

**A BASIC Programmer's Guide to the
STARFISH 84 Computer Model
(Starfish Version 2)**

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Introduction

The computer programme which is the subject of this report is one of a series which is in the STARFISH suite.

It was lifted out of that suite for a particular purpose (the IIC/UNIDO knitgoods seminar in April 1984) in order to provide a self-contained demonstration of routines which had been extensively tested and were believed to be relatively free from bugs.

At the same time the opportunity was taken to include some of the "new" equations which are emerging from the second phase of the mathematical analysis of the STARFISH data base. This is the phase which attempts to combine the data from different fabrics and/or finishing routes in order to reduce the number of separate equations which are needed and to improve (hopefully) the reliability and the versatility of these equations.

For the preparation of this report, an attempt has been made to render the original programme listing more intelligible by the liberal insertion of the REMark statements and comment tails, by the replacement of GOTO statements with the more cumbersome but more reliable and readable IF - THEN - ELSE - ENDIF structures and by a certain amount of rearrangement and rewriting of some routines. For the same reason, the use of programme overlays has been eliminated and this means that the whole of the programme is in memory throughout. It occupies about 36K without variables which leaves about 18K free for variables on the Tektronix 4052A; it will not run on the 4051 or 4052 models due to memory and language restrictions.

This report is not a layman's guide to the operation of the STARFISH computer models. It is intended as an aid to a computer programmer who is reasonably fluent in BASIC and who wishes to understand the detailed operation of the programme in order that she may (at least) implement this particular unit of the STARFISH suite on a different computer or (preferably) produce an improved version.

It is assumed that the programmer is familiar with the STARFISH concept and has seen the model running so no attempt is made to explain any jargon such as "the equations of the reference state", nor to elaborate all subroutines in detail.

The language used is Tektronix 4052A BASIC which is a very powerful implementation, and is not necessarily compatible with other BASIC dialects, so a certain amount of rewriting will be necessary. This has hopefully been facilitated by the general construction of the programme which consists overwhelmingly of more or less self-contained subroutines.

Operation

General Programme Flow

Figure 1 shows the overall flow of the programme. After loading and typing "RUN" the operator is presented with a series of messages which explain the function of the programme and the information which she will be required to enter - *Figures 2, 3 and 4*. An experienced operator may avoid all these explanations by RUNning from line 1000. After the messages have been delivered, there is an initialisation routine in which the required variables are defined and some are assigned starting values, the two main management files are opened, and the printer is set up with an appropriate printing format.

Then the operator is required to enter details of the fabric type, finishing process, knitting machine, qualities to be knitted (yarn counts and stitch lengths) and the required finishing targets.

As soon as all the necessary data have been entered a menu of options is presented (*Figure 5*). All subsequent operations are controlled from this option menu.

Structure

The programme is organised around six main structural elements:

1. The main option menu
2. The disc files
3. The F array
4. The data arrays

5. The P array
6. The subroutines

The main option menu controls programme flow according to the wishes of the operator who selects the operation required from the list of options presented. After each operation has been executed, the main menu is presented again until the session is terminated by selecting Option 0, Exit.

The disc files contain the STARFISH equations and also various lists which are needed to prompt the operator during the selection of fabric, process, and knitting machine. There are five classes of files which are named and explained below. Obviously, the information in these files could be made to reside in DATA statements at the cost of extra memory.

1. "FABRICS"

A random access file with four records, one for each type of fabric "known" by the model. In each record are three items. The first item is the name of the fabric (*Figure 6*), the second item is a segment of a filename, which will be tacked on to the string "PROCESS/" in order to generate the filename which refers to the list of processing routes known by the programme for this fabric type. The third item is a number which gives the number of records in the corresponding "PROCESS/" file. These items are read into the variables $F\$, Fi\$, Z9$.

2. "PROCESS/...."

A set of random access files, one for each different fabric type. Each record contains two items. The first is the name of the process (*Figures 7, 8 and 9*). The second is a 15 element data array which contains the coefficients of the STARFISH equations referring to this fabric-process combination. These items are read into the variables $P\$, Eq$.

3. "MACHINES"

A random access file containing four records, one for each fabric type. Each record contains three items. The first is the name of the fabric type. The second is a filename segment which will be tacked on to the string "MACHINE/" in order to generate the filename which refers to the list of knitting machines known by the programme for this fabric type. The third item is a number which gives the number of records in the corresponding "MACHINE/..." file. These items are read into the variables $K\$, Km\$, Z9$.

4. "MACHINE/...."

A set of random access files, one for each different fabric type. Each record contains five numbers which define a certain knitting machine. They are the gauge (n.p.i.), the diameter (inches), the number of needles, the lowest yarn count (Ne) and the highest yarn count (Ne) recommended for this machine (*Figure 10*). These five numbers are read into the variable Ma .

5. "COUNTERS"

A random access file of three records. Each record contains a number which gives the number of records in the "FABRICS", "EQUATION" and "MACHINES" files respectively. The "EQUATIONS" file is not actually used by this unit of the STARFISH suite. It serves a different unit whose function is to enter and/or change the values of the coefficients in the various "PROCESS/..." files. The three numbers are read into the variable CI .

The F array (*Figure 11*) is a list of status flags which indicate the choices which have been made by the operator at various stages in the selection of fabric type, process, machine, quality units, quality format, finishing targets and output units. There are also flags to indicate unreasonable finishing targets and data out of range.

Unreasonable finishing targets are defined in subroutine 42500 on a fairly arbitrary basis. Data out of range is checked in SUB 43500 and means that one or more of the numbers to be printed (fabric dimensions or shrinkage) would cause the programme to generate a fatal error due to a PRINT USING format field overflow.

The status flags control the detailed programme flow within subroutines.

The data arrays *C5, C6, C7, and CB* contain the information concerning the range of fabric qualities to be evaluated and the finishing targets (*Figure 12*). These arrays are dimensioned, deleted, and re-dimensioned as required. Dynamic selective deletion and re-dimensioning of array variables is a valuable feature of Tektronix BASIC which is not generally available on microcomputers. In rewriting this programme for other machines it may be necessary to dimension these arrays during the initialisation routine and to place an upper limit on the number of qualities and sets of finishing targets which can be allowed. Appropriate error traps will be needed.

Data array *C1* contains the list of counters read from the "COUNTERS" file.

The P array (*Figure 13*) contains the dimensional properties of the fabric quality which is currently being evaluated. It serves as a common reference point for all those subroutines which are concerned with any calculations using the STARFISH equations, or conversions from reference state to as-delivered, or from all the default units (used by STARFISH), into the units requested by the operator. It is also used as a device to increase speed and conserve memory since, by storing the properties of only the current quality in the P array, it is not necessary to calculate and store all properties for all qualities before printing the results; qualities are calculated and printed one at a time and then discarded. Furthermore, one may make changes to individual assumptions without having to recalculate all properties for all qualities. Since the calculations for an individual quality can be made within the time it takes to print one line of data, results are generated apparently instantaneously and at no time in the programme sequence is the operator waiting for the computer, even when large numbers of qualities are being evaluated.

The subroutines are, of course, the basic building blocks of the programme and represent the bulk of the code. A list of the locations and functions of these routines is given in *Figure 14*.

There are several types of routines at various levels of complexity.

At the very simplest level are those which simply display a list for the operator to make a selection. An example is SUB 6000 which lists the available fabric types for the operator to select one. Most of the values in the *F* array are defined in this way.

At the next level of complexity the subroutine will be required to make a decision and perform a calculation. An example would be SUB 12500 where the tex (as knitted) is calculated and placed into the *P* array at position 1 according to the value of flag *F(2)*, which indicates the yarn count units selected by the operator, and the value of yarn count (as knitted) currently in the *P* array at position 23. There are many such routines to allow for all the various calculations and conversions which may need to be made as a result of different combinations of user inputs, output units, and finishing targets.

At the next level of complexity, a routine will be calling one or more of the lower level subroutines guided both by the operator choices and by internal decision making based on one or more of the status flags. An example would be SUB 24000 where a new set of fabric qualities is to be selected.

At the highest level the tabulation routine at line 30000 calls many of the lower level subroutines with extensive internal decision making based on the status flags, makes extensive, repetitive calculations using these low level subroutines, and displays the results to the screen or at the printer.

At all levels of complexity, the routines are provided with error-trapping checks, especially when operator inputs are required. For example, the operator will not be allowed to select an item which does not appear on the current list. However, there is no protection at present against choosing unreasonable or impossible sets of input parameters and there is, in fact, considerable scope for the operator to make "silly" predictions. This situation usually arises when changes in output units are made after the finishing targets have been set. For example, if

the finished width has been specified in open form and the output units are subsequently changed to tubular, then exceedingly large shrinkages will be generated in the width direction. If the numbers are still small enough to be printed then they will be displayed and marked with an asterisk. If not, then an empty line will appear and it is up to the operator to work out what went wrong.

Although a very large margin is allowed this is obviously a rather unfriendly behaviour and later versions of this STARFISH unit will build in extra checks to provide some guidance to the operator, and/or will automatically harmonise the units for finishing targets and calculated dimensions.

Finally, it should perhaps be observed that, in the coding, all subroutines start with one or more REM statements and practically all subroutine calls are to a REM line. Any attempt to save memory by deleting REM's must be accompanied by appropriate renumbering.

A complete list of all variables used is given in *Figures 15 and 16*.

Detailed Programme Flow

1. Start Up

Lines up to 1000 are self-explanatory and simply deliver a series of messages to the screen to give an inexperienced operator some indication of what is coming. Experienced operators may start by typing RUN 1000. Obviously this first section can be deleted to conserve memory, either permanently, or dynamically by inserting a DELETE 1,999 statement at line 1020.

2. Initialisation

Lines 1000 to 1999 are reserved for dimensioning variables, allocating initial values to these, setting up the printer and opening the two management files, which remain open throughout.

The variable, S\$, is specific to the Tektronix file manager system and may not be required by other computers.

Lines 1100 to 1130 are specific to the Tektronix system and the Epson FX-80 printer.

Lines 1170 to 1260 make entries part way into the appropriate subroutines for setting the input and output user units to those most commonly required by IIC workers. To set alternative units, consult the *F* array in *Figure 11* to see what are the appropriate values to assign to *F(5)*, *F(2)*, *F(7)*, *F(8)*, and *F(9)*. The same entry points to the subroutines must be used whatever the *F* values are. This initialisation section will not be used again and may be dynamically deleted after execution.

3. Set Starting Conditions

Before the main option menu can be presented, the operator is forced to select an initial set of conditions, i.e. fabric type, process route, knitting machine, range of knitting qualities, and set of finishing targets. This is achieved at lines 2000, 2999 by simply calling the appropriate subroutines.

These lines are used again whenever a change of fabric type is requested because, when the fabric type is changed, then all other selections must change also.

4. Main Menu

Lines 3000 to 3999 are reserved for the main option menu (*Figure 5*), which is the master controller for the rest of the programme. Each option is treated as a subroutine and, after execution, control is passed back to this menu. There are two exceptions to this general procedure. If Option 0 is selected, then a goodbye message is printed and the programme is ENDED. With the Tektronix system, an END statement causes all disc files to be closed (although the variables are not lost). A different computer may require file closing statements between lines 3140 and 3160.

The second exception is when Option 1 is selected. In this case control is passed back to line 2000 for reselection of all parameters before the main menu is displayed again.

5. Option 2: Change Knitting Machine

Lines 10000 to 10499 are a self-contained subroutine for selecting or changing the knitting machine. The routine is actually unnecessarily elaborate since it was originally written for another purpose and the only information which is strictly needed for the present purpose is the number of needles. However, it adds to the presentation of the final print-out if the gauge and diameter of the machine are included, and there are occasions when the gauge and diameter are known but not the number of needles so the routine has been retained in this form which is certainly adequate.

It starts by reading file #2 ("MACHINES") at the appropriate record number - indicated by $F(3)$ - and then, after opening the corresponding "MACHINE..." file, presents the list of standard knitting machines for this fabric type.

These standard lists are very short at present since they indicate only the actual machinery and yarns with which the original STARFISH qualities were knitted. This "file and list" format allows for the relatively easy augmentation of the number of standard choices available to the operator. All that is necessary is to write additional records in the "MACHINE/..." file and to alter the corresponding counter in the "MACHINES" file.

Having presented the list of standard machines (lines 10060 - 10140) the operator is requested to select one or to specify an alternative.

If a standard model is selected, then its details are read directly into array Ma from the file (line 10380), otherwise the operator is prompted for the machine gauge, diameter and number of needles (lines 10190 - 10260). A check is made to see whether the specified number of needles lies within $\pm 5\%$ of theoretical and, if not, the option to re-enter is given (lines 10270 - 10360).

Control is passed back to the main menu.

6. Option 3: Change Knitting Qualities

This routine is located at lines 24000 to 25999 and makes use of several lower level subroutines.

A knitting quality is defined by two parameters; the yarn count and the stitch length, as knitted.

The user may select various units for these two parameters. For yarn count she may specify Ne, Nm, or Tex; for stitch length she may work in cm or inches or may elect to use the tightness factor, i.e. square root tex divided by stitch length in cm.

The fabric qualities are specified in one of two different formats which are explained in the message given in *Figure 2*. The flag to signal which format has been selected is $F(6)$.

The routine starts by reminding the operator which format has been selected and then offers a small option menu, lines 24040 - 24180. The menu is different for the two different formats, and the programme is directed to the appropriate subroutines by the operator's response and the tests at lines 24200 - 24250.

In grouped format, where $F(6) = 1$, the appropriate subroutines are 11500 to enter a set of yarns and 12000 to enter a set of stitch lengths or tightness factors. In each case, the operator is first reminded of the current units and offered the option to change them before being prompted for the number of items and the values of these. The yarns are stored in $C5$ and the stitch lengths in $C6$. Note the dynamic deletion and re-dimensioning of these arrays which is not allowed in some BASIC dialects. On RETURNing, control is transferred back to the "change qualities" menu in case further changes are required.

In individual format, where $F(6) = 2$, the appropriate subroutines are 24310, 24510, and 24750. For this format both yarn count and tightness data are stored in one array, $C8$, since they are presented and used in pairs. The three subroutines allow for changing, adding, or deleting one or more of the individual qualities. Adding and deleting of qualities are also achieved via dynamic deleting and re-dimensioning of arrays and, after RETURNing control is also passed back to the menu at 24040.

In either format one may elect to enter a completely new set of qualities, SUB 25050, in which case the option to change the format is also offered.

Note that there are two possible exits from SUB 24000, either by selecting Option 0 or after Option 1, at the end of SUB 25050. Purists may avoid this by reconstructing line 24220 into

```

24220    IF Opt = 1 then
24222        GOSUB 25050
24224    END IF
24226    GOT0 24040

```

in which case, control would also be passed back to "Change Qualities" menu at line 24040.

Selection of Option 0 passes control back to the main menu.

7. Option 4: Change Finishing Route

Lines 11000 to 11499 allow the selection of a different processing route. Since the process route list is specific for the current fabric type, there is a test at line 11010 to ensure that the fabric has been selected. If not, then control is switched to SUB 10500 where fabric selection is enforced. Actually, this test should not be needed since fabric selection is forced during initial start up but it is inserted as a guard against the operation of Murphy's Law.

The rest of this routine is self-explanatory. The list of appropriate process routes is presented via SUB 6500 and a selection is made, $F(4)$.

The name of the process and the values of the coefficients of the corresponding STARFISH equations are read into $P\$$ and Eq via SUB 9000. In this latter routine there are redundant Murphy's Law double checks at lines 9040 - 9050 and 9100 - 9150. These could probably be deleted if memory is in short supply.

Control is passed back to the main menu.

8. Option 5: Change Finishing Targets

Lines 22000 to 22999 contain the routine for selecting and changing the finishing targets. The function of these is explained by the message given in *Figure 3*. In the present implementation there are five options covering different pairs of fabric properties which are held constant (*Figure 17*). In principle, other combinations are possible and, due to the modular nature of the programme, are relatively easy to install. The flow of the routine is controlled by the value of $F(11)$ which is selected by the operator from the option list at lines 22040 - 22160.

In each case, the operator is reminded of the current units for the selected two parameters, asked how many pairs are required, and prompted to enter them in turn. Dynamic deletion and re-dimensioning of array $C7$ is used. Control is passed immediately back to the main menu.

If the programmer wishes to insert further options for finishing targets (for example the combination "weight and length shrinkage", then the following steps are required.

- a) Move lines 22690 - 22830 to higher line numbers, but below 22999.
- b) Insert the appropriate PRINT statement at line 22130.
- c) Adjust the error trap at line 22190 to allow the extra option.
- d) write a piece of code analogous to lines 22210 - 22320 including the two new parameters and allowing $F(11)$ to take a value of 6.
- e) Write a new section in SUB 20000 analogous to lines 20020 - 20080 allowing for $F(11) = 6$, and calculating the as delivered fabric properties from the reference state and the finishing targets. For example, if the targets are weight and length shrinkage, then width shrinkage is calculated from these two; courses and wales are calculated from the reference courses and wales and the corresponding shrinkages; width is calculated from the reference wales, the number of needles, and the calculated width shrinkage.

Thus:

```

IF F(11) = 6 THEN
    P(22) = FNR (P(13))
    P(11) = P(7)* FNG (P(21 )) / 100

```

$$P(12) = P(8) * FNH (P(22)) / 100$$

$$P(14) = FNK (P(22))$$

ENDIF

The functions are defined in SUB 21000.

- f) Write a new section in SUB 42000 which converts the finished dimensions into user units, allowing for $F(11) = 6$. Since the finishing targets are already expressed in user units, it is only necessary to call the subroutines for the remaining parameters. Thus continuing the same example, the calls would be to SUBS 13500, 14000 and 16000 for courses, wales and width respectively.
- g) Write a new section in SUB 41500, which assigns the fixed parameters (finishing targets) to the P array, allowing for $F(11) = 6$. Thus, continuing the same example:

IF F(11) = 6 THEN

P(19) = Z1 (finished weight user units)

P(21) = Z2 (length shrinkage)

GOSUB 19000 (finished weight, default units)

ENDIF

- h) Insert an extra DATA string at line 26760.

9. Option 6: Change Units for Outputs

Lines 23000 to 23999 are reserved for selecting the units to be used when printing results. This is a self-contained routine with its own control menu at lines 23040 - 23070 which allows selection of the courses and wales, or the weight, or the width units independently, and passes control back to the main menu when Option 0 is selected. Flags $F(7)$, $F(8)$, and $F(9)$ are used to store the results of these selections; $V\$$, $W\$$, and $X\$$ hold the names of the units for subsequent printing operations.

10. Option 7: List Current Parameters

Lines 26000 to 26999 are reserved for a self-contained, once-through routine which simply prints out the conditions which have been selected by the operator. The only subroutine call is to SUB 8000 which allows selection of the VDU screen or the printer as the output device. This subroutine returns a value of either 32 or 41 for the variable D which is used extensively in PRINT@D: statements. This statement and these values are specific to the Tektronix computer and SUB 8000 will need to be rewritten for other systems as will the PRINT statements.

Note the extensive use here and elsewhere of control characters in the PRINT statements, which are denoted in the listing by underlined characters. These are used in the Tektronix BASIC to control the movement of the cursor on the screen and are not or not all available on other computers, especially those (the majority) which have raster screen technology. They have the following functions:

CTRL G =	bell
CTRL H =	backspace
CTRL I =	horizontal tab
CTRL J =	down one line
CTRL K =	up one line
CTRL L =	clear screen and home
CTRL M =	RETURN
CTRL N =	expanded characters (printer only)
CTRL ↑ =	home
CTRL Rubout =	carriage return and line feed

These control characters are very helpful in formatting information on the screen in an economical way. A certain amount of rewriting of these PRINT statements will be necessary for other computers in order to have a similar presentation.

After displaying the required information the programme waits for the operator to press RETURN before passing control back to the main menu.

Lines 26120 and 26160 - 26180 are anti-Murphy devices and could be deleted to save memory since, in principle, the programme already knows $F\$$ and $P\$$.

11. Option 8: Print the Results

Lines 30000 - 30999 are reserved for the most complex routine of all which calculates the dimensions of each quality in turn and prints them to the selected output devices. The core of this routine is as follows:

```
PRINT Title and headings
FOR EACH QUALITY IN TURN
    calculate reference state in default units
    scale up to as delivered dimensions
    convert to user units
    print properties for this quality
NEXT QUALITY
```

The detailed flow chart is given in *Figures 18, 19 and 20*.

These flow charts are self-explanatory when read together with the corresponding code. Lines 30000 - 30270 represent the initialisation. The TIME statement returns the time and date to variable $D\$$ of which the first 15 characters are extracted in line 30130. These two statements are specific to Tektronix BASIC. Lines 30150 - 30190 ensure that the equations held in Eq do refer to the current fabric/process combinations. PI is the page counter and $F(13)$ is the "silly targets" flag. $L1$ is the maximum number of lines allowed on a page which defaults to 15 for the screen ($D = 32$) or 30 for the printer ($D = 41$). L is the counter which keeps track of the number of lines printed on the current page. It is reset to zero after each page is printed. Lines 30220 - 30270 check whether the default maximum number of lines will be exceeded and, if so, allow the operator to redefine $L1$.

After initialisation, the title and column headings are printed.

The programme then diverges into one of two directions according to whether the fabric quality data has been entered in grouped, $F(6) = 1$, or individual, $F(6) = 2$ format. $L3$ is the total number of lines to be printed.

In either case, for each quality in turn, the yarn count and stitch length, as specified by the user, are taken from the data arrays, $C5$ and $C6$, or $C8$, placed into the P array and converted to the STARFISH default units, Tex and cm. The fixed finishing targets are also placed in their appropriate locations of the P array via intermediate variables $Z1$ and $Z2$.

Then the finished reference dimensions are calculated via SUB 20500 using the STARFISH equations. These are scaled up to as delivered dimensions by SUB 20000 and are then converted into the specified user units by SUB 42000. Before printing the dimensions, checks are made for silly finishing targets and data out of range.

Silly finishing targets are defined in SUB 42500 as being those targets which result in any of the following:

- a) Finished weight heavier than 96% of reference weight.
- b) Finished courses and finished wales both greater than 98% of reference values.
- c) Length shrinkage (5WTD) less than 2% when the sum of length and width shrinkage is less than 8%.
- d) Length shrinkage greater than 20%.
- e) Width shrinkage less than 2% when the sum of length and width shrinkage is less than 8%.
- f) Width shrinkage > 20%.

Obviously these criteria are somewhat arbitrary and may be changed to suit individual preferences. If silly targets are detected, then $F(13)$ is set to 1 and the marker $Ast\$$ is set to "*".

The data out of range criteria are fixed by the parameters of the IMAGE statement at line 40640 which is called by PRINT USING statements at lines 30930 or 40610 and in which only three leading digits are allowed for courses, wales and shrinkages or four digits for weight and width. With Tektronix BASIC, a fatal error results if these allowances are exceeded and programme execution will be halted. The result of this test is returned to flag $F(12)$ and data will not be printed if $F(12)$ is not zero.

Note that in printing a row of data (lines 30930 or 40610) the shrinkage values are multiplied by minus one to conform with the latest fashion whereby shrinkages are shown with the negative values and extensions with positive ones. At the end of the row of data, the silly targets marker is printed. An asterisk denotes silly targets or data out of range.

After the marker has been printed, the line counter, L , is incremented by one and is tested for the page full condition, $L = LI$. If so, then the new page routine is invoked via SUB 41000.

In this routine we first check to see if we have just printed the last page, i.e. $PI * L = L3$.

If so, then SUB 41000 is immediately exited. If not, then the footnote messages are printed via SUB 43000, the page counter is incremented, $F(13)$ and L are reset to zero, and the operator is prompted for a RETURN, after adjusting the printer paper if required.

After each quality has been calculated and printed, control is passed back to the main menu.

An example of a typical print out is given in Figure 21.

Figure 1

BASIC FLOWCHART

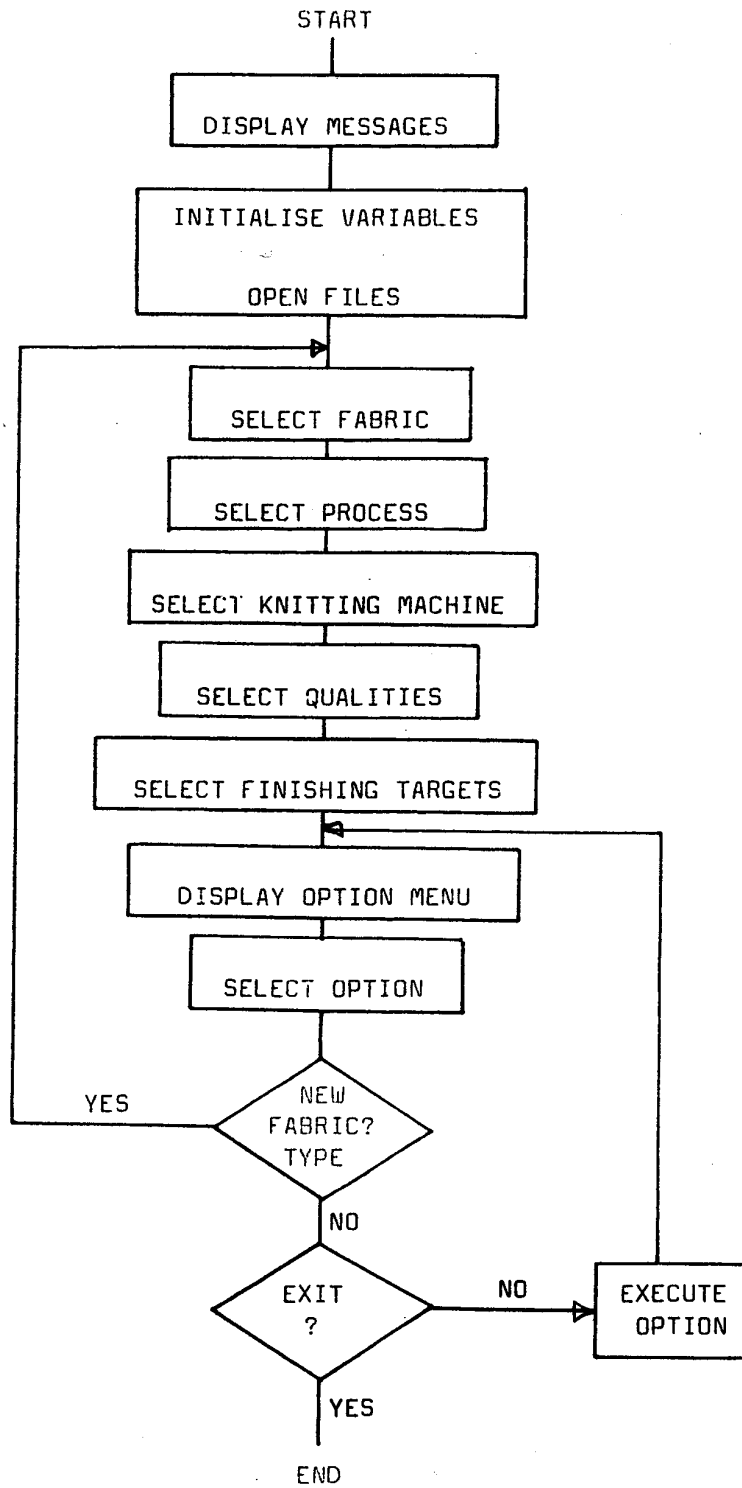


Figure 2

**** IIC -STARFISH- MODEL ****

Being a set of routines to help in the designing of knitted cotton fabrics to meet given specifications for weight, width, and shrinkage etc, whilst at the same time taking account of the changes in the relaxed structure which are brought about by different finishing routes.

You must begin by specifying a FABRIC/PROCESS combination and a knitting MACHINE. Then you must choose one or more sets of YARN COUNT and STITCH LENGTH with which your proposed fabrics are to be made.

You may specify any reasonable number of qualities, (ie combinations of yarn & stitch length), and this may be done in one of two ways.

- 1 - grouped qualities, or
- 2 - individual qualities.

In the first case, you specify count & stitch length in separate groups. The computer will then combine every yarn with every stitch length in turn.

In the second case you specify particular combinations of count and stitch length, and only those combinations will be examined.

press > RETURN < to continue

Figure 3

Finally, you will have to choose your finishing targets, ie those two properties of the finished fabric which the computer will hold constant while it calculates the other finished dimensions.

Finished dimensions are calculated via the STARFISH equations according to your selected finishing targets which may be either :-

- Length & Width Shrinkages,
- Finished Courses & Wales,
- Finished Weight & Width,
- Finished Weight & Courses,
- Length Shrinkage & Finished width.

If you choose more than one set of finishing targets, then each set of targets will be combined with every different fabric quality in turn.

press > RETURN < to continue

Figure 4

At any stage thereafter, you may :-

Print the current assumptions
Print the resulting predictions,
Change any of the assumptions,
Start over with a new fabric type

After each operation you will see the main menu from which the various options can be selected at will.

If you are going to use the printer, then it must be switched on now.

press > RETURN < to continue
whenever you see the flashing ?

Figure 5

*** STARFISH84 ***

- 0 ... EXIT
- 1 ... Change FABRIC type
- 2 ... Change knitting MACHINE
- 3 ... Change knitting QUALITIES
- 4 ... Change finishing ROUTE
- 5 ... Change finishing TARGETS
- 6 ... Change UNITS for output
- 7 ... LIST current assumptions
- 8 ... PRINT Results

enter option ...

Figure 6

Please indicate FABRIC type ...

- 1 ... Interlock - singles, combed ring yarns
- 2 ... 1x1 Rib - singles, combed ring yarns
- 3 ... Plain Single Jersey - singles, combed ring yarns
- 4 ... Plain Single Jersey - twofold, combed ring yarns

enter Fabric code No. ...

Figure 7

```
Please select PROCESS route ...  
Interlock - singles, combed ring yarns  
  
1 ... Greige  
2 ... Continuous Bleach  
3 ... Winch dye (white)  
4 ... Winch dye (medium)  
5 ... Ecosoft (medium)  
6 ... R-Jet95 (deep)  
7 ... R-Jet95 (deep) + Resin finish  
8 ... Mercerise (Omez) + R-Jet95 (deep)  
9 ... Mercerise (Omez) + R-Jet95 (deep) + Resin finish  
  
enter Process code No. ...
```

Figure 8

```
Please select PROCESS route ...  
1x1 Rib - singles, combed ring yarns  
  
1 ... Greige  
2 ... Winch dye (white)  
3 ... Winch dye (medium)  
4 ... Ecosoft (medium)  
5 ... R-Jet95 (deep)  
6 ... R-Jet95 (deep) + Resin finish  
7 ... Mercerise (Omez) + Winch dye (white)  
8 ... Mercerise (Omez) + R-Jet95 (deep)  
9 ... Mercerise (Omez) + R-Jet95 (deep) + Resin finish  
  
enter Process code No. ...
```

Figure 9

```
Please select PROCESS route ...  
Plain Single Jersey - singles, combed ring yarns  
  
1 ... Greige  
2 ... R-Jet95 (medium) + Tubular finish  
3 ... Rotostream (medium) + Open width finish  
  
enter Process code No. ...
```

Figure 10

Please select your knitting machine ...

18-28g Plain Single Jersey (singles)

Mach.No	gauge	Diam.	Needles	Count range
1	18	26	1500	16 to 24
2	24	26	1920	24 to 32
3	28	24	2112	32 to 40

enter machine No ...
OR type 0 to specify a different model

Please select your knitting machine ...

14g 1x1 Rib

Mach.No	gauge	Diam.	Needles	Count range
1	14	24	1056	26 to 34

enter machine No ...
OR type 0 to specify a different model

Please select your knitting machine ...

20-28g Interlock

Mach.No	gauge	Diam.	Needles	Count range
1	20	24	1500	34 to 42
2	28	30	2640	50 to 70

enter machine No ...
OR type 0 to specify a different model

STATUS FLAGS : F array

- F(1) Reserved
- F(2) Yarn counting system: 1 = Tex, 2 = Ne, 3 = Nm
- F(3) Current fabric type
- F(4) Current processing route
- F(5) Tightness units: 1 = St. Len (cm), 2 = St. Len (in), 3 = T.F.
- F(6) Qualities format : 1=grouped, 2=individual
- F(7) Course/wale user units : 1=/cm, 2=/3cm, 3=/in
- F(8) Weight user units : 1=gsm, 2=oz/sy
- F(9) Width user units : 1=cmT, 2=inT, 3=cm Open, 4=in Open
- F(10) Reserved
- F(11) Finishing targets option : 1 to 5
- F(12) Current row contains data out of range? \emptyset = No, $> \emptyset$ = Yes
- F(13) Current page contains unreasonable fin. targets? \emptyset = No, 1 = Yes
- F(14) Reserved
- F(15) Reserved

DATA ARRAYS : C, C1 CØ

C	Scratch for data manipulations
C1(3)	Counters
C2	Reserved
C3	Reserved
C4	Reserved
C5(N)	Set of chosen yarn counts (grouped format)
C6(N1)	Set of chosen stitch lengths (grouped format)
C7(N2,2)	Set of chosen finishing targets
C8(N3,2)	Set of chosen fabric qualities (individual format)
C9	Reserved
CØ	Reserved

These arrays are deleted and redimensioned as required, except for C1 which resides permanently and holds the counters for the number of records currently held in the three main management files (FABRICS, EQUATIONS, MACHINES)

Figure 13

Properties of the current Quality : P array

	Property	Fabric state	Units
P(1)	Yarn count	as knitted	Tex
P(2)	Yarn count	reference	Tex
P(3)	Stitch length	as knitted	cm
P(4)	Stitch length	reference	cm
P(5)	T.F.	as knitted	$\sqrt{Tx}/1$
P(6)	T.F.	reference	$\sqrt{Tx}/1$
P(7)	Courses	)	per cm
P(8)	Wales	) reference	per cm
P(9)	Weight	)	gsm
P(10)	Width	)	cm Open
P(11)	Courses	)	per cm
P(12)	Wales	) as delivered	per cm
P(13)	Weight	)	gsm
P(14)	Width	)	cm Open
P(15)	Yarn count	) reference	) user units
P(16)	Stitch length))
P(17)	Courses))
P(18)	Wales	) as delivered	) user units
P(19)	Weight))
P(20)	Width))
P(21)	Shrinkage length	) as delivered) %
P(22)	Shrinkage width))
P(23)	Yarn count	) as knitted	) user units
P(24)	Stitch length))
P(25)			

SUBROUTINES

6000	List fabric types
6500	List process routes
7000	List equations
7500	Change/no change
8000	Screen or printer
8500	Yarn counting system
9000	Obtain data from "PROCESS/..." file
9500	Tightness units
10000	Select knitting machine
10500	Select Fabric/Process combinations
11000	Change processing route
11500	Change yarns
12000	Change tightness
12500	Calculate Tex as knitted
13000	Calculate St. Len and T.F. as knitted
13500	Finished courses in user units
14000	Finished wales in user units
14500	
15000	Finished weight in user units
15500	
16000	Finished width in user units
17000	FR count in user units
17500	FR St. Len & T.F. in user units
18000	Fin courses in default units
18500	Fin wales in default units
19000	Fin weight in default units
19500	Fin width in default units
20000	Convert FR to as del in default units
20500	Calculate FR dimensions
21000	Define functions
22000	Select finishing targets
23000	Select user units
24000	Select fabric qualities
26000	Print current assumptions

SUBROUTINES (cont)

30000	Print results
40000	Tabulation subroutines
40040	Print title and headings
40500	Print a row of data (grouped format)
41000	Start a new page
41500	Assgn finishing targets to P array
42000	Convert as del dimensions to user units
42500	Check for silly finishing targets
43000	Print foot notes
43500	Test for data out of range

NUMERIC VARIABLES

C	Scratch data array (delete after use)
C1(3)	Counters
C5(N)	Set of chosen yarn counts
C6(N1)	Set of chosen tightnesses
C7(N2,2)	Set of chosen finishing targets
C8(N3,2)	Set of chosen individual qualities
Ch	Change/no change flag: 1= change, 2= no change, 3= invalid
D	Current output device: 32= screen, 41= printer
Eq(15)	Equation coefficients for current fabric/process
F(15)	Flags and controllers
I,J,K,M	Looping counters
L	Number of rows of data which have been printed
L1	Max number of data rows to a page
L3	Total number of data rows to be printed
Ma(5)	Knitting machine parameters
N	Number of yarns selected
N1	Number of tightnesses selected
N2	Number of pairs of finishing targets
N3	Number of individual fabric qualities
Opt	Current option selected from a menu
P(25)	Properties of current fabric quality
P1	Current page number
Z...Z9	Scratch
Z1, Z2	Current values of finishing targets

STRING VARIABLES

Ast\$	Marker to indicate silly finishing targets
A\$	Scratch for reading files
C\$	Current user units for yarn count
D\$	Date and time
Eq\$	Formula of current equation
F\$	Name of current fabric
Fi\$	Filename or part of a filename for a process
K\$	Name of current knitting machine
Km\$	Filename or part filename for a knitting machine
P\$	Name of current processing route
S\$	Target for file status messages
T\$	Current user units for tightness
Tar\$	Name of current finishing targets
U\$	Current user units for stitch length
V\$	Current user units for courses and wales
W\$	Current user units for weight
X\$	Current user units for width
Y\$	Name of output from current equation
Z\$	Scratch input variable
Z1\$	) Names of current finishing target parameters
Z2\$	

*** FINISHING TARGETS ***

Finished dimensions are calculated according to assumed finishing targets.

You have five options for these as follows ...

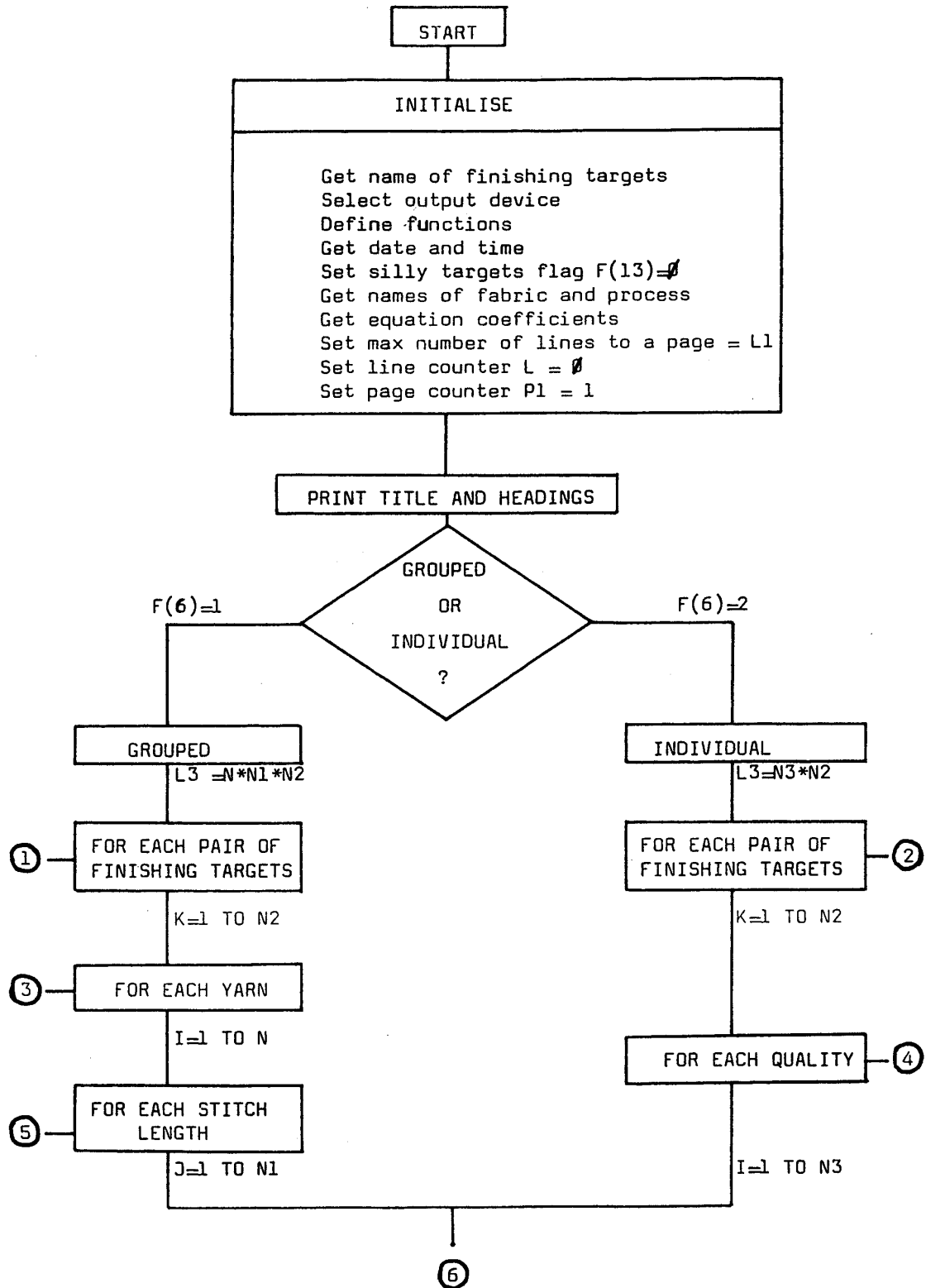
- 1 ... Length & Width Shrinkages,
- 2 ... Courses & Wales,
- 3 ... Weight & Width,
- 4 ... Weight & Courses,
- 5 ... Length Shrinkage & Width.

enter option ...

[Zero to return]

Figure 18

FLOW CHART FOR TABULATION : SUB 30000



FLOW CHART FOR TABULATION, CONTINUED

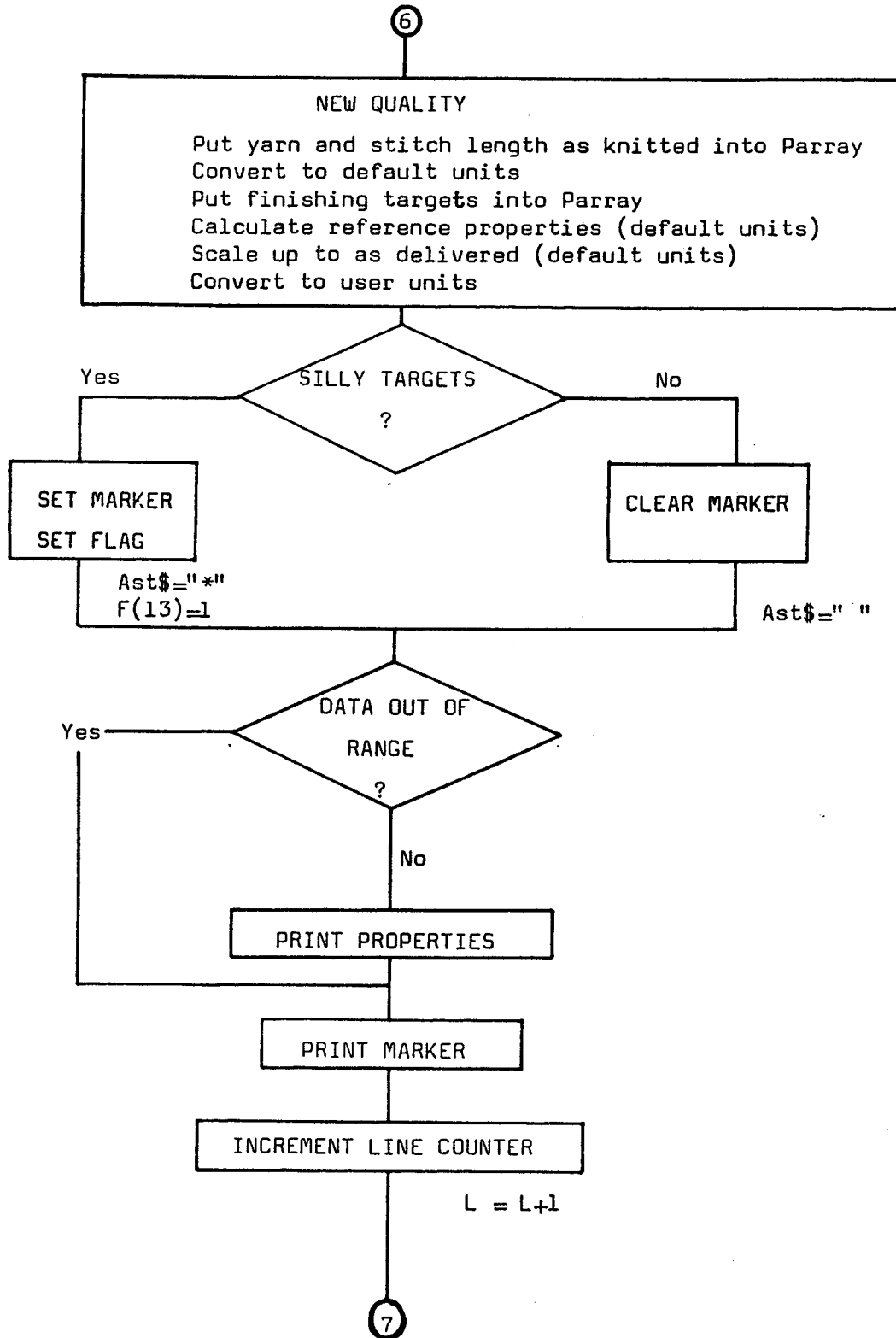


Figure 20

FLOW CHART FOR TABULATION, CONTINUED

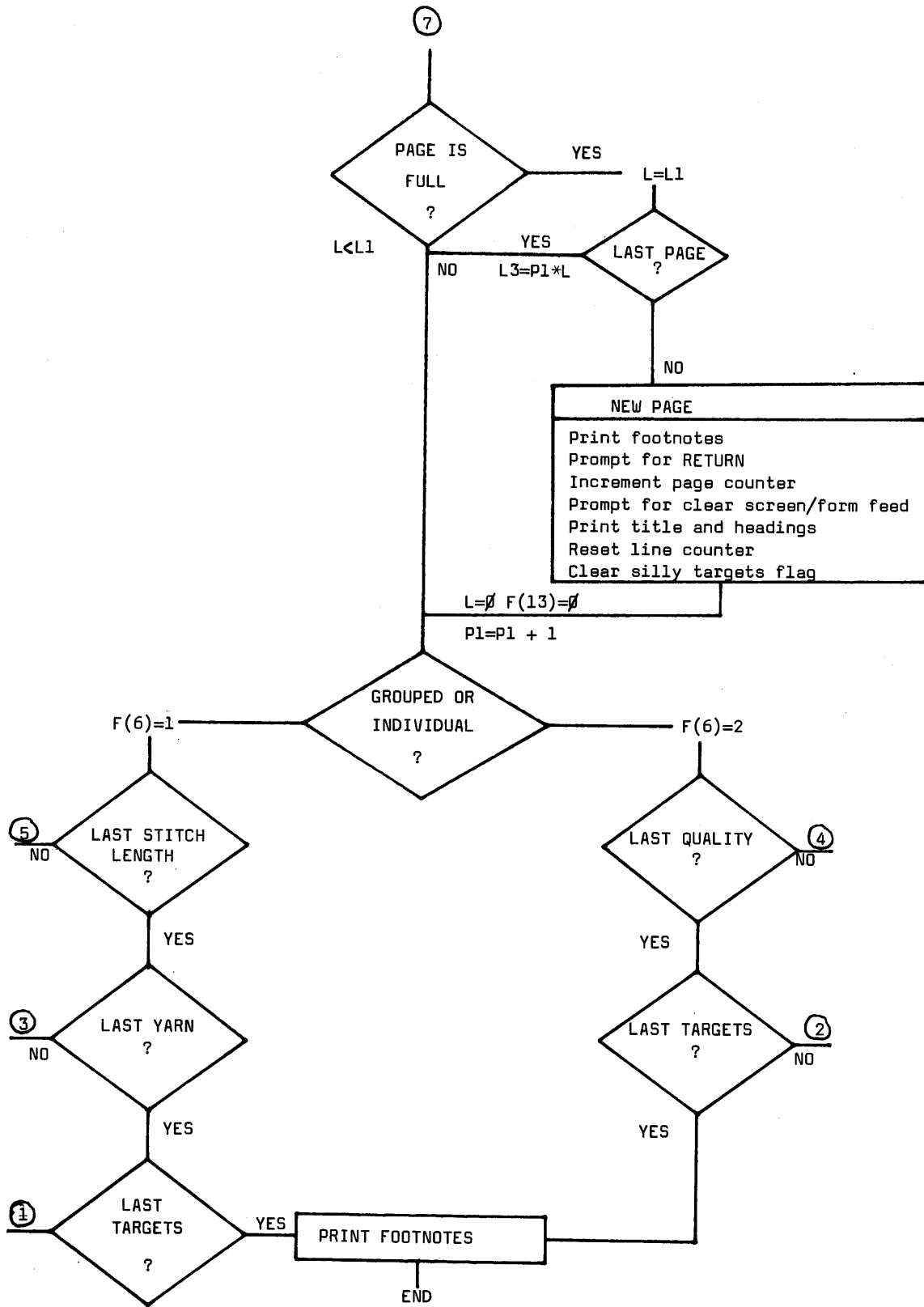


Figure 21

*** IIC -STARFISH 84- MODEL PREDICTIONS ***

1x1 Rib - singles, combed ring yarns
 14g 24in 1056 needles
 Greige

Targets are Length & Width Shrinkages

12-APR-84 16:36

As knitted			Average finished dimensions				Shrinkage (5 W&T)	
Yarn Ne	StLen cm	TF	courses 3cm	wales 3cm	weight g/sm	width cm(T)	Length %	Width %
38.0	0.330	11.9	47.1	29.6	140.2	53.5	0.0	0.0 *
38.0	0.336	11.7	46.1	29.1	137.1	54.4	0.0	0.0 *
38.0	0.342	11.5	45.1	28.7	134.1	55.2	0.0	0.0 *
38.0	0.330	11.9	43.3	27.2	118.7	58.2	-8.0	-8.0
38.0	0.336	11.7	42.4	26.8	116.1	59.1	-8.0	-8.0
38.0	0.342	11.5	41.5	26.4	113.5	60.0	-8.0	-8.0
38.0	0.330	11.9	42.4	26.6	113.6	59.5	-10.0	-10.0
38.0	0.336	11.7	41.5	26.2	111.1	60.4	-10.0	-10.0
38.0	0.342	11.5	40.6	25.8	108.6	61.3	-10.0	-10.0

NB : Shrinkage convention is + for growth, - for contraction
 : Qualities marked with * have unreasonable finishing targets
 : Estimates are given in good faith but without liability

```

1 REM *****
2 REM          STARFISH84          SAH MAR-84
3 REM *****
4 REM
5 INIT
100 PRINT "LI**** IIC      -STARFISH-  MODEL ****"
110 PRINT "JJ      Being a set of routines to help in the designing of";
120 PRINT "knitted_      cotton fabrics to meet given specifications ";
130 PRINT "for weight, width,_      and shrinkage etc, whilst at the ";
140 PRINT "same time taking account of the_      changes in the relaxed ";
150 PRINT "structure which are brought about by_      different ";
160 PRINT "finishing routes."
170 PRINT "JJYou must begin by specifying a FABRIC/PROCESS ";
180 PRINT "combination and a_knitting MACHINE. Then you must ";
190 PRINT "choose one or more sets of YARN COUNT_and STITCH ";
200 PRINT "LENGTH with which your proposed fabrics are to be ";
210 PRINT "made._JYou may specify any reasonable number of ";
220 PRINT "qualities,(ie combinations of_yarn & stitch length), ";
230 PRINT "and this may be done in one of two ways.J"
240 PRINT "I1 - grouped qualities, or_I2 - individual qualities."
250 PRINT "JJ In the first case, you specify count & stitch length ";
260 PRINT "in separate_groups. The computer will then combine ";
270 PRINT "every yarn with every_stitch length in turn._JIn the ";
280 PRINT "second case you specify particular combinations of ";
290 PRINT "count and_stitch length, and only those combinations ";
300 PRINT "will be examined."
310 PRINT "JJIIpress > RETURN < to continueGG";
320 INPUT Z$
330 PRINT "LJFinally, you will have to choose your finishing ";
340 PRINT "targets, ie those two_properties of the finished fabric ";
350 PRINT "which the computer will hold constant_while it ";
360 PRINT "calculates the other finished dimensions."
370 PRINT "J Finished dimensions are calculated via the STARFISH ";
380 PRINT "equations_according to your selected finishing targets ";
390 PRINT "which may be either :-"
400 PRINT "JILength & Width Shrinkages,_IFinished Courses & Wales,"
410 PRINT "IFinished Weight & Width,"
420 PRINT "IFinished Weight & Courses,"
430 PRINT "ILength Shrinkage & Finished width."
440 PRINT "JIf you choose more than one set of finishing targets,";
450 PRINT " then each_set of targets will be combined with every ";
460 PRINT " different fabric quality_in turn."
470 PRINT "JJIIpress > RETURN < to continueGG";
480 INPUT Z$
490 PRINT "LJAt any stage thereafter, you may :-"
500 PRINT "JIPrint the current assumptions"
510 PRINT "IPrint the resulting predictions,"
520 PRINT "IChange any of the assumptions,"
530 PRINT "IStart over with a new fabric type"
540 PRINT "JAfter each operation you will see the main menu from ";
550 PRINT "which the_various options can be selected at will."
560 PRINT "JJIf you are going to use the printer, then it must be ";
570 PRINT "switched on now."
580 PRINT "JJIIpress > RETURN < to continue"
590 PRINT "IWhenever you see the flashing GG";
600 INPUT Z$
1000 REM
1010 REM -----(initialise default parameters)-----
1020 REM
1030 DIM S$(300),Eq(15),C1(5),Ma(5),F(15),P(25)

```

```

1040 F=0
1050 P=0
1060 Eq=0
1070 Ma=0
1090 C1=0
1100 PRINT @41,11:1
1110 Z#=CHR(27)&"1"&CHR(6)&CHR(27)&"!"&CHR(1) ! set up printer
1120 PRINT @41:Z#
1130 D=32
1140 OPEN "FABRICS";1,"R",S#
1150 OPEN "MACHINES";2,"R",S#
1160 GOSUB 21000 ! Define Functions
1170 F(5)=1
1180 GOSUB 9620 ! Set tightness units (cm)
1190 F(2)=2
1200 GOSUB 8610 ! Set yarn count units (Ne)
1210 F(7)=2
1220 GOSUB 23210 ! set Course/Wale units (per 3cm)
1230 F(8)=1
1240 GOSUB 23380 ! set Weight units (gsm)
1250 F(9)=1
1260 GOSUB 23520 ! set Width units (cm Tubular)
1270 OPEN "COUNTERS";9,"R",S#
1280 FOR I=1 TO 3
1290 READ #9,I:C1(I)
1300 NEXT I
1310 CLOSE 9
1320 N=0
1330 N1=0
1340 N2=0
1350 N3=0
2000 REM -----set starting conditions-----
2010 REM
2020 GOSUB 10500 ! select fabric/process
2030 GOSUB 10000 ! select knitting machine
2090 GOSUB 25050 ! select knitting qualities
2330 GOSUB 22000 ! set finishing targets
3000 REM -----
3010 REM MAIN MENU
3020 REM -----
3030 PRINT "LI *** STARFISH04 ***JJ"
3040 PRINT "I0 ... EXIT_JI1 ... Change FABRIC type"
3050 PRINT "JI2 ... Change knitting MACHINE"
3060 PRINT "I3 ... Change knitting QUALITIES"
3070 PRINT "JI4 ... Change finishing ROUTE"
3080 PRINT "I5 ... Change finishing TARGETS"
3090 PRINT "JI6 ... Change UNITS for output"
3100 PRINT "JI7 ... LIST current assumptions"
3110 PRINT "JI8 ... PRINT Results"
3120 PRINT "J enter option ... GG";
3130 INPUT Opt
3140 IF Opt<>0 THEN 3170
3150 PRINT "JOK, thank you and goodbyeG"
3160 END
3170 IF Opt=1 THEN 2000
3180 IF Opt<2 OR Opt>8 THEN 3120
3190 GOSUB Opt-1 OF 10000,24000,11000,22000,23000,26000,30000
3200 GO TO 3010
5000 REM -----
5010 REM SUBROUTINES

```

```

5020 REM -----
5030 REM
6000 REM -----(list fabrics)-----
6010 FOR I=1 TO C1(1)
6020     READ #1,I:A$
6030     PRINT I;" ... ";A$
6040 NEXT I
6050 RETURN
6500 REM -----(list processes)-----
6510 READ #1,F(3):F$,Fi$,Z9
6520 PRINT "J";F$;"JJ"
6530 Fi$="PROCESS/"&Fi$
6540 OPEN Fi$;9,"R",S$
6550 FOR I=1 TO Z9
6560     READ #9,I:A$
6570     PRINT I;" ... ";A$
6580 NEXT I
6590 CLOSE 9
6600 RETURN
7000 REM -----(list equations)-----
7010 OPEN "EQUATIONS";9,"R",S$
7020 PRINT " EQUATIONSJJ"
7022 PRINT " No.IOutputI FormulaJ"
7030 FOR I=1 TO C1(2)
7040     READ #9,I:Y$,Eq$
7050     PRINT I;" .....I";Y$,Eq$
7060 NEXT I
7070 CLOSE 9
7080 RETURN
7500 REM------(change Ch=1, nochange Ch=2, or invalid Ch=3)-----
7510 INPUT Z$
7520 Ch=3
7530 IF Z$="" THEN
7540     Ch=2
7550 ELSE ! check that Z$ contains a number
7560     I6=0
7570     DO
7580         I6=I6+1
7590         Z6=ASC(Z$,I6)
7600         IF Z6<48 OR Z6>57 THEN 7620
7610         Ch=1
7620     EXIT IF Ch=1 OR I6=LEN(Z$)
7630     LOOP
7640 END IF
7650 IF Ch=3 THEN
7660     PRINT "GGGGG"
7670 END IF
7680 RETURN
8000 REM -----(screen or printer)-----
8010 PRINT "JenterI .. for screen display, or I2 ... for printer GG";
8020 INPUT Z
8030 IF Z<>1 AND Z<>2 THEN 8010
8040 IF Z=1 THEN
8050     D=32
8060 ELSE
8070     D=41
8080 END IF
8090 RETURN
8500 REM -----(yarn counting system)-----
8510 PRINT "J Units of Count are ";C$;" (resultant)"

```

```

8520 PRINT "Enter I1 ... to continue II2 ... to change units GG";
8530 INPUT Z
8540 IF Z<>1 AND Z<>2 THEN 8520
8550 IF Z=2 THEN
8560 PRINT "Please choose your units for resultant yarn count ...J"
8570 PRINT "enter ...I1 ... for Tex_I2 ... for Ne_I3 ... for Nm ";
8580 INPUT Z
8590 IF Z<>1 AND Z<>2 AND Z<>3 THEN 8570
8600 F(2)=Z
8610 IF F(2)=1 THEN
8620 C$="Tex"
8630 ELSE
8640 IF F(2)=2 THEN
8650 C$="Ne"
8660 ELSE
8670 C$="Nm"
8680 END IF
8690 END IF
8700 END IF
8710 RETURN
9000 REM -----(obtain data from PROCESS/... file)-----
9010 REM
9020 REM
9030 READ #1,F(3):F$,Fi$,Z9
9040 IF F(4)<=Z9 THEN 9060
9050 GOSUB 6500 ! list processes
9060 Fi$="PROCESS/"&Fi$
9070 OPEN Fi$;9,"R",S$
9080 READ #9,F(4):P$,Eq
9090 CLOSE 9
9100 IF Eq(1)<>0 THEN 9160
9110 PRINT "Sorry, equations for";F$;" ";P$
9120 PRINT "are not on file. Please select an alternative process"
9130 PRINT "Press >RETURN< to continueGG"
9140 INPUT Z$
9150 GOSUB 11000 ! change process
9160 RETURN
9500 REM -----(Tightness)-----
9510 PRINT " Units of Tightness are ";T$
9520 PRINT "Enter I1 ... to continue II2 ... to change units GG";
9530 INPUT Z
9540 IF Z<>1 AND Z<>2 THEN 9520
9550 IF Z=2 THEN
9560 PRINT "Please choose your units of fabric tightness ...J"
9570 PRINT "enter ...I1 ... for St length in cm_I2 ... for St len in"
;
9580 PRINT " inches_I3 ... for Tightness factor GG";
9590 INPUT Z
9600 IF Z<>1 AND Z<>2 AND Z<>3 THEN 9570
9610 F(5)=Z
9620 IF F(5)=1 THEN
9630 T$="St Len (cm)"
9640 U$="cm"
9650 ELSE
9660 IF F(5)=2 THEN
9670 T$="St Len (inches)"
9680 U$="in"
9690 ELSE
9700 T$="(Root Tex)/St Len"
9710 U$="cm"

```

```

9720     END IF
9730     END IF
9735 END IF
9740 RETURN
10000 REM -----(choose knitting machine)-----
10010 IF F(3)<>0 THEN 10030
10020 GOSUB 10500 ! choose fabric/process
10030 READ #2,F(3):K$,Km$,Z9
10040 Km$="MACHINE/"&Km$
10050 OPEN Km$;9,"R",S$
10060 PRINT "L_Please select your knitting machine ...JJ"
10062 PRINT K$;"J"
10070 PRINT USING 10090:"Mach.No","gauge","Diam.,""Needles","Count range
"
10080 PRINT
10090 IMAGE 7a,10t,5a,20t,5a,30t,7a,48t,11a
10100 IMAGE 3t,2d,11t,2d,21t,2d,31t,4d,48t,2d,52t,2a,56t,2d
10110 FOR I=1 TO Z9
10120     READ #9,I:Ma
10130     PRINT USING 10100:I,Ma(1),Ma(2),Ma(3),Ma(4),"to",Ma(5)
10140 NEXT I
10150 PRINT "J_enter machine No ..._IDR type 0 to specify a different";
10160 PRINT " model ..... ";
10170 INPUT Z
10180 IF Z<0 OR Z>Z9 THEN 10150
10190 IF Z=0 THEN
10200     Ma=0
10210     PRINT "JJ_gauge ... ";
10220     INPUT Ma(1)
10230     PRINT "diameter ... ";
10240     INPUT Ma(2)
10242     Z3=INT(PI*Ma(2)*Ma(1))
10250     PRINT "Theoretical No of needles is ";Z3
10252     PRINT "How many do you want ";
10260     INPUT Ma(3)
10270     Z1=PI*0.95*Ma(2)*Ma(1)
10280     Z2=PI*1.05*Ma(2)*Ma(1)
10290     IF Ma(3)<Z2 AND Ma(3)>Z1 THEN 10370
10300     PRINT "J_These machine parameters are incompatible !! GG"
10310     PRINT "J_For a ";Ma(1);"g machine the number of needles should
be"
10320     PRINT "I_between ";INT(Z1);" and ";INT(Z2)
10330     PRINT "J_enter I1 ... to continue, I2 ... to re-enter ";
10340     INPUT Z1
10350     GO TO Z1 OF 10370,10150
10360     GO TO 10330
10370 ELSE
10380     READ #9,Z:Ma
10390 END IF
10400 CLOSE 9
10410 RETURN
10500 REM -----(FABRIC/PROCESS combination)-----
10510 PRINT "L_Please indicate FABRIC type ...J"
10520 GOSUB 6000
10530 PRINT "J_enter Fabric code No. ... GG";
10540 INPUT F(3)
10550 IF F(3)<1 OR F(3)>C1(1) THEN 10530
10560 PRINT "L_Please select PROCESS route ..."
10570 GOSUB 6500
10580 PRINT "J_enter Process code No. ... GG";

```



```

10590 INPUT F(4)
10600 IF F(4)<1 OR F(4)>Z9 THEN 10580
10610 RETURN
11000 REM -----(change process)-----
11010 IF F(3)<>0 THEN 11040
11020 GOSUB 10500 ! switch to fabric/process sub
11030 RETURN
11040 PRINT "LI*** FINISHING ROUTE ***JJ"
11050 GOSUB 6500
11060 PRINT "JJEnter process code No ... GG";
11070 INPUT F(4)
11080 IF F(4)<1 OR F(4)>Z9 THEN 11060
11090 GOSUB 9000 ! get proc name & equations
11100 RETURN
11500 REM -----(change yarns)-----
11510 GOSUB 8500 ! select count units
11520 PRINT "J How many different values of ";C#;" do you want to use "
;
11530 INPUT N
11540 IF N>1 THEN 11620
11550 DELETE C5
11560 DIM C5(2)
11570 C5=0
11580 PRINT "JWhat is it ... ";
11590 INPUT C5(1)
11600 N=1
11610 RETURN
11620 DELETE C5
11630 DIM C5(N)
11640 PRINT "JOK, please enter the values_JItemI";C#;"J"
11650 FOR I=1 TO N
11660 PRINT I;"I";
11670 INPUT C5(I)
11680 NEXT I
11690 RETURN
12000 REM -----(change tightness)-----
12010 GOSUB 9500 ! select tightness units
12020 PRINT "JHow many different values of ";T#;" do you want to use ";
12030 INPUT N1
12040 IF N1>1 THEN 12110
12050 DELETE C6
12060 DIM C6(2)
12070 N1=1
12080 PRINT "JWhat is it ... ";
12090 INPUT C6(1)
12100 RETURN
12110 DELETE C6
12120 DIM C6(N1)
12130 PRINT "JOK, please enter the values_JItemI";T#;"J"
12140 FOR I=1 TO N1
12150 PRINT I;"I";
12160 INPUT C6(I)
12170 NEXT I
12180 RETURN
12500 REM -----(calculate Tex as knitted)-----
12510 IF F(2)=1 THEN
12520 P(1)=P(23)
12530 ELSE
12540 IF F(2)=2 THEN
12550 P(1)=FNL(P(23))

```

```

12560     ELSE
12570         P(1)=FNM(P(23))
12580     END IF
12590 END IF
12600 RETURN
13000 REM -----(St.Len & TF as knitted)-----
13010 IF F(5)=1 THEN
13020     P(3)=P(24)
13030     P(5)=SQR(P(1))/P(3)
13040 ELSE
13050     IF F(5)=2 THEN
13060         P(3)=2.54*P(24)
13070         P(5)=SQR(P(1))/P(3)
13080     ELSE
13090         P(3)=SQR(P(1))/P(24)
13100         P(5)=P(24)
13110     END IF
13120 END IF
13130 RETURN
13500 REM -----(Fin Courses in user units)-----
13510 IF F(7)=1 THEN
13520     P(17)=P(11)
13530 ELSE
13540     IF F(7)=2 THEN
13550         P(17)=P(11)*3
13560     ELSE
13570         P(17)=P(11)*2.54
13580     END IF
13590 END IF
13600 RETURN
14000 REM -----(Fin Wales in user units)-----
14010 IF F(7)=1 THEN
14020     P(18)=P(12)
14030 ELSE
14040     IF F(7)=2 THEN
14050         P(18)=P(12)*3
14060     ELSE
14070         P(18)=P(12)*2.54
14080     END IF
14090 END IF
14100 RETURN
15000 REM -----(Fin Weight in user units)-----
15010 IF F(8)=1 THEN
15020     P(19)=P(13)
15030 ELSE
15040     P(19)=P(13)*0.02949
15050 END IF
15060 RETURN
16000 REM -----(Fin Width in user units)-----
16010 P(20)=P(14)
16020 GO TO F(9) OF 16040,16030,16040,16030
16030 P(20)=P(10)/2.54
16040 GO TO F(9) OF 16050,16050,16060,16060
16050 P(20)=P(20)/2
16060 RETURN
17000 REM -----(FR count in user units)-----
17010 IF F(2)=1 THEN
17020     P(15)=P(2)
17030 ELSE
17040     IF F(2)=2 THEN

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17050      P(15)=FNL(P(2))
17060      ELSE
17070      P(15)=FNM(P(2))
17080      END IF
17090 END IF
17100 RETURN
17500 REM -----(FR St.Len. & TF in user units)-----
17510 IF F(5)=1 OR F(5)=3 THEN
17520      P(16)=P(4)
17530 ELSE
17540      P(16)=P(4)/2.54
17550 END IF
17555 P(6)=SQR(P(2))/P(4)
17560 RETURN
18000 REM -----(Fin Courses in default units)-----
18010 IF F(7)=1 THEN
18020      P(11)=P(17)
18030 ELSE
18040      IF F(7)=2 THEN
18050          P(11)=P(17)/3
18060      ELSE
18070          P(11)=P(17)/2.54
18080      END IF
18090 END IF
18100 RETURN
18500 REM -----(Fin Wales in default units)-----
18510 IF F(7)=1 THEN
18520      P(12)=P(18)
18530 ELSE
18540      IF F(7)=2 THEN
18550          P(12)=P(18)/3
18560      ELSE
18570          P(12)=P(18)/2.54
18580      END IF
18590 END IF
18600 RETURN
19000 REM -----(FIN weight in default units)-----
19010 IF F(8)=1 THEN
19020      P(13)=P(19)
19030 ELSE
19040      P(13)=P(19)/0.02949
19050 END IF
19060 RETURN
19500 REM -----(FIN width in default units)-----
19510 P(14)=P(20)
19520 GO TO F(9) OF 19540,19530,19540,19530
19530 P(14)=P(14)*2.54
19540 GO TO F(9) OF 19550,19550,19560,19560
19550 P(14)=P(14)*2
19560 RETURN
20000 REM -----(convert FR to as delivered in default units)-----
20010 REM
20020 IF F(11)=1 THEN
20030      REM .....fixed shrinkages.....
20040      P(11)=P(7)*FNG(P(21))/100
20050      P(12)=P(8)*FNH(P(22))/100
20060      P(13)=FNI(P(9))
20070      P(14)=P(10)/FNH(P(22))*100
20080 END IF
20090 IF F(11)=2 THEN

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20100 REM .....fixed courses & wales.....
20110 P(21)=FNN(P(7))
20120 P(22)=FND(P(8))
20130 P(13)=FNI(P(9))
20140 P(14)=FNK(P(22))
20150 END IF
20160 IF F(11)=3 THEN
20170 REM .....fixed weight & width.....
20180 P(22)=FNP(P(14))
20190 P(21)=FNQ(P(13))
20200 P(11)=P(7)*FNG(P(21))/100
20210 P(12)=P(8)*FNH(P(22))/100
20220 END IF
20230 IF F(11)=4 THEN
20240 REM .....fixed weight & courses.....
20250 P(21)=FNN(P(7))
20260 P(22)=FNR(P(13))
20270 P(12)=P(8)*FNH(P(22))/100
20280 P(14)=FNK(P(22))
20290 END IF
20300 IF F(11)=5 THEN
20310 REM .....fixed % LS & Width.....
20320 P(11)=P(7)*FNG(P(21))/100
20330 P(22)=FNP(P(14))
20340 P(12)=P(8)*FNH(P(22))/100
20350 P(13)=FNI(P(21))
20360 END IF
20370 RETURN
20500 REM -----(calculate finished FR dimensions)-----
20510 P(2)=FNA(P(1))
20520 P(4)=FNB(P(3))
20530 P(7)=FND(P(1))
20540 P(8)=FNC(P(1))
20550 P(9)=FNF(P(1))
20560 P(10)=FNJ(P(1))
20570 P(6)=SQR(P(2))/P(4)
20580 RETURN
21000 REM ***** DEFINE FUNCTIONS *****
21010 REM
21020 REM .....BASIC STARFISH EQUATIONS.....
21030 REM
21040 DEF FNA(X)=Eq(1)*P(1) ! Tex
21050 DEF FNB(X)=Eq(2)*P(3) ! St Length
21060 DEF FNC(X)=Eq(6)+Eq(7)/FNB(P(3))+Eq(8)*SQR(FNA(P(1))) ! Wales
21070 DEF FND(X)=Eq(3)+Eq(4)/FNB(P(3))+Eq(5)*SQR(FNA(P(1))) ! Courses
21080 DEF FNE(X)=Eq(9)+Eq(10)/FNB(P(3))^2+Eq(11)*FNA(P(1)) ! Stitches
21090 DEF FNF(X)=Eq(12)+Eq(13)*FNA(P(1))/FNB(P(3)) ! Weight
21100 REM
21110 REM .....CONVERSIONS.....
21120 DEF FNG(X)=100-P(21) ! Len Shrinkage factor
21130 DEF FNH(X)=100-P(22) ! Wid Shrinkage factor
21140 DEF FNI(X)=P(9)*FNH(P(22))*FNG(P(21))/10000 ! Wt fr Shr
21150 DEF FNJ(X)=Ma(3)/FNC(P(1)) ! Wid from Ndls & Wales FR
21160 DEF FNK(X)=FNJ(P(1))*100/FNH(P(22)) ! Wid from Shr
21170 DEF FNL(X)=590.54/X ! Ne to Tex or vice versa
21180 DEF FNM(X)=1000/X ! Nm to Tex or vice versa
21190 DEF FNN(X)=100*(P(7)-P(11))/P(7) ! Len Shr from Courses
21200 DEF FNO(X)=100*(P(8)-P(12))/P(8) ! Wid Shr from Wales
21210 DEF FNP(X)=100*(P(14)-P(10))/P(14) ! Wid Shr direct
21220 DEF FNQ(X)=100-10000/FNH(P(22))*P(13)/P(9) ! LS fr Wt & Shr

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21230 DEF FNR(X)=100-10000/FNG(P(21))*P(13)/P(9) ! WShr fr Wt & LShr
21240 RETURN
22000 REM -----
22010 REM FINISHING TARGETS
22020 REM -----
22030 REM
22040 PRINT "LI*** FINISHING TARGETS ***JJ"
22050 PRINT "Finished dimensions are calculated according to assumed"
22060 PRINT "finishing targets."
22070 PRINT "J You have five options for these as follows ..."
22080 PRINT "JJ1 ... Length & Width Shrinkages,"
22090 PRINT "I2 ... Courses & Wales,"
22100 PRINT "I3 ... Weight & Width,"
22110 PRINT "I4 ... Weight & Courses,"
22120 PRINT "I5 ... Length Shrinkage & Width."
22130 REM
22140 REM
22150 REM
22160 PRINT "JJEnter option ... I[ Zero to return ] GG";
22170 INPUT Z
22180 IF Z=0 THEN 22030
22190 IF Z<1 OR Z>5 THEN 22160
22200 F(11)=Z
22210 IF F(11)=1 THEN
22220 REM -----(shrinkages)-----
22230 Z1$="Length %"
22240 Z2$="Width %"
22250 REM
22260 PRINT "LI*** SHRINKAGE ***JJ"
22270 PRINT "Shrinkages are assumed to be measured by the standard ";
22280 PRINT "IIC 5-cycle_relaxation procedure."
22290 PRINT "JJ Units of Shrinkage are  $\%(BW-AW)/BW$  and are treated
";
22300 PRINT "in pairs;_ie length and width are entered togetherJJ"
22310 PRINT "JDo not use a minus sign for entering shrinkages"
22320 END IF
22330 IF F(11)=2 THEN
22340 REM -----(Courses & Wales)-----
22350 Z1$="Courses"
22360 Z2$="Wales"
22370 PRINT "LI*** COURSES & WALES ***JJ"
22380 PRINT " Units of Courses & Wales are stitches per ";V$
22390 PRINT "J They are entered together in pairs."
22400 END IF
22410 IF F(11)=3 THEN
22420 REM -----(Weight & Width)-----
22430 Z1$="Weight"
22440 Z2$="Width"
22450 PRINT "LI*** WEIGHT & WIDTH ***JJ"
22460 PRINT " Units of Weight are ";W$
22470 PRINT " Units of Width are ";X$
22480 PRINT "J They are entered together in pairs."
22490 END IF
22500 IF F(11)=4 THEN
22510 REM -----(Weight & Courses)-----
22520 Z1$="Weight"
22530 Z2$="Courses"
22540 PRINT "LI*** WEIGHT & COURSES ***JJ"
22550 PRINT " Units of Weight are ";W$
22560 PRINT "J Units of Courses are stitches per ";V$

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22570 PRINT "J They are entered together in pairs."
22580 END IF
22590 IF F(11)=5 THEN
22600 REM -----(% Length Shr. & Width)-----
22610 Z1$="Length Shr.%"
22620 Z2$="Width"
22630 PRINT "LI*** LENGTH SHRINKAGE & WIDTH ***JJ"
22640 PRINT "Units of Length Shrinkage are % (SWTD)"
22650 PRINT "Units of Width are ";X$
22660 PRINT "J They are entered together in pairs"
22670 PRINT "JDo not use a minus sign for entering shrinkage"
22680 END IF
22690 REM .....enter finishing targets.....
22700 PRINT "J How many pairs of ";Z1$;" and ";Z2$;" do you want GG";
22710 INPUT N2
22720 IF N2<1 THEN 22700
22730 DELETE C7
22740 DIM C7(N2+1,2)
22750 C7=0
22760 PRINT "JOK, please enter the values ... _I";Z1$;"I";Z2$
22770 FOR I=1 TO N2
22780 PRINT " ";I;"I";
22790 INPUT C7(I,1)
22800 PRINT "KII ";
22810 INPUT C7(I,2)
22820 NEXT I
22830 RETURN
23000 REM -----
23010 REM SELECT USER UNITS
23020 REM -----
23030 REM
23040 PRINT "LWhat units do you want to change ..."
23050 PRINT "JI1 ... Courses & Wales_I2 ... Weight_I3 ... Width"
23060 PRINT "Jenter option ... _I[ zero to return ] GG";
23070 INPUT Opt
23080 IF Opt=0 THEN
23090 RETURN
23100 END IF
23110 IF Opt<1 OR Opt>3 THEN 23060
23120 GOSUB Opt OF 23140,23310,23440
23130 GO TO 23040
23140 REM .....Courses & Wales.....
23150 PRINT "JHow do you want to calculate courses and wales ...J"
23160 PRINT "I1 ... per cm._I2 ... per 3 cm._I3 ... per inch"
23170 PRINT "Jenter option ... GG";
23180 INPUT Z
23190 IF Z<>1 AND Z<>2 AND Z<>3 THEN 23170
23200 F(7)=Z
23210 IF F(7)=1 THEN
23220 V$="/cm"
23230 ELSE
23240 IF F(7)=2 THEN
23250 V$="3cm"
23260 ELSE
23270 V$="/in"
23280 END IF
23290 END IF
23300 RETURN
23310 REM .....Weight.....
23320 PRINT "JHow do you want to calculate weight ...J"

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23330 PRINT "I1 ... g/sq m_I2 ... oz/sq yd"
23340 PRINT "Jenter option ... GG";
23350 INPUT Z
23360 IF Z<>1 AND Z<>2 THEN 23340
23370 F(8)=Z
23380 IF F(8)=1 THEN
23390   W$="g/sm"
23400 ELSE
23410   W$="oz/sy"
23420 END IF
23430 RETURN
23440 REM .....Width.....
23450 PRINT "JHow do you want to calculate the width ..."
23460 PRINT "I1 ... cm tubular_I2 ... inches tubular"
23470 PRINT "I3 ... cm opened_I4 ... inches opened"
23480 PRINT "Jenter option ... GG";
23490 INPUT Z
23500 IF Z<>1 AND Z<>2 AND Z<>3 AND Z<>4 THEN 23480
23510 F(9)=Z
23520 IF F(9)=1 OR F(9)=3 THEN
23530   X$="cm"
23540 ELSE
23550   X$="in"
23560 END IF
23570 IF F(9)=1 OR F(9)=2 THEN
23580   X$=X$&"(T)"
23590 ELSE
23600   X$=X$&"(O)"
23610 END IF
23620 RETURN
24000 REM -----
24010 REM                   CHANGE QUALITIES
24020 REM -----
24030 REM
24040 PRINT "JI*** CHANGE FABRIC QUALITIES **JJ"
24050 PRINT "Yarn count/Stitch Length data are presently in ";
24060 IF F(6)=1 THEN
24070   PRINT "GROUPED format"
24080 ELSE
24090   PRINT "INDIVIDUAL format"
24100 END IF
24110 PRINT "JI1 ... Enter completely new set of Qualities"
24120 IF F(6)=1 THEN
24130   PRINT "JI2 ... Change yarn counts_I3 ... Change stitch lengths"
24140 ELSE
24150   PRINT "JI2 ... Change a quality_I3 ... Add a quality"
24160   PRINT "I4 ... Delete a quality"
24170 END IF
24180 PRINT "JJenter option ... JI[ Zero to return ] GG";
24190 INPUT Opt
24200 IF Opt<>0 THEN 24220
24210 RETURN ! note alternative exit from sub 25050 when Opt=1
24220 IF Opt=1 THEN 25050
24230 IF F(6)=1 AND (Opt=2)+(Opt=3)<>1 THEN 24180
24240 IF F(6)=2 AND (Opt=2)+(Opt=3)+(Opt=4)<>1 THEN 24180
24250 IF F(6)=1 THEN
24260   GOSUB Opt-1 OF 11500,12000
24270 ELSE
24280   GOSUB Opt-1 OF 24310,24510,24750
24290 END IF

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24300 GO TO 24000
24310 REM----- (changes for indiv. quals)-----
24320 PRINT "LJICurrent qualities are :-"
24330 PRINT "Quality No. IYarn ";C#;"I";T#;"J"
24340 FOR I=1 TO N3
24350   PRINT " ";I;"I";C8(I,1);"I";C8(I,2)
24360 NEXT I
24370 PRINT "JWhich quality is to be changed ? (Return for no change)";
24380 GOSUB 7500
24390 GO TO Ch OF 24400,24500,24370
24400 Z=VAL(Z#)
24410 IF Z<1 OR Z>N3 THEN 24370
24420 PRINT "J";C#;" change ";C8(Z,1);" to ";
24430 GOSUB 7500
24440 GO TO Ch OF 24450,24460,24420
24450 C8(Z,1)=VAL(Z#)
24460 PRINT "J";U#;" change ";C8(Z,2);" to ";
24470 GOSUB 7500
24480 GO TO Ch OF 24490,24370,24460
24490 C8(Z,2)=VAL(Z#)
24500 RETURN
24510 REM ----- (add a new quality)-----
24520 PRINT "JHow many new qualities do you want to add ...GG";
24530 INPUT Z
24540 IF Z=0 THEN 24740
24550 DELETE C
24560 DIM C(N3+Z,2)
24570 FOR I=1 TO N3
24580   C(I,1)=C8(I,1)
24590   C(I,2)=C8(I,2)
24600 NEXT I
24610 PRINT "JOK, enter new qualities ..."
24620 PRINT "Quality ICount ";C#;"I";T#;"J"
24630 FOR I=N3+1 TO N3+Z
24640   PRINT " ";I;"I";
24650   INPUT C(I,1)
24660   PRINT "KII";
24670   INPUT C(I,2)
24680 NEXT I
24690 DELETE C8
24700 DIM C8(N3+Z,2)
24710 C8=C
24720 N3=N3+Z
24730 DELETE C
24740 RETURN
24750 REM ----- (delete a quality)-----
24760 PRINT "LJICurrent qualities are :-"
24770 PRINT "JQuality No. IYarn ";C#;"I";T#;"J"
24780 FOR I=1 TO N3
24790   PRINT " ";I;"I";C8(I,1);"I";C8(I,2)
24800 NEXT I
24810 PRINT "JWhich quality is to be deleted ... GG"
24820 PRINT "II [ ZERO for no deletions] ";
24830 INPUT Z
24840 IF Z=0 THEN
24850   RETURN
24860 END IF
24870 IF Z=N3 THEN 25030
24880 IF Z<0 OR Z>N3 THEN 24810
24890 DELETE C

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24900 DIM C(N3-1,2)
24910 FOR I=1 TO Z-1
24920   C(I,1)=C8(I,1)
24930   C(I,2)=C8(I,2)
24940 NEXT I
24950 FOR I=Z+1 TO N3
24960   C(I-1,1)=C8(I,1)
24970   C(I-1,2)=C8(I,2)
24980 NEXT I
24990 DELETE C8
25000 DIM C8(N3-1,2)
25010 C8=C
25020 DELETE C
25030 N3=N3-1
25040 GO TO 24750
25050 REM -----(new set of qualities)-----
25060 PRINT "LHow do you want to enter your fabric qualities ..."
25070 PRINT "JenterI1 ... for grouped data"
25080 PRINT "I2 ... for individual qualities G6";
25090 INPUT Z
25100 IF Z<>1 AND Z<>2 THEN 25070
25110 F(6)=Z
25120 IF F(6)=1 THEN
25130   REM .....(grouped qualities).....
25140   REM
25150   GOSUB 11500 ! enter yarns
25160   GOSUB 12000 ! enter stitch lengths
25170 END IF
25180 IF F(6)=2 THEN
25190   REM .....(individual qualities).....
25200   REM
25210   GOSUB 8500 ! Yarn units
25220   GOSUB 9500 ! Tightness units
25230   PRINT "LJHow many separate constructions do you want ";
25240   INPUT N3
25250   DELETE C8
25260   DIM C8(N3,2)
25270   PRINT "Quality No.IYarn ";C#;"I";T#;"J"
25280   PRINT
25290   FOR I=1 TO N3
25300     PRINT " ";I;"I";
25310     INPUT C8(I,1)
25320     PRINT "KII";
25330     INPUT C8(I,2)
25340   NEXT I
25350 END IF
25360 RETURN
26000 REM -----
26010 REM           CURRENT PARAMETERS
26020 REM -----
26030 REM
26040 GOSUB 8000 ! screen or printer?
26050 IF D=32 THEN
26060   PAGE
26070 ELSE
26080   PRINT "JIADJUST PAPER & PUT PRINTER ON-LINEG6"
26090   INPUT Z#
26100 END IF
26110 PRINT @D:"I***** CURRENT PARAMETERS *****JJ"
26120 READ #1,F(3):F#,Fi#

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26130 PRINT @D:"FABRIC :I";F$
26140 PRINT @D:"JMACHINE :I";
26150 PRINT @D:Ma(1);"g ";Ma(2);"in ";Ma(3);" needles"
26160 Fi$="PROCESS/"&Fi$
26170 OPEN Fi$;9,"R",S$
26180 READ #9,F(4):P$
26190 PRINT @D:"JPROCESS :I";P$
26200 CLOSE 9
26210 IF F(6)=1 THEN ! grouped format
26220 PRINT @D:"JYARNS : I";"Resultant count"
26230 PRINT @D:" I";
26240 FOR I=1 TO N
26250 IF I=1 THEN 26290
26260 IF INT((I-1)/5)<>(I-1)/5 THEN 26290
26270 PRINT @D:
26280 PRINT @D:"I";
26290 PRINT @D:C5(I);C$;" ";
26300 NEXT I
26310 PRINT @D:
26320 PRINT @D:"JTIGHTNESS :I";T$
26330 PRINT @D:" I";
26340 FOR I=1 TO N1
26350 IF I=1 THEN 26390
26360 IF (I-1)/5<>INT((I-1)/5) THEN 26390
26370 PRINT @D:
26380 PRINT @D:"I";
26390 PRINT @D:C6(I);" ";
26400 NEXT I
26410 ELSE ! individual format
26420 PRINT @D:"JQUALITIES :INo.I";C$;" (res.)I";T$
26430 PRINT @D:" I";
26440 FOR I=1 TO N3
26450 IF I=1 THEN 26490
26460 IF INT((I-1)/3)=(I-1)/3 THEN 26490
26470 PRINT @D:
26480 PRINT @D:" I";
26490 PRINT @D:" ";I;" I";C8(I,1);" I";C8(I,2);
26500 NEXT I
26510 END IF
26520 RESTORE 26740
26530 FOR I=1 TO F(11)
26540 READ Z1$
26550 NEXT I
26560 PRINT @D:
26570 PRINT @D:"JTARGETS :I(";Z1$;)"
26580 PRINT @D:" I";
26590 FOR I=1 TO N2
26600 IF I=1 THEN 26640
26610 IF INT((I-1)/3)<>(I-1)/3 THEN 26640
26620 PRINT @D:" I";
26630 PRINT @D:
26640 PRINT @D:C7(I,1);" & ";C7(I,2);"I";
26650 NEXT I
26660 PRINT @D:
26670 PRINT @D:"JUNITS : "
26680 PRINT @D:" ICourses & WalesI";V$
26690 PRINT @D:" IWeightI";W$
26700 PRINT @D:" IWidthI";X$
26710 IF D=41 THEN 26730
26720 INPUT Z$

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26730 RETURN
26740 DATA "Length & Width Shrinkages","Finished Courses & Wales"
26750 DATA "Finished Weight & Width","Finished Weight & Courses"
26760 DATA "Length Shrinkage & Width"
30000 REM -----
30010 REM                      TABULATION
30020 REM -----
30030 REM
30040 RESTORE 26740
30050 FOR I=1 TO F(11)
30060   READ Tar$
30070 NEXT I
30080 Tar$="Targets are "&Tar$
30090 GOSUB 8000  ! screen or printer?
30100 P1=1
30110 GOSUB 21000 ! define functions
30120 CALL "TIME",D$
30130 D$=SEG(D$,1,15)
30140 F(13)=0
30150 READ #1,F(3):F$,Fi$
30160 Fi$="PROCESS/"&Fi$
30170 OPEN Fi$;9,"R",S$
30180 READ #9,F(4):P$,Eq
30190 CLOSE 9
30200 L1=15+15*(D=41)
30210 L=0
30220 IF F(6)=1 AND N*N1*N2<=L1 THEN 30280
30230 IF F(6)=2 AND N3*N2<=L1 THEN 30280
30240 PRINT "JYou have ";N*N1*N2*(F(6)=1)+N3*N2*(F(6)=2);" rows of data"
30250 PRINT "JHow many rows do you want to a page ... GG";
30260 INPUT L1
30270 IF L1<1 THEN 30250
30280 GOSUB 40040 ! print title & headings
30290 IF F(6)=1 THEN
30300   REM -----grouped qualities-----
30305   L3=N*N1*N2
30310   FOR K=1 TO N2 ! outer loop is fin. targets
30330     FOR I=1 TO N ! second loop is yarn counts
30340       IF I=1 AND K=1 THEN 30360
30350       PRINT @D:
30360       FOR J=1 TO N1 ! inner loop is stitch lengths
30370         P(23)=C5(I)
30380         GOSUB 12500 ! Tex as knitted
30390         P(2)=FNA(P(1))
30410         GOSUB 17000 ! F.FR count in user units
30420         P(24)=C6(J)
30430         GOSUB 13010 ! St.Len & TF as knitted ,default units
30440         P(4)=FNB(P(3))
30460         GOSUB 17500 ! St.Len in user units
30470         Z1=C7(K,1)
30480         Z2=C7(K,2)
30490         GOSUB 41500 ! assign fixed finished props to P array
30500         GOSUB 20500 ! F.FR dims in default units
30510         GOSUB 20000 ! convert F.FR to as del in default unit
30520         GOSUB 42000 ! convert as del to user units
30530         GOSUB 40500 ! print a row of data
30540         L=L+1
30550         IF L<L1 THEN 30570
30560         GOSUB 41000 ! start a new page

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30570         NEXT J
30580         NEXT I
30590     NEXT K
30600     GOSUB 43010 ! print footnotes
30610     IF D=41 THEN 30630
30620     INPUT Z$
30630 END IF
30640 IF F(6)=2 THEN
30650     REM -----INDIVIDUAL QUALITIES-----
30660     L3=N3*N2
30670     FOR K=1 TO N2 ! outer loop is fin targets
30680         IF K=1 THEN 30700
30690         PRINT @D:
30700         FOR I=1 TO N3 ! inner loop is indiv qualities
30710             P(23)=C8(I,1)
30720             GOSUB 12500 ! Tex as knitted
30730             P(2)=FNA(P(1))
30750             GOSUB 17000 ! FR count in user units
30760             P(24)=C8(I,2)
30770             GOSUB 13010 ! St Len & TF as knitted, default units
30780             P(4)=FNB(P(3))
30800             GOSUB 17500 ! St Len in user units
30810             Z1=C7(K,1)
30820             Z2=C7(K,2)
30830             GOSUB 41500 ! assign fin targets to P array
30840             GOSUB 20500 ! F.FR dims in default units
30850             GOSUB 20000 ! convert F.FR to as del, default units
30860             GOSUB 42000 ! convert as del to user units
30870             GOSUB 42500 ! test for silly fin targets
30880             PRINT @D: USING 40630:C8(I,1),C8(I,2),P(5)
30890             GOSUB 43500 ! test for data out of range
30900             IF F(12)>0 THEN 30950
30930             PRINT @D: USING 40640:P(17),P(18),P(19),P(20),P(21)*-1,P(
30950                 PRINT @D:Ast$
30960                 L=L+1
30970                 IF L<L1 THEN 30990
30980                 GOSUB 41000 ! start new page
30990         NEXT I
31000     NEXT K
31010     GOSUB 43010 ! print footnotes
31020     IF D=41 THEN 31040
31030     INPUT Z$
31040 END IF
31050 RETURN
40000 REM -----
40010 REM             TABULATION SUBS
40020 REM -----
40030 REM
40040 REM .....Print title & headings.....
40050 IF D=32 THEN
40060     PAGE
40070 ELSE
40080     PRINT "JIADJUST PAPER & PUT PRINTER ON-LINEGG";
40090     INPUT Z$
40100 END IF
40110 Z$="          *** IIC -STARFISH 84- MODEL PREDICTIONS ***"
40120 IF D=32 THEN 40140
40130 Z$="NIIC -STARFISH 84- MODEL PREDICTIONS"
40140 PRINT @D:Z$

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40150 PRINT @D:
40160 PRINT @D:F$
40170 PRINT @D:"   ";Ma(1);"g   ";Ma(2);"in   ";Ma(3);" needles"
40180 PRINT @D:"   ";P$
40190 PRINT @D: USING "54a,15a":Tar$,D$
40200 FOR M=1 TO 70
40210   PRINT @D:"-";
40220 NEXT M
40230 PRINT @D:
40240 PRINT @D:" As knitted   ! Average finished dimensions   ";
40250 PRINT @D:"! Shrinkage (5 W&T)"
40260 PRINT @D:
40270 PRINT @D: USING 40280:"Yarn","StLen","TF"
40280 IMAGE 4a,6t,5a,13t,2a,S
40290 PRINT @D: USING 40300:"courses","wales","weight","width"
40300 IMAGE 3x,7a,3x,5a,3x,6a,3x,5a,S
40310 PRINT @D: USING "3x,7a,3x,7a": "Length","Width"
40320 PRINT @D: USING 40330:C$,U$,V$,V$,W$,X$,"%","%"
40330 IMAGE 3a,7t,2a,20t,3a,28t,3a,36t,5a,45t,5a,56t,1a,65t,1a
40340 FOR M=1 TO 70
40350   PRINT @D:"-";
40360 NEXT M
40370 PRINT @D:
40380 RETURN
40500 REM .....print a row of data.....
40510 GOSUB 42500 ! test for silly fin targets
40520 IF F(5)=1 OR F(5)=2 THEN
40530   PRINT @D: USING 40630:C5(I);C6(J);P(5)
40540 ELSE
40550   PRINT @D: USING 40630:C5(I),P(3),P(5)
40560 END IF
40570 GOSUB 43500 ! test for data out of range
40580 IF F(12)>0 THEN 40650
40610 PRINT @D: USING 40640:P(17),P(18),P(19),P(20),P(21)*-1,P(22)*-1
40630 IMAGE 2d,1d,6t,1d,3d,12t,2d,1d,S
40640 IMAGE 3x,3d,1d,3x,3d,1d,3x,4d,1d,3x,4d,1d,3x,+3d,1d,4x,+3d,1d,S
40650 PRINT @D:Ast$
40660 RETURN
41000 REM .....start a new page.....
41010 IF P1*L=L3 THEN 41130
41020 GOSUB 43010 ! print footnotes
41030 IF D=32 THEN
41035   PRINT "000"
41040   INPUT Z$
41050 ELSE
41060   PRINT "J_IADJUST PAPER & PUT PRINTER ON-LINE00";
41070   INPUT Z$
41080 END IF
41090 P1=P1+1
41100 GOSUB 40040 ! title & headings
41110 L=0
41120 F(13)=0
41130 RETURN
41500 REM -----(assign finishing targets to P array)-----
41510 IF F(11)=1 THEN
41520   P(21)=Z1
41530   P(22)=Z2
41535 END IF
41540 IF F(11)=2 THEN
41550   P(17)=Z1

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41560 P(18)=Z2
41570 GOSUB 18000 ! courses
41580 GOSUB 18500 ! wales
41585 END IF
41590 IF F(11)=3 THEN
41600     P(19)=Z1
41610     P(20)=Z2
41620     GOSUB 19000 ! weight
41630     GOSUB 19500 ! width
41635 END IF
41640 IF F(11)=4 THEN
41650     P(19)=Z1
41660     P(17)=Z2
41670     GOSUB 19000
41680     GOSUB 18000
41685 END IF
41690 IF F(11)=5 THEN
41700     P(21)=Z1
41710     P(20)=Z2
41720     GOSUB 19500
41730 END IF
41740 RETURN
42000 REM -----(convert Fin as del to user units)-----
42010 IF F(11)=1 THEN
42020     GOSUB 13500 ! courses
42030     GOSUB 14000 ! wales
42040     GOSUB 15000 ! weight
42050     GOSUB 16000 ! width
42055 END IF
42060 IF F(11)=2 THEN
42070     GOSUB 15000
42080     GOSUB 16000
42085 END IF
42090 IF F(11)=3 THEN
42100     GOSUB 13500
42110     GOSUB 14000
42115 END IF
42120 IF F(11)=4 THEN
42130     GOSUB 14000
42140     GOSUB 16000
42145 END IF
42150 IF F(11)=5 THEN
42160     GOSUB 13500
42170     GOSUB 14000
42180     GOSUB 15000
42190 END IF
42200 RETURN
42500 REM -----(check for silly finishing targets)-----
42510 Ast$=""
42520 IF P(13)>P(9)*0.96 OR (P(11)>P(7)*0.98 AND P(12)>P(8)*0.98) THEN
42530     Ast$=" *"
42540     F(13)=1
42550 END IF
42560 IF P(21)<2 AND P(21)+P(22)<8 OR P(21)>20 THEN
42570     Ast$=" *"
42580     F(13)=1
42590 END IF
42600 IF P(22)<2 AND P(21)+P(22)<8 OR P(22)>20 THEN
42610     Ast$=" *"
42620     F(13)=1

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42630 END IF
42640 RETURN
43000 REM -----(print footnotes)-----
43010 REM
43020 FOR M=1 TO 70
43030   PRINT @D:"-";
43040 NEXT M
43050 PRINT @D:
43060 PRINT @D:" NB : Shrinkage convention is + for growth, ";
43070 PRINT @D:" - for contraction"
43080 IF F(13)=0 THEN 43110
43090 PRINT @D:"      : Qualities marked with * have unreasonable ";
43100 PRINT @D:"finishing targets"
43110 PRINT @D:"      : Estimates are given in good faith but without ";
43120 PRINT @D:"liability      "
43130 RETURN
43500 REM -----(test for data out of range)-----
43510 REM
43520 F(12)=P(17)>999 OR P(18)>999
43530 F(12)=F(12)+(P(19)>9999 OR P(20)>9999)
43540 F(12)=F(12)+(P(21)<-999 OR P(21)>999)
43550 F(12)=F(12)+(P(22)<-999 OR P(22)>999)
43560 RETURN
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