>4892</td>
<td>0.1944</td>
<td>0.1317</td>
</tr>
</tbody>
</table>

where the following are given:

- a standard title (on the first line) and two lines for an optional subtitle
- in the columns:

1. The total and the age groups used
2. The total population and population by age group
3. The total deaths and death by age group
4. The cumulative population from age x on (N(x+))
5. The cumulative deaths from age x on (D(x+))
6. The population density at age x (N(x))
7. The "birth rate" of x+ (b(x+))
8. The "death rate" of x+ (d(x+))
9. The "growth rate" of $x^+$ ( $r(x^+)$ )

Next the program shows the following:

<table>
<thead>
<tr>
<th>Initial age</th>
<th>Final age</th>
<th>Correction factor $f$</th>
<th>Growth rate $r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>60</td>
<td>0.969</td>
<td>0.03156</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
<td>1.000</td>
<td>0.03120</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>0.974</td>
<td>0.03106</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>0.971</td>
<td>0.03110</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>1.047</td>
<td>0.03030</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
<td>0.985</td>
<td>0.03160</td>
</tr>
<tr>
<td>10</td>
<td>65</td>
<td>1.013</td>
<td>0.03066</td>
</tr>
<tr>
<td>10</td>
<td>70</td>
<td>0.963</td>
<td>0.03134</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
<td>0.963</td>
<td>0.03161</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>1.040</td>
<td>0.03047</td>
</tr>
<tr>
<td>15</td>
<td>60</td>
<td>1.027</td>
<td>0.03009</td>
</tr>
<tr>
<td>15</td>
<td>65</td>
<td>1.015</td>
<td>0.03025</td>
</tr>
<tr>
<td>15</td>
<td>70</td>
<td>0.961</td>
<td>0.03142</td>
</tr>
<tr>
<td>15</td>
<td>75</td>
<td>0.956</td>
<td>0.03149</td>
</tr>
<tr>
<td>15</td>
<td>80</td>
<td>1.039</td>
<td>0.03057</td>
</tr>
</tbody>
</table>

which gives the individual correction factors that will be applied to the observed data or to the central mortality rates, in order to estimate the coverage of the death records, and/or to adjust the central mortality rates by age.

In the table,

- **Initial age** of the reference interval is for the estimations of $f$ and $r$.
- **Final age** of the reference interval is for the estimations of $f$ and $r$.
- **Correction factor** is for the death records ($f = 1/C$), where $C$ is the record coverage.
- **Growth rate** estimated ($r$) refers to the conditions of population stability for the interval of reference shown, and the corresponding correction factor ($f$).

**Note:** This version of the program does not allow for fitting the relation between the rates, nor the graph which would permit the selection of points for fitting.

**f. Form of operation of the routine**

1. From the main PANDEM menu, select the "Menu of Indirect Estimation" option.

2. Selection of the program "Distribution of deaths by age" within this sub-menu.

3. Indicate if you want:
Application of the method of the distribution of deaths by age

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enter new data</td>
</tr>
<tr>
<td>2</td>
<td>modify old data</td>
</tr>
<tr>
<td>3</td>
<td>process old data</td>
</tr>
<tr>
<td>F10</td>
<td>return to Main Menu</td>
</tr>
</tbody>
</table>

Subsequently you must supply the name of the file (to be created, modified or used, as the case may be) and then hit [ENTER].

If option 2 or 3 is chosen, the next screen (with the first menu shown in point 4 below) will offer you the choice of using [F9] to go to the Options Menu of this routine, which would appear as follows:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To go to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First Menu</td>
</tr>
<tr>
<td>8</td>
<td>Data</td>
</tr>
<tr>
<td>9</td>
<td>Results option</td>
</tr>
</tbody>
</table>

If option 1 is chosen from the First Menu, you must go as far as the results of the routine before being able to go to the Options Menu. The detailed steps under option 1 are shown in the following paragraphs.

4. When all the data have been entered, press [ENTER] and the following will appear on the screen:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>correct continue</td>
</tr>
<tr>
<td>2</td>
<td>continue</td>
</tr>
</tbody>
</table>

If you continue, you must input the title of the table on two lines:

```
Title
line 1    //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
line 2    //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
```

5. The presentation of the results may be done using one of the following options:

<table>
<thead>
<tr>
<th>Enter</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>list results on printer</td>
</tr>
<tr>
<td>2</td>
<td>write results on disk</td>
</tr>
<tr>
<td>9</td>
<td>view on screen only</td>
</tr>
<tr>
<td>F8</td>
<td>previous screen</td>
</tr>
</tbody>
</table>
PANDEM 2.00 User’s Manual

Application of the method of the distribution of deaths by age

If you choose Option 2, PANDEM will write a file in the work directory, with the file name (without extension) already given, automatically adding the appropriate extension. The message "file being created: filename.brl" will appear very briefly on the screen, where "filename" is the name of your file.

6. When all this information has been provided, the calculations of this routine will begin. Then the results appear on the screen, with the instruction:

Press any key to continue

When this instruction is followed, the remaining results appear.

7. Now the options [F8], [F9] and [F10] appear once again at the bottom of the screen so that you may indicate whether you wish to return to the First Menu of the routine or continue working with this same analysis. If you choose [F10], the screen will show, highlighted, the query:

Abandon the session? Y/N

If your response is Y, you will be returned to the First Menu of the routine. If you enter N, the machine will "beep" and offer the three function keys again so that you may now continue with this analysis.

g. Bibliographical references


