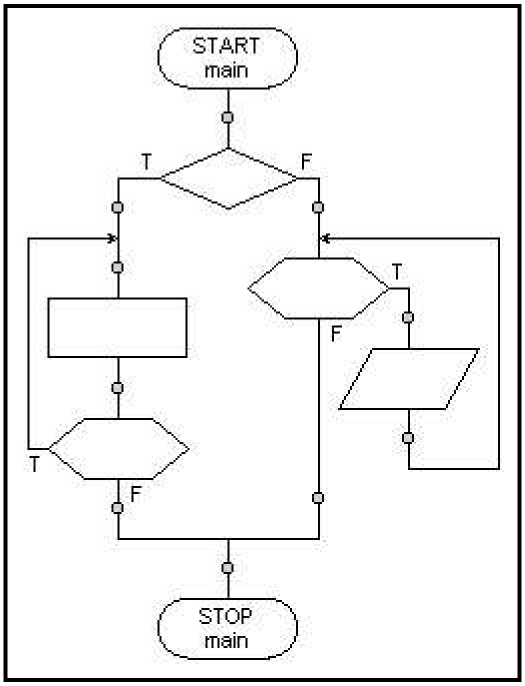
SFC

A Structured Flow Chart Editor

Version 2.3
User's Guide



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SFC – A Structured Flow Chart Editor
Version 2.3
User's Guide

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1. Introduction

Program development can be described as a seven step process:

1. Understand the problem.
2. Plan the logic of the program.
3. Code the program using a structured high level computer language.
4. Using a compiler, translate the program into a machine language.
5. Test and debug the program.
6. Put the program into production.
7. Maintain and enhance the program.

Planning the logic of the program requires the development of algorithms. An algorithm is a finite, ordered set of unambiguous steps that terminates with a solution to the problem. Human readable representations such as flow charts and pseudo code are typically used to describe the steps of an algorithm and the relationships among the steps.

A flow chart is a graphical representation of the steps and control structures used in an algorithm. A flow chart does not involve a particular programming language, but rather uses a set of geometric symbols and flow control lines to describe the algorithm. From a flowchart, a programmer can produce the high level code required to compile an executable program.

Initially, the standard for describing flow charts only specified the types of shapes and lines used to produce a flow chart. The introduction of structured programming in the 1960's and 70's brought with it the concept of Structured Flow Charts. In addition to a standard set of symbols, structured flow charts specify conventions for linking the symbols together into a complete flow chart.

The structured programming paradigm evolved from the mathematically proven concept that all problems can be solved using only three types of control structures:

Sequence
Decision (or Selection)
Iterative (or looping).

The definition of structured flow charts used in this document and software further defines:

- 3 types of sequential structures:
  - Process, Input/Output, and Subroutine Call
- 3 types of decision structures
  - Single Branch, Double Branch, and Case
- 4 types of iterative structures
  - Test at the Top, Test at the Bottom, Counting, and User Controlled Exit.

The SFC program is designed to aid the programmer in designing and presenting structured flow charts. In addition, SFC will automatically generate pseudo code for a flow chart as the flow chart is being created.

2. Getting Started with SFC

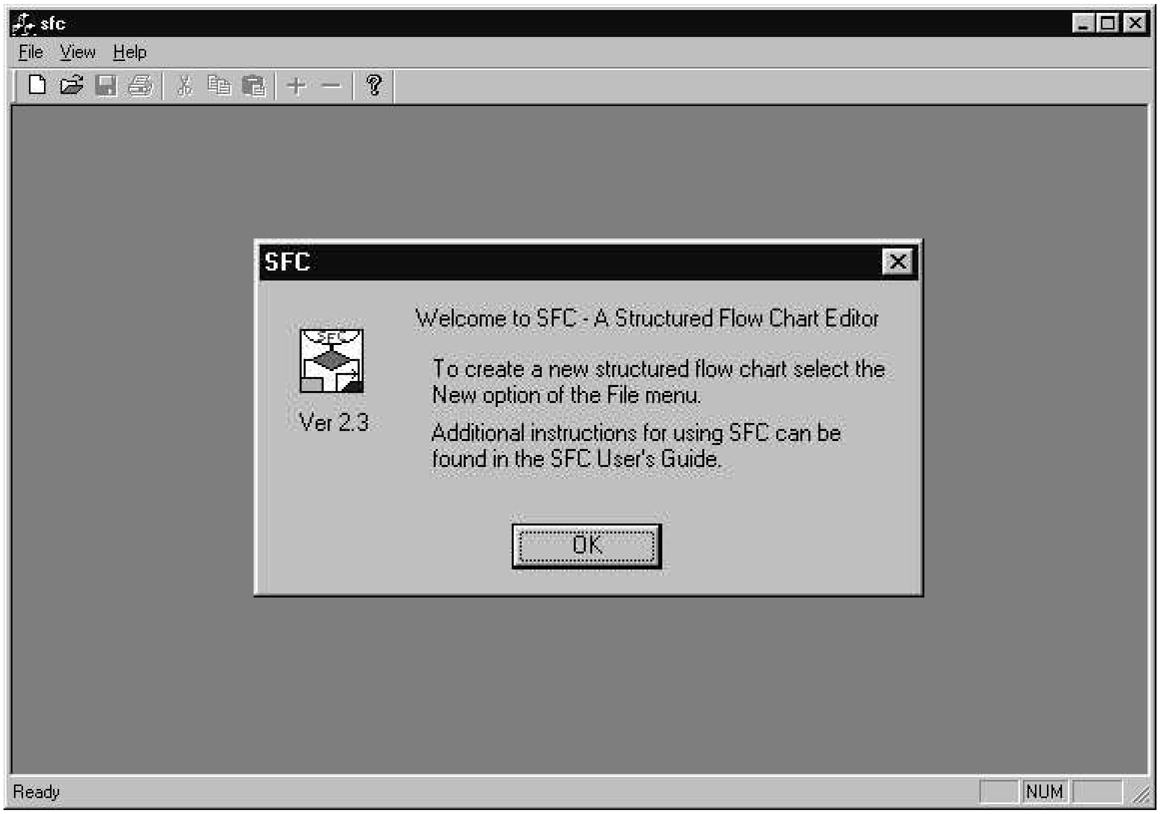
To start the SFC program:

Place the disk containing the SCF program in the A: drive.
From the Start menu, select the Run option.
Enter a:\sfc in the Run dialog box and click on OK or press the enter key.

OR if you have copied the SFC program onto the hard drive (C:) of your computer

From the Start menu, select the Run option.
Enter c:\sfc in the Run dialog box and click on OK or press the enter key.

Once you have started the SFC program, the main window will be displayed:



Welcome to SFC - A Structured Flow Chart Editor

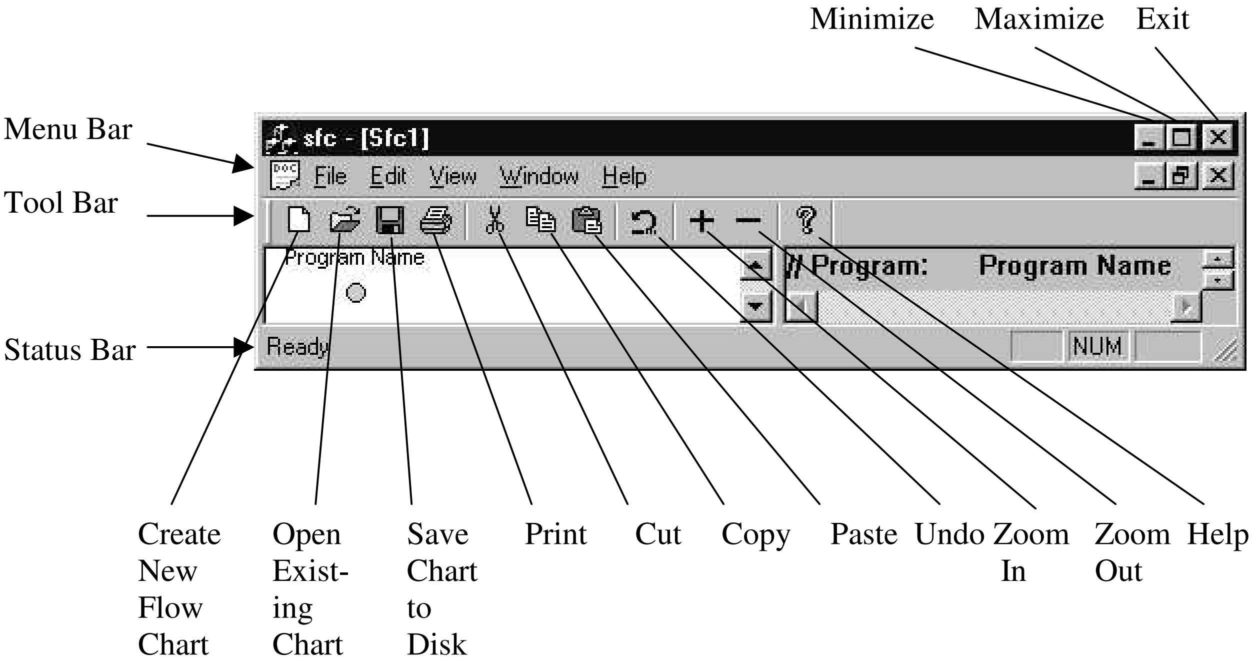
To create a new structured flow chart select the New option of the File menu.

Additional instructions for using SFC can be found in the SFC User's Guide.

Using the left mouse button, click on OK to proceed.

You can maximize the size of this window by clicking on the full screen button in the upper right corner of the window frame.

3. The SFC Environment



The **File** menu includes options allowing the user to:

- Create a new SFC flow chart document
- Open an existing SFC flow chart document
- Save the current SFC flow chart document to a file
- Save the current SFC flow chart document to a newly named file
- Export the current SFC flow chart to an SVG or TXT file
- Print the current SFC flow chart or pseudo code view
- Preview the print version of the current SFC flow chart or pseudo code view
- Set the printing parameters
- View and select from a list of recent SFC flow chart documents
- Exit from the SFC Editor.

The **Edit** menu includes options allowing the user to:

- Undo the most recent modification made to the current SFC flow chart
- Cut the selected control structure or subroutine from the current SFC flow chart
- Copy the selected flow chart element from the current SFC flow chart to the clipboard
- Copy the selected pseudo code from the current SFC pseudo code view to the clipboard
- Paste the flow chart element stored on the clipboard into the selected insertion point in the current SFC flow chart
- Insert a new flow chart element at the selected insertion point in the current SFC flow chart
- Modify the selected control structure or subroutine in the current SFC flow chart.
- Transform the selected control structure in the current SFC flow chart to another control structure.

The **View** menu includes options allowing the user to:

- View or hide the Tool Bar
- View or hide the Status Bar
- Select the Generic style of pseudo code for the current SFC flow chart
- Select the C++ style of pseudo code for the current SFC flow chart
- Include line numbers in the pseudo code window

The **Window** menu includes options allowing the user to:

- Create a copy of the current SFC flow chart in a new window
- Display a cascade of the open SFC flow chart documents
- Display a horizontal tiling of the open SFC flow chart documents
- View and select from a list of the open SFC flow chart documents.

The **Help** menu includes options allowing the user to:

- View SFC version information.

The *left* mouse button is used to select or modify an element in the current SFC flow chart:

- Pointing to the symbol associated with a control structure, subroutine, or insertion point and *single* clicking the left mouse button will select the element. If the selected element is a control structure or subroutine, selection will be indicated by a dashed-line rectangle enclosing the complete structure or subroutine. If the selected element is an insertion point, selection will be indicated by a dashed-line square enclosing the insertion point.
- Pointing to the symbol associated with a control structure, subroutine, or insertion point and *double* clicking the left mouse button will allow the user to modify the element. If the element is a control structure or subroutine, the appropriate text entry dialog box will be displayed. If the element is an insertion point, the appropriate insertion dialog box will be displayed.

The *left* mouse button is also used to select a segment of the current pseudo code.

The *right* mouse button is used to display pop-up menus:

- Pointing to the symbol associated with a control structure or subroutine and clicking the right mouse button will display a pop-up menu with options to:
    - Copy the control structure or subroutine to the clipboard
    - Cut the control structure or subroutine and place a copy on the clipboard
    - Delete the control structure or subroutine
    - Modify the control structure or subroutine
    - Transform the control structure
- Pointing to an insertion point and clicking the right mouse button will display a pop-up menu with options to:
    - Insert a new control structure or subroutine at the insertion point
    - Paste a copy of the appropriate control structure or subroutine on the clipboard at the insertion point.

4. Creating a New Structured Flow Chart

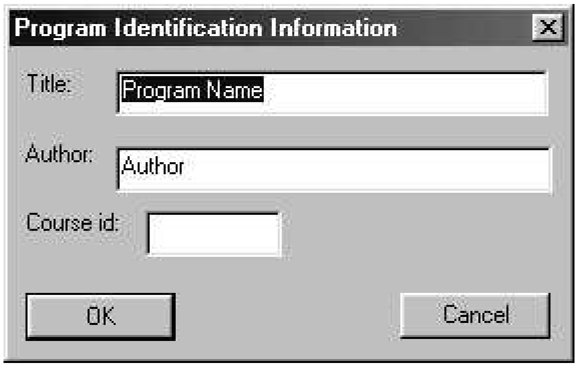
To create a new structured flow chart:

Click on the word File in the main SFC menu bar.
Select the New option in the file menu.

OR

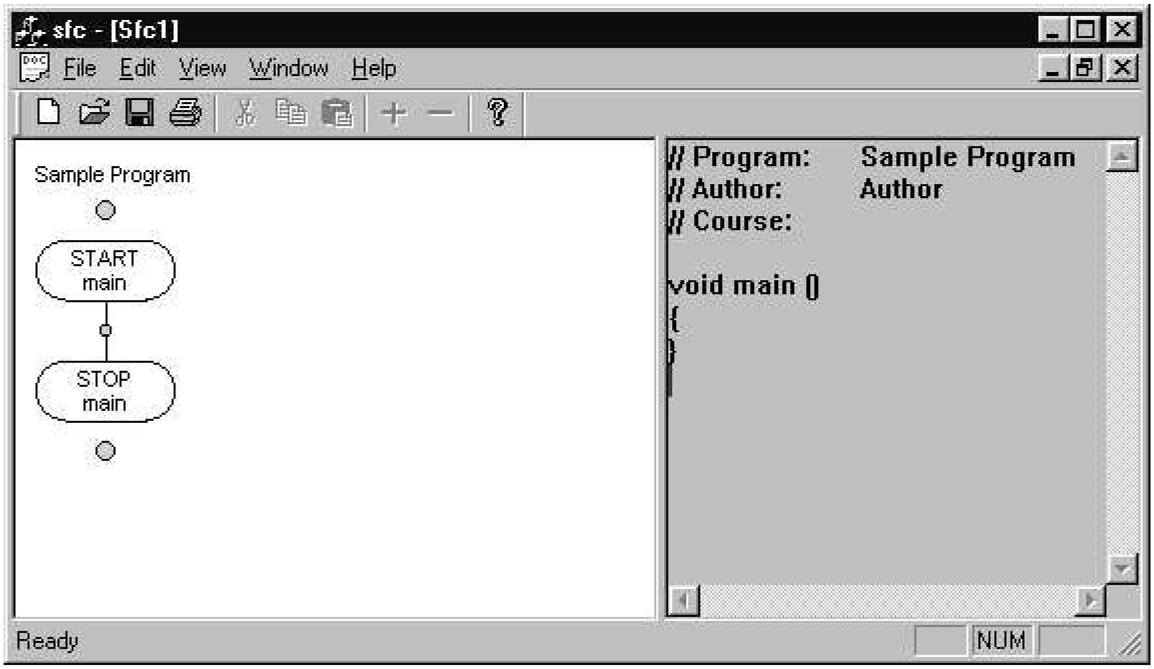
Click on the blank page icon in the SFC tool bar.

A New Program dialog box will be displayed. Use this dialog box to name the program and identify yourself as the author.



Title: Program Name
Author: Author
Course id:

The new flow chart, displayed on the left side of the screen, consists of a procedure called "main" and two subroutine insertion points (the large shaded circles). The "main" subroutine (a procedure) is identified by START and STOP labels and contains a single control structure insertion point (the small shaded circle on the control flow lines between START and STOP). Read-only pseudo code for the main procedure is displayed on the right side of the screen.



```
// Program:     Sample Program
// Author:      Author
// Course:

void main ()
{
}
```

5. Opening an Existing Structured Flow Chart

To open and edit a saved structured flow chart:

Select the Open option in the file menu.
Select or enter the name of the file.
Click on OK or press the enter key.

OR

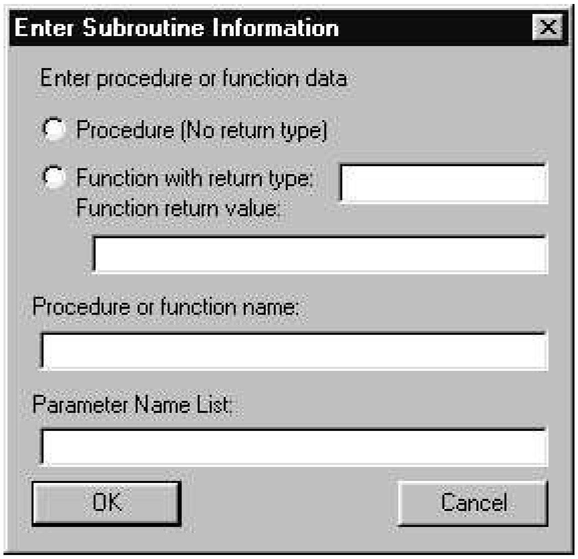
Click on the open folder icon in the SFC tool bar.
Select or enter the name of the file.
Click on OK or press the enter key.

6. Inserting a New Subroutine (Procedure or Function)

Typically, programs are designed as a set of subroutines, one of which is designated as the "main" subroutine. When the program is executed, execution begins with the first statement in the "main" subroutine. The other subroutines in the program are called by the "main" subroutine and/or by each other.

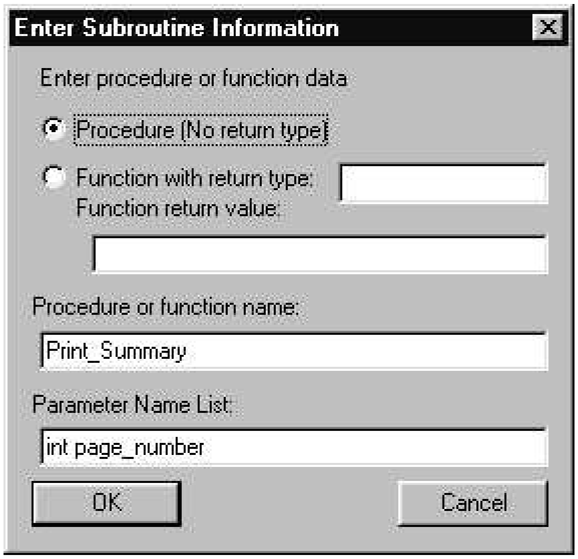
Subroutines can be divided into two categories: functions and procedures. A function returns a value to the calling subroutine, a procedure does not. Both functions and procedures can have information passed to them by the calling subroutine; this is usually done by supplying a list of actual parameter values when the subroutine is called. The formal descriptions of the parameter values expected by the subroutine are declared as part of the subroutine.

A new function or procedure can be inserted at a subroutine insertion point (represented by a large shaded circle). To insert a new function or procedure, double click the left mouse button while pointing to the subroutine insertion point. A dialog box will be displayed:


Enter Subroutine Information
Enter procedure or function data
○ Procedure (No return type)
○ Function with return type:
Function return value:
Procedure or function name:
Parameter Name List:
OK
Cancel

Inserting a New Procedure

Enter the name of the new procedure and the list of parameter names in the dialog box and then left click on OK or press the enter key.



Enter procedure or function data

● Procedure (No return type)

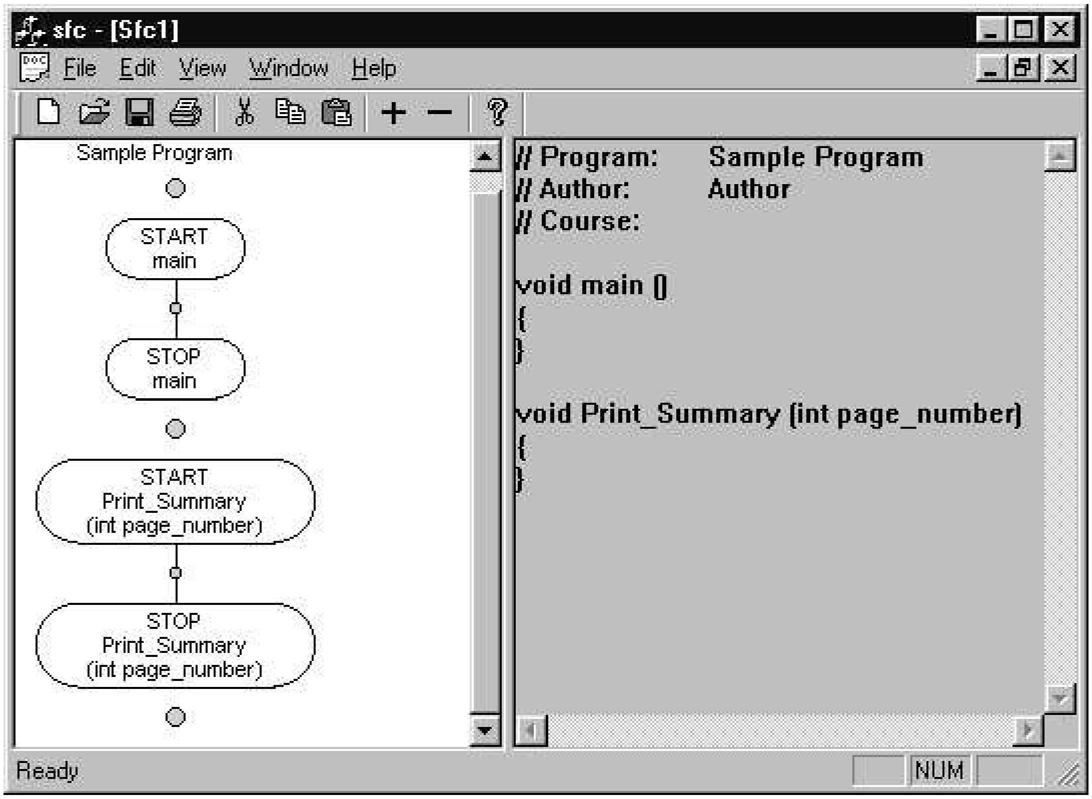
○ Function with return type:

Function return value:

Procedure or function name: Print_Summary

Parameter Name List: int page_number

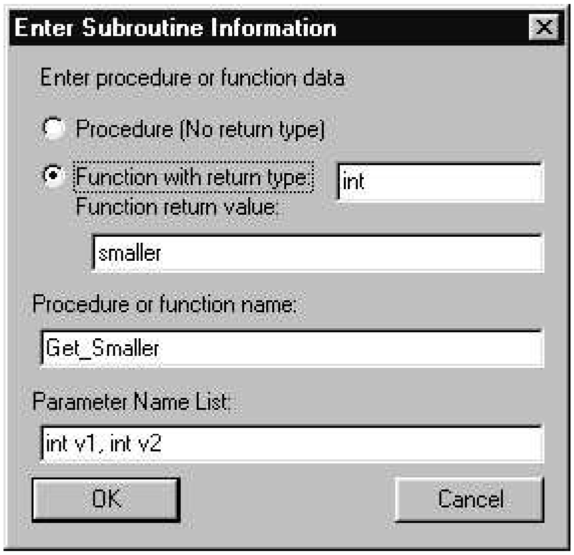
Initially the new procedure consists of START and STOP labels and a control structure insertion point. In addition, when a new procedure is added to a program, subroutine insertion points will be placed before and after the new procedure.



```
// Program:    Sample Program
// Author:     Author
// Course:

void main ()
{
}

void Print_Summary (int page_number)
{
}
```

Inserting a New Function

Enter the name of the new procedure and the list of parameter names in the dialog box. In addition, the value to be returned and its type should be entered in the dialog box before left clicking on OK or pressing the enter key.



Enter Subroutine Information

Enter procedure or function data

○ Procedure (No return type)

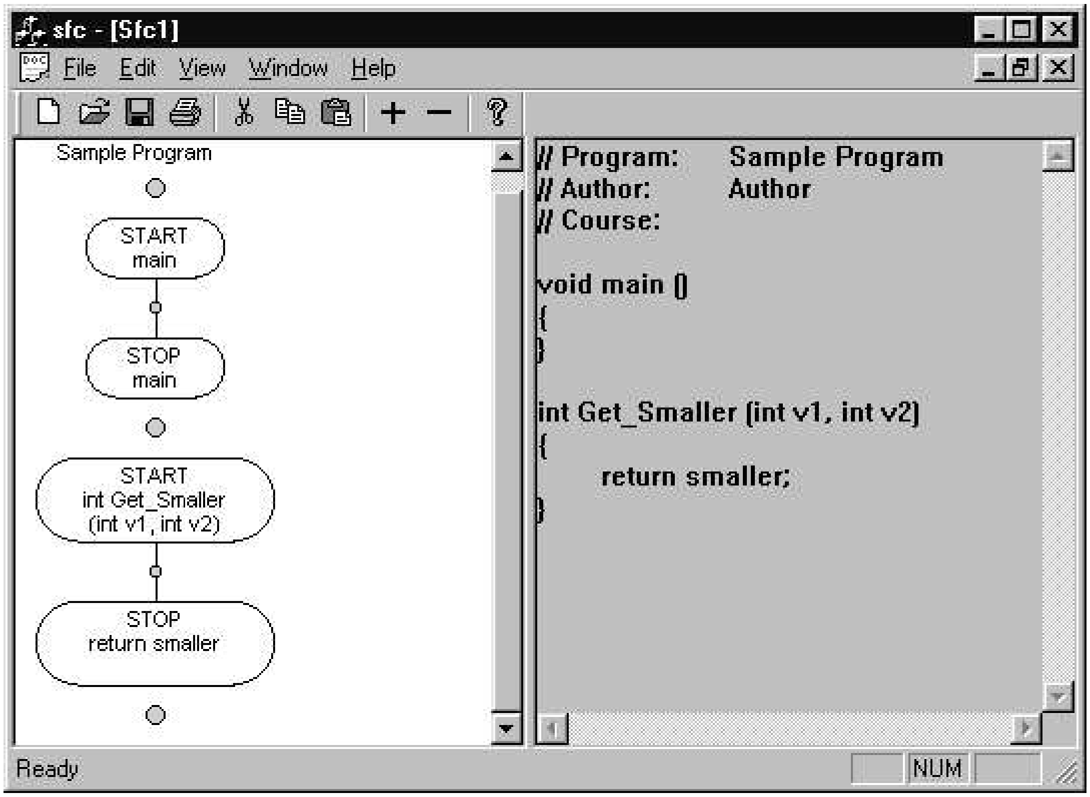
● Function with return type: int

Function return value: smaller

Procedure or function name: Get_Smaller

Parameter Name List: int v1, int v2

Initially the new function consists of START and STOP labels and a control structure insertion point. The return value will be indicated in the STOP label. In addition, when a new function is added to a program, subroutine insertion points will be placed before and after the new function.

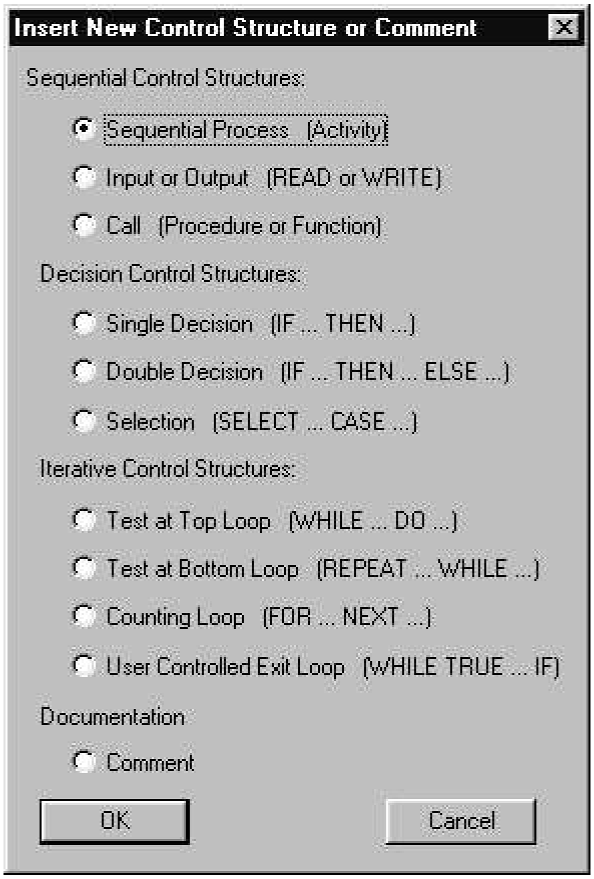


```
// Program:     Sample Program
// Author:      Author
// Course:

void main ()
{
}

int Get_Smaller (int v1, int v2)
{
        return smaller;
}
```

7. Inserting Control Structures

Control structures are inserted by double clicking the left mouse button while pointing to a control structure insertion point. The control structure insertion points are represented as small shaded circles on the control flow lines of a procedure. On some screens, control structure insertion point circles may actually appear as small shaded diamonds.

When the left mouse button is double clicked, a control structure insertion dialog box will be displayed. The type of control structure is determined by left clicking on the appropriate radio button. After selecting the control structure type, left click on OK or press the enter key. A dialog box for the selected control structure type will be displayed. After a new control structure is inserted in a procedure, control structure insertion points will be placed before and after the new structure. This dialog box will also be used when adding documenting comments to a flow chart.



Insert New Control Structure or Comment

Sequential Control Structures:

● Sequential Process   (Activity)

○ Input or Output   (READ or WRITE)

○ Call   (Procedure or Function)

Decision Control Structures:

○ Single Decision   (IF ... THEN ...)

○ Double Decision   (IF ... THEN ... ELSE ...)

○ Selection   (SELECT ... CASE ...)

Iterative Control Structures:

○ Test at Top Loop   (WHILE ... DO ...)

○ Test at Bottom Loop   (REPEAT ... WHILE ...)

○ Counting Loop   (FOR ... NEXT ...)

○ User Controlled Exit Loop   (WHILE TRUE ... IF)

Documentation

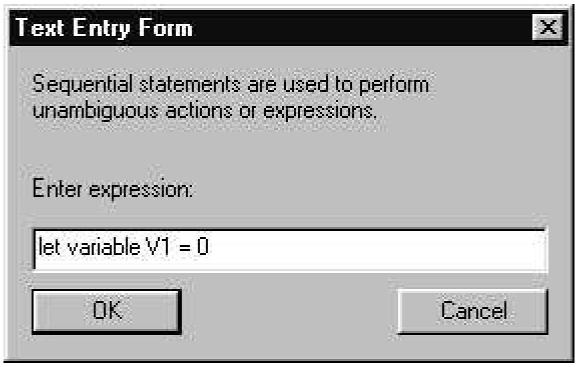
○ Comment

The following sections describe each of the types of control structures that can be added to the flow chart.

a. Sequential Processes or Activity

The Sequential Process symbol is used to represent calculations, processes, and other unambiguous actions.

After selecting the sequential process option of the insert new control structure dialogue box and left clicking on OK or pressing the Enter key, a dialogue box for entering the contents of the sequential process symbol will be displayed:

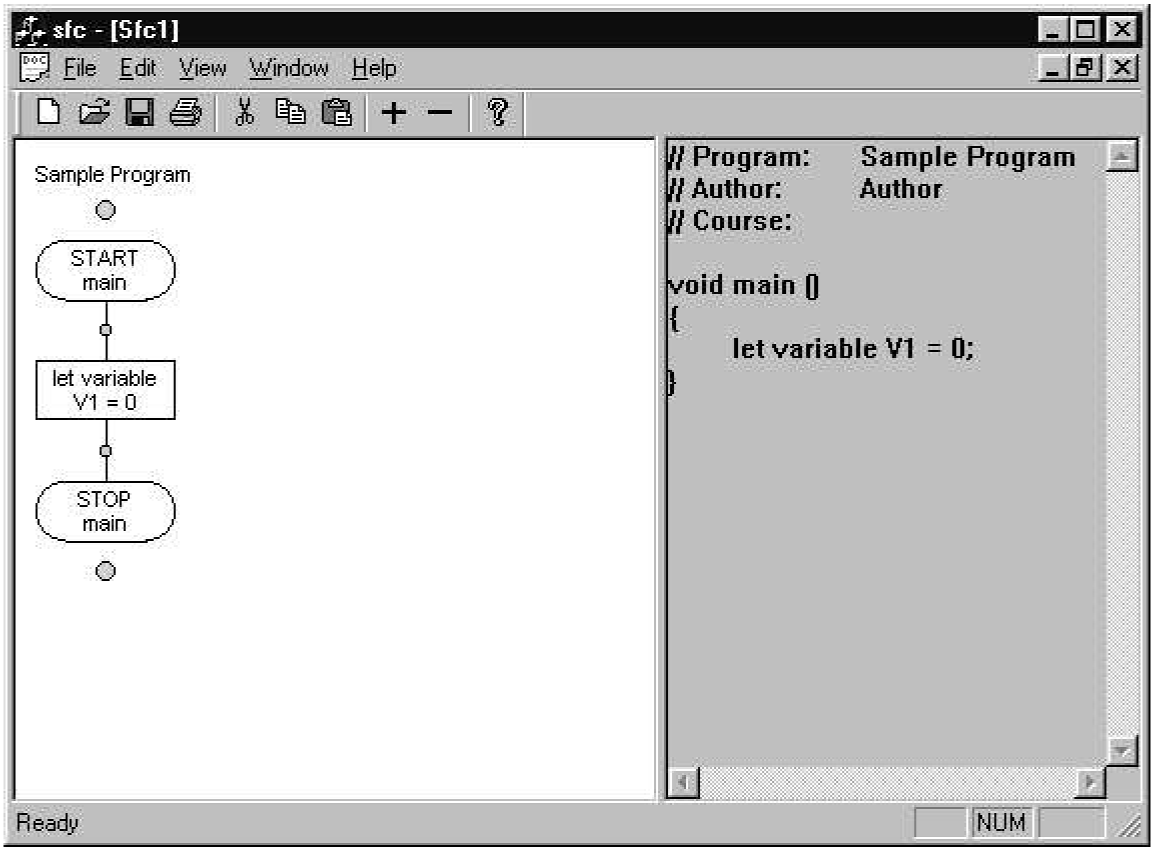


Sequential statements are used to perform unambiguous actions or expressions.

Enter expression:

let variable V1 = 0

After entering the statement associated with the sequential process in the dialog box, left click on OK or press the Enter key. The new sequential process symbol and its contents will then be displayed in the flow chart:

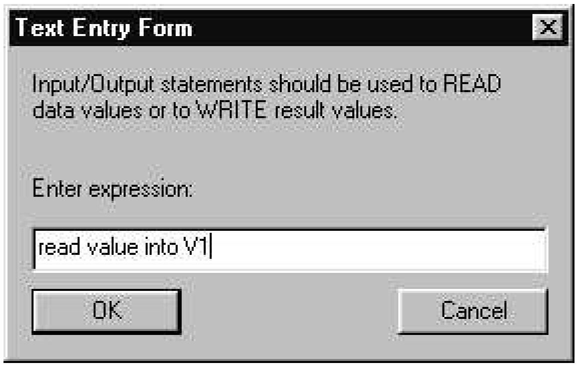


```
// Program:     Sample Program
// Author:      Author
// Course:

void main ()
{
        let variable V1 = 0;
}
```

b. Input or Output

The Input or Output symbol is used to represent input (read) or output (write) statements.

After selecting the input or output option, a dialogue box for entering the contents of the input /output symbol will be displayed:



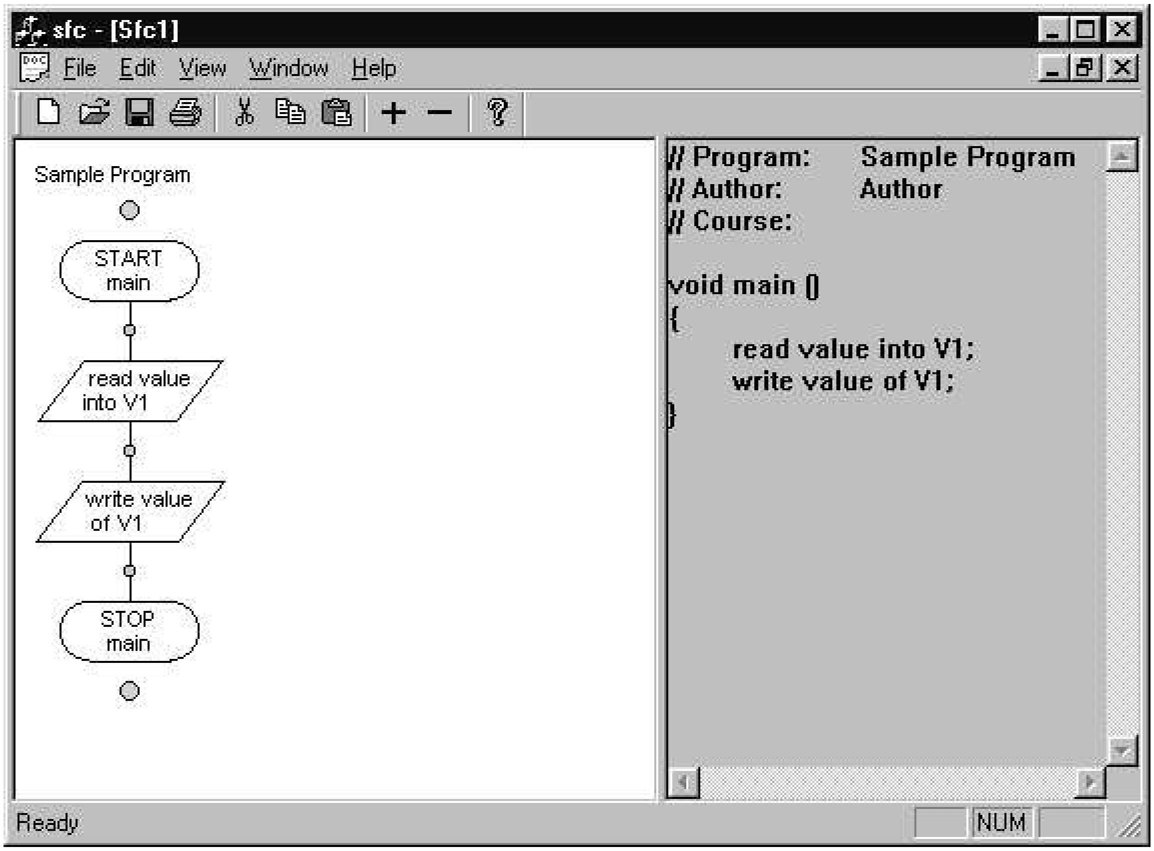
Text Entry Form

Input/Output statements should be used to READ data values or to WRITE result values.

Enter expression:

read value into V1

After entering the statement associated with the input/output statement in the dialog box, left click on OK or press the Enter key. The new input/output symbol and its contents will then be displayed in the flow chart:



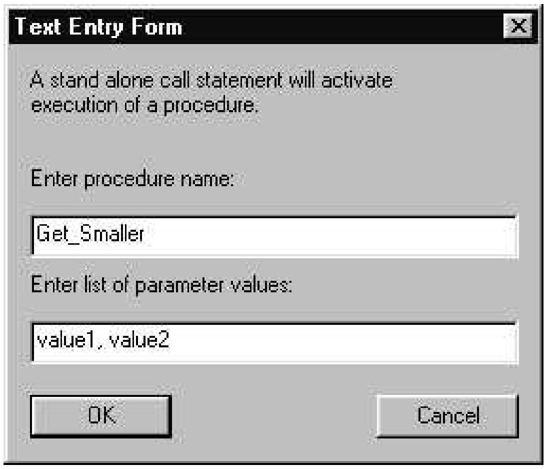
sfc - [Sfc1]

```
// Program:     Sample Program
// Author:      Author
// Course:

void main ()
{
        read value into V1;
        write value of V1;
}
```

c. Subroutine Call

The Subroutine Call symbol is used to represent execution of a predefined process or group of processes. The name of the subroutine and values to be passed to the subroutine should be enclosed within the subroutine call symbol.

After selecting the subroutine call option, a dialogue box for entering the contents of the subroutine call symbol will be displayed:



A stand alone call statement will activate execution of a procedure.

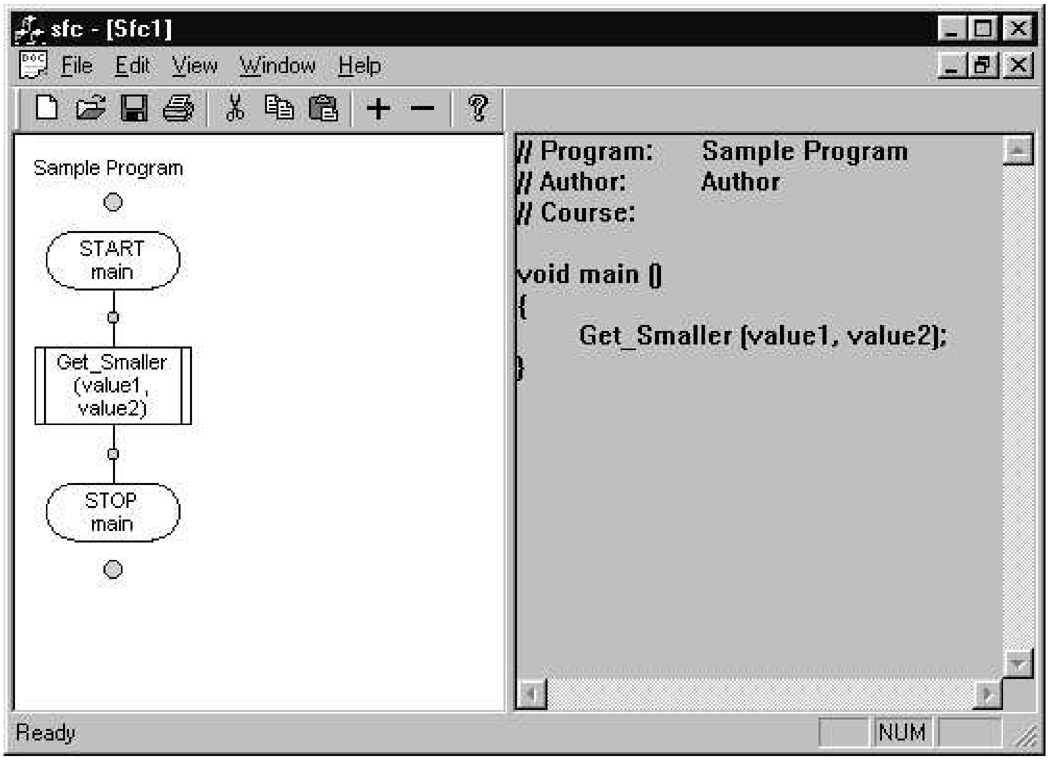
Enter procedure name:

Get_Smaller

Enter list of parameter values:

value1, value2

After entering the statement associated with the subroutine call statement in the dialog box, left click on OK or press the Enter key. The new subroutine call symbol and its contents will then be displayed in the flow chart:

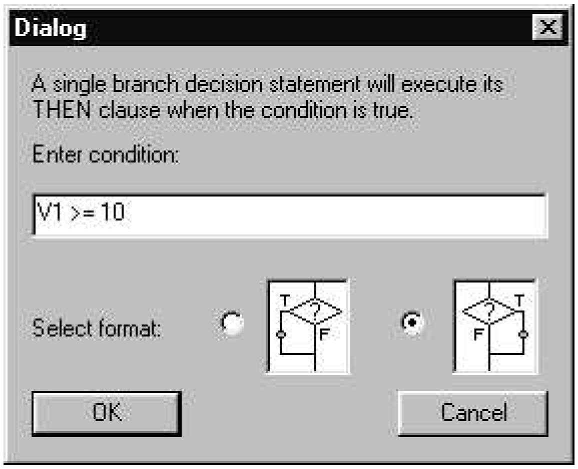


```
// Program:     Sample Program
// Author:      Author
// Course:

void main ()
{
        Get_Smaller (value1, value2);
}
```

d. Single Decision

The decision symbol is used to represent a comparison, question, test, selection, or decision that determines an alternative path to be followed. The single branch decision structure has a control structure insertion point only on the True (T) branch of the decision symbol. Control structures placed on the True branch of a single decision structure are only executed if the test enclosed in the decision symbol is true. If the result of the test is false, the structures on the True branch are by-passed.

After selecting the single decision option, a dialogue box for entering the contents of the decision symbol will be displayed:



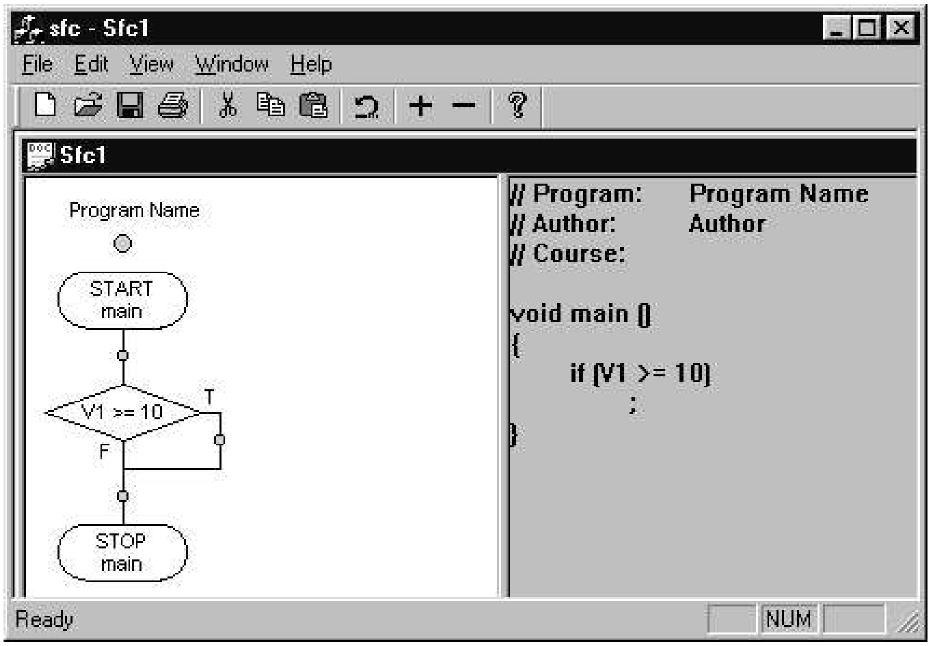
A single branch decision statement will execute its THEN clause when the condition is true.

Enter condition:

V1 >= 10

Select format: ○ ●

After entering the condition associated with the single branch decision statement in the dialog box, left click on OK or press the Enter key. The new decision symbol, its condition and a true branch containing a single structure insertion point will then be displayed in the flow chart:

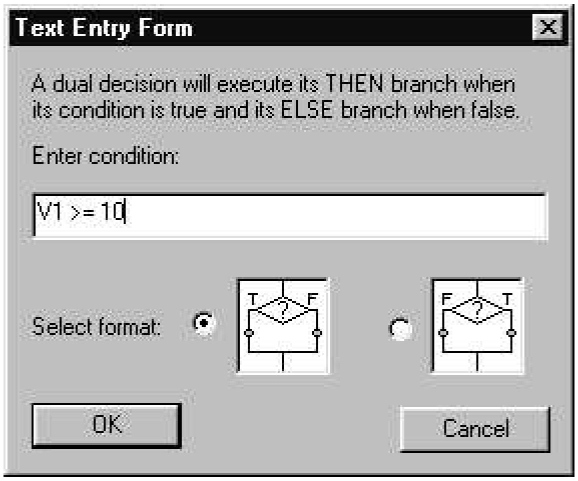


```
// Program:     Program Name
// Author:      Author
// Course:

void main ()
{
        if (V1 >= 10)
                ;
}
```

e. Double Decision

The double branch decision structure has control structure insertion points on both the True (T) and False (F) branches of the decision symbol. Only one path will be followed after the test enclosed in the decision symbol is evaluated.

After selecting the double decision option, a dialogue box for entering the contents of the decision symbol will be displayed:

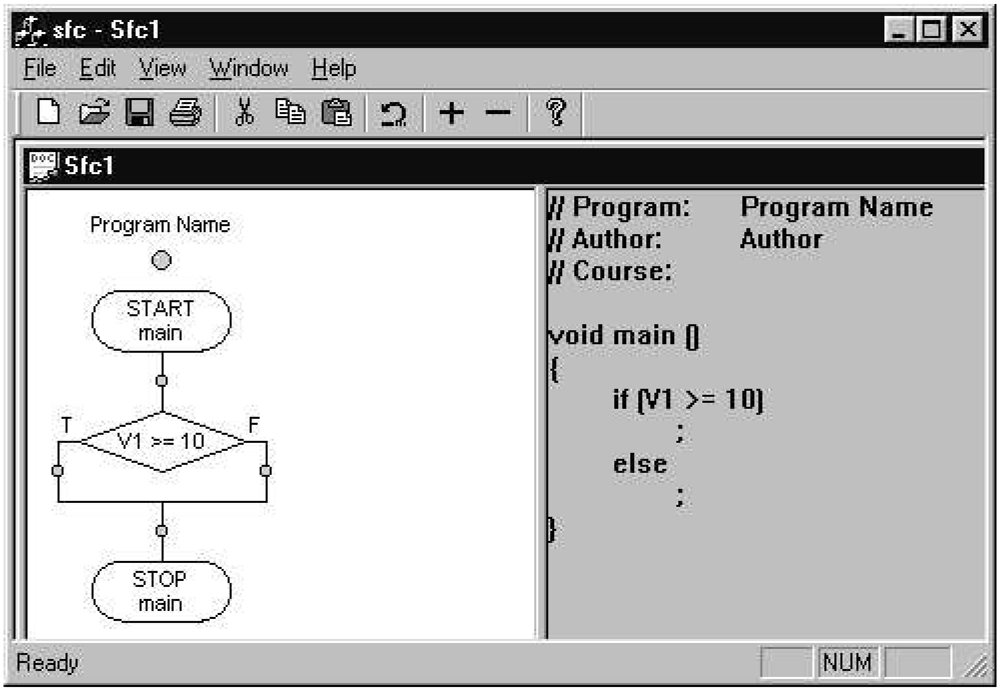


A dual decision will execute its THEN branch when its condition is true and its ELSE branch when false.

Enter condition: V1 >= 10

Select format: ● T/F ○ F/T

After entering the condition associated with the double branch decision statement in the dialog box, left click on OK or press the Enter key. The new decision symbol, its condition and true and false branches, each containing a single structure insertion point, will then be displayed in the flow chart:

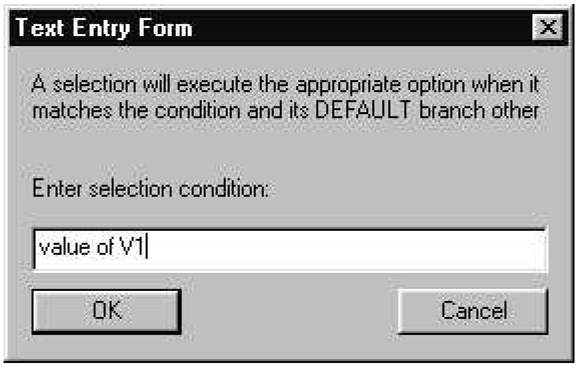


```
// Program:        Program Name
// Author:         Author
// Course:

void main ()
{
        if (V1 >= 10)
                ;
        else
                ;
}
```

f. Case Statements

The case, or multi-branch decision, structure has insertion points for case option statements and a default branch. Only one path will be followed after the statement enclosed in the decision symbol is evaluated.

After selecting the case statement option, a dialogue box for entering the contents of the case selection statement will be displayed:



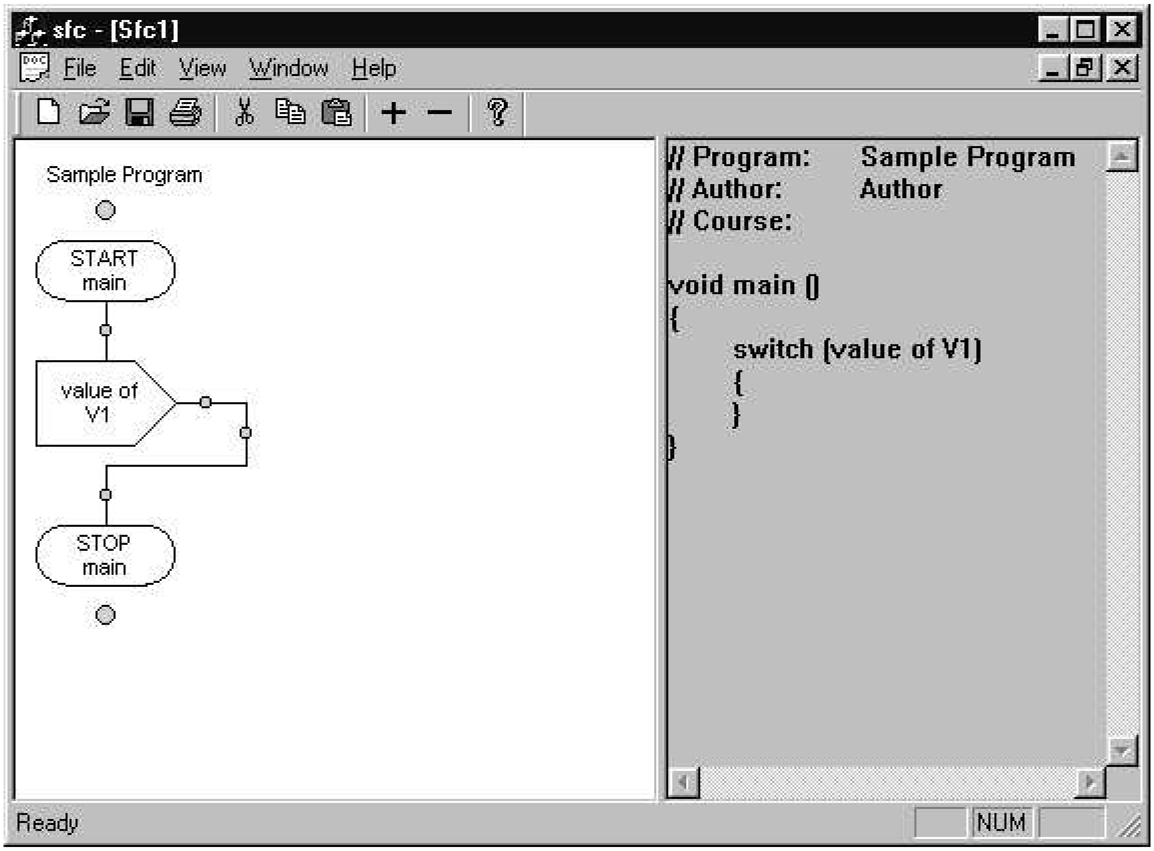
Text Entry Form

A selection will execute the appropriate option when it matches the condition and its DEFAULT branch other

Enter selection condition:

value of V1

After entering the statement associated with the case statement in the dialog box, left click on OK or press the Enter key. The new case symbol, its selection statement and case option and default branches will then be displayed in the flow chart:

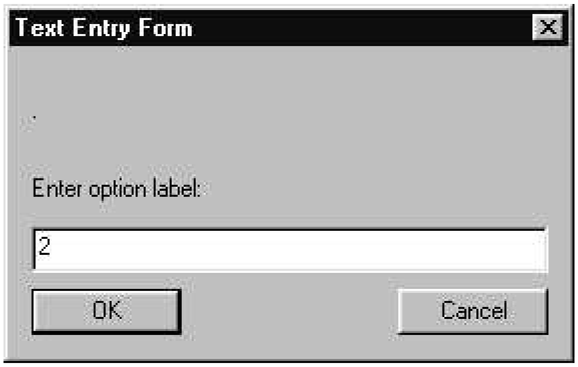


```
// Program:     Sample Program
// Author:      Author
// Course:

void main ()
{
        switch (value of V1)
        {
        }
}
```

g. Case Options

The double branch decision structure has control structure insertion points on both the True (T) and False (F) branches of the decision symbol. Only one path will be followed after the test enclosed in the decision symbol is evaluated.

After double clicking the left button on a case option insertion point, a dialogue box for entering the contents of the option decision symbol label will be displayed:

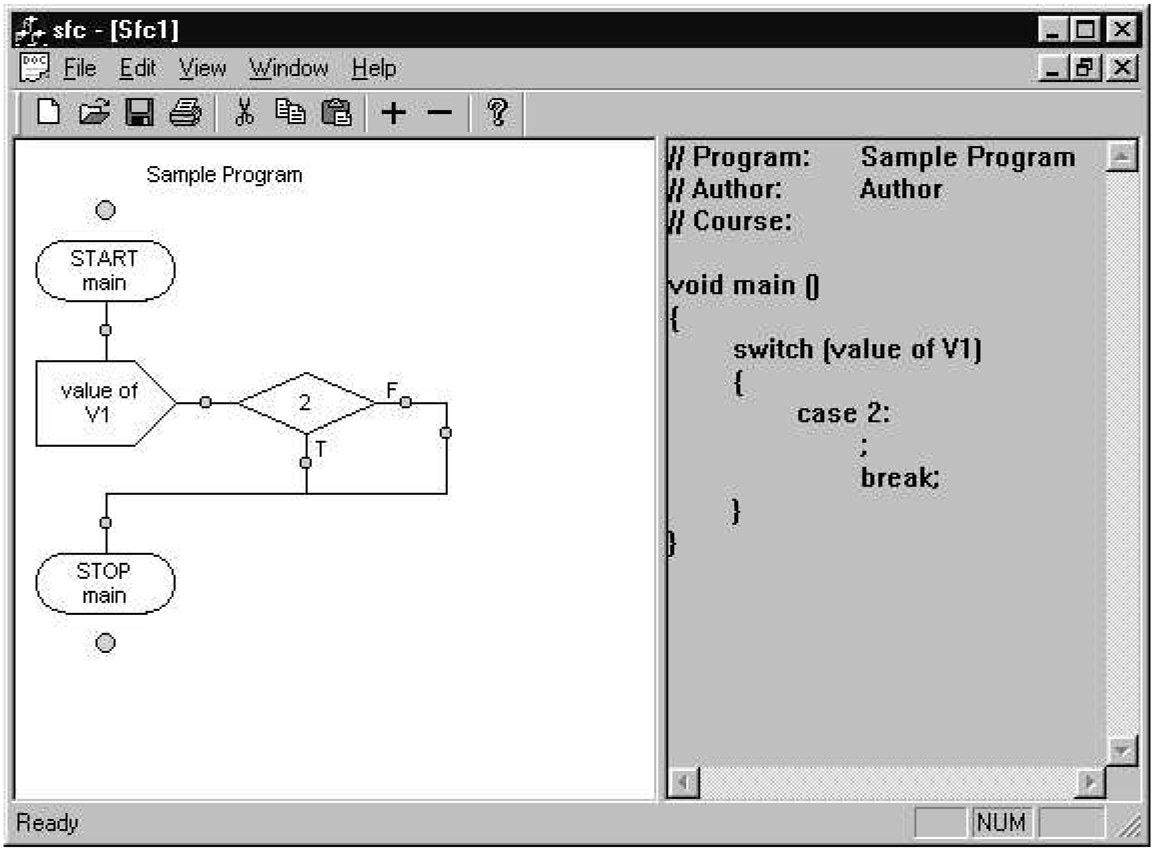


Text Entry Form

Enter option label:

2

After entering the value associated with the case option in the dialog box, left click on OK or press the Enter key. The new option decision symbol, its value and a path containing a single structure insertion point, will then be displayed in the flow chart:



sfc - [Sfc1]

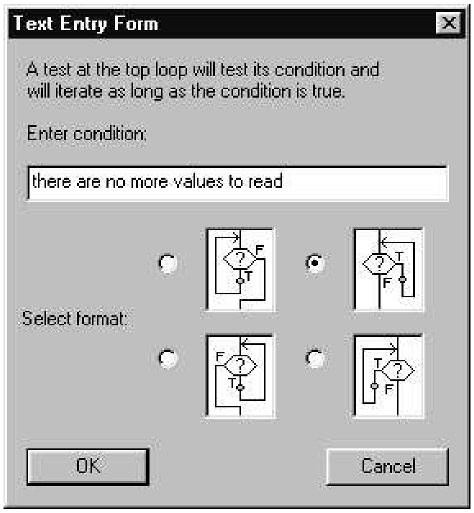
```
// Program:    Sample Program
// Author:     Author
// Course:

void main ()
{
        switch (value of V1)
        {
                case 2:
                        ;
                        break;
        }
}
```

Ready

h. Test at the Top Loop

Looping, or iterative, structures are used to represent repetitive actions. The loop control symbol contains a comparison, question, test, or decision that determines which branch of the loop will be executed. Initially, the true branch of the loop contains a control structure insertion point. Control structures inserted on the true branch of the loop comprise the body of the loop. The Test at the Top Loop performs the test prior to executing the body of the loop. As long as the test result is true, the body of the loop will continue to be executed. If the result of the test is false, iterative execution of the body of the loop will be terminated. In some cases, the body of a test at the top loop may not be executed at all.

After selecting the test at the top loop option, a dialogue box for entering the contents of the loop decision symbol will be displayed:



Text Entry Form

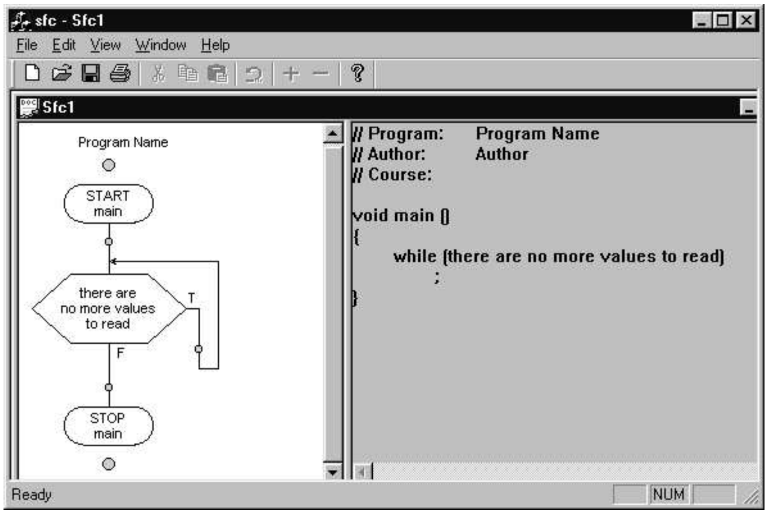
A test at the top loop will test its condition and will iterate as long as the condition is true.

Enter condition:

there are no more values to read

Select format: ○ ● ○ ○

After entering the condition associated with the test at the top looping statement in the dialog box and selecting the desired format, left click on OK or press the Enter key. The new loop decision symbol, its contents and a true branch containing a single structure insertion point will then be displayed in the flow chart:

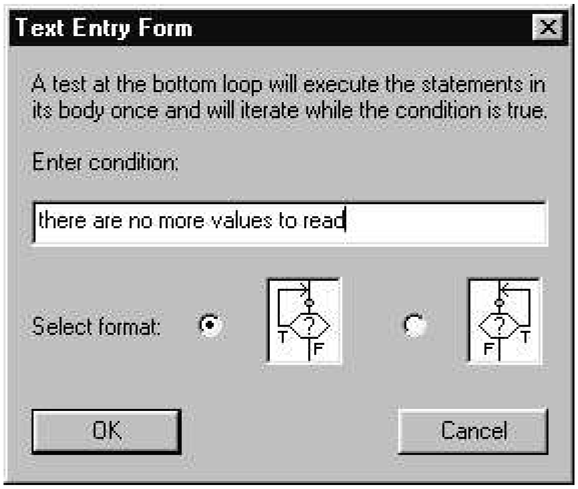


```
// Program:     Program Name
// Author:      Author
// Course:

void main ()
{
        while (there are no more values to read)
                ;
}
```

i. Test at the Bottom Loop

The Test at the Bottom Loop performs the test after executing the body of the loop. As long as the result of the test is true, the body of the loop will continue to be executed. If the result of the test is false, iterative execution of the body of the loop will be terminated. The body of a test at the bottom loop will always be executed at least one time.

After selecting the test at the bottom loop option, a dialogue box for entering the contents of the loop decision symbol will be displayed:



Text Entry Form

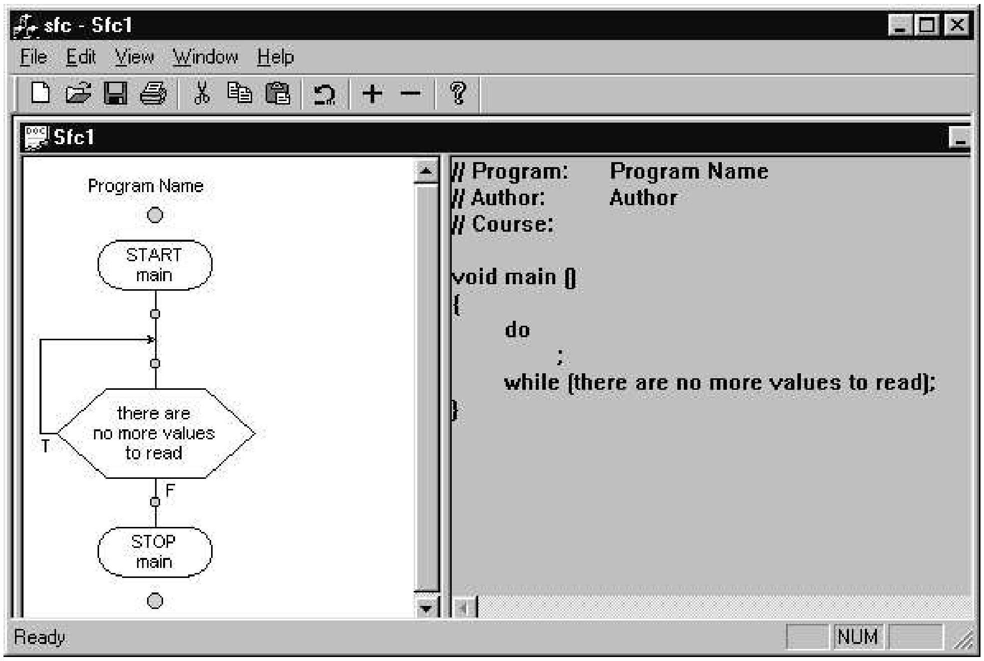
A test at the bottom loop will execute the statements in its body once and will iterate while the condition is true.

Enter condition:

there are no more values to read

Select format: ● ○

After entering the condition associated with the test at the bottom looping statement in the dialog box, left click on OK or press the Enter key The new loop decision symbol and its contents and a entry flow line containing a single structure insertion point will then be displayed in the flow chart:

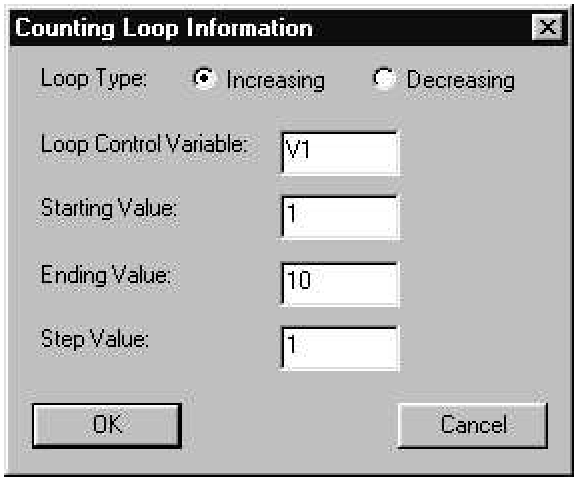


```
// Program:     Program Name
// Author:      Author
// Course:

void main ()
{
        do
                ;
        while (there are no more values to read);
}
```

j. Counting Loop

The counting loop performs body of the loop once for each desired value of the loop control variable. When the value of the loop control variable is outside of the indicated bounds, iterative execution of the body of the loop will be terminated. In some cases, the body of a counting loop may not be executed at all.

After selecting the counting loop option, a dialogue box for entering the contents of the loop header symbol will be displayed:



Counting Loop Information

Loop Type: ● Increasing ○ Decreasing

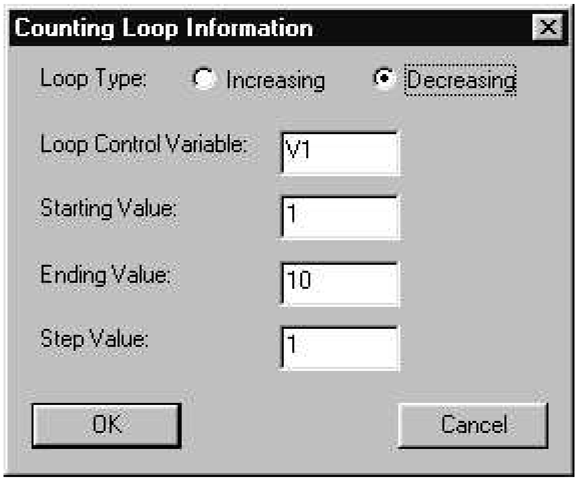
Loop Control Variable: V1

Starting Value: 1

Ending Value: 10

Step Value: 1

OR



Counting Loop Information

Loop Type: ○ Increasing ● Decreasing

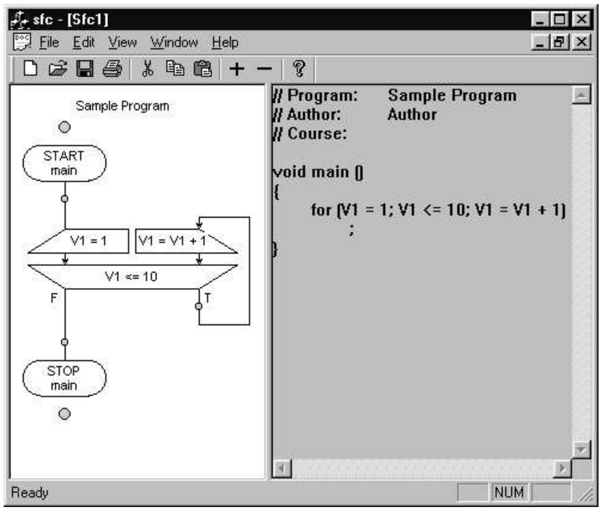
Loop Control Variable: V1

Starting Value: 1

Ending Value: 10

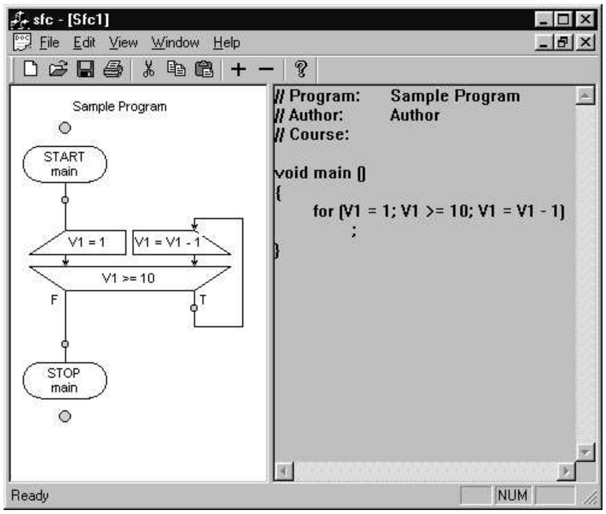
Step Value: 1

After entering the loop control variable and the desired starting, ending, and step values in the dialog, left click on OK or press the Enter key. The new loop header symbol, its contents and a true branch containing a single structure insertion point will then be displayed in the flow chart:



```
// Program:    Sample Program
// Author:     Author
// Course:

void main ()
{
     for (V1 = 1; V1 <= 10; V1 = V1 + 1)
          ;
}
```

OR

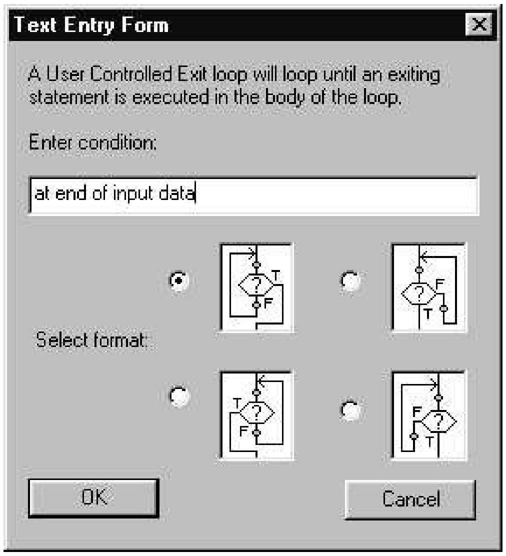


```
// Program:    Sample Program
// Author:     Author
// Course:

void main ()
{
     for (V1 = 1; V1 >= 10; V1 = V1 - 1)
          ;
}
```

k. User Controlled Exit Loop

The User Controlled Exit Loop performs body of the loop until the exit condition is true. As long as the test result is false, the body of the loop will continue to be executed. In some cases, the portion of the loop body following the exit test may not be executed at all.

After selecting the user controlled exit loop option, a dialogue box for entering the contents of the loop decision symbol will be displayed:

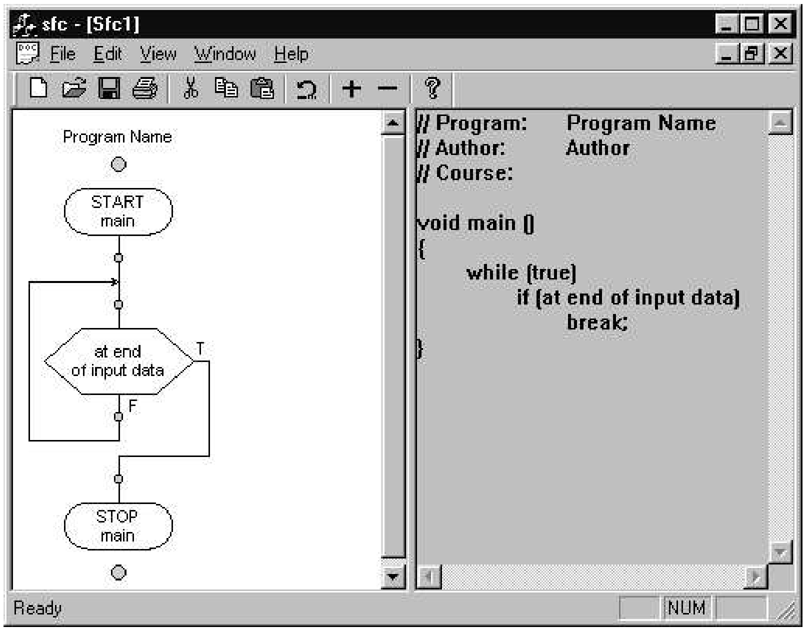


A User Controlled Exit loop will loop until an exiting statement is executed in the body of the loop.

Enter condition: at end of input data

Select format: ● ○ ○ ○

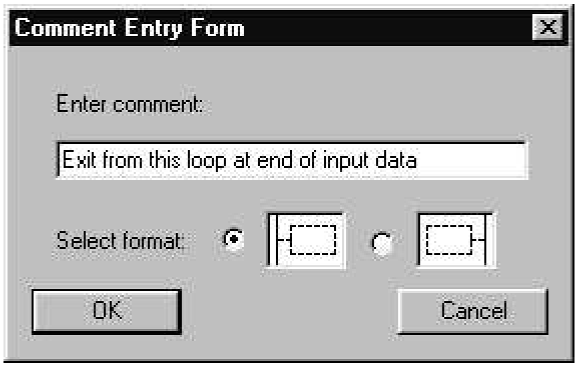
After entering the condition associated with the user looping statement in the dialog box and selecting the desired format, left click on OK or press the Enter key. The new loop decision symbol, its contents and a path containing a structures insertion points before and after the exit condition will then be displayed in the flow chart:



```
// Program:     Program Name
// Author:      Author
// Course:

void main ()
{
      while (true)
            if (at end of input data)
                  break;
}
```

8. Inserting Documentation

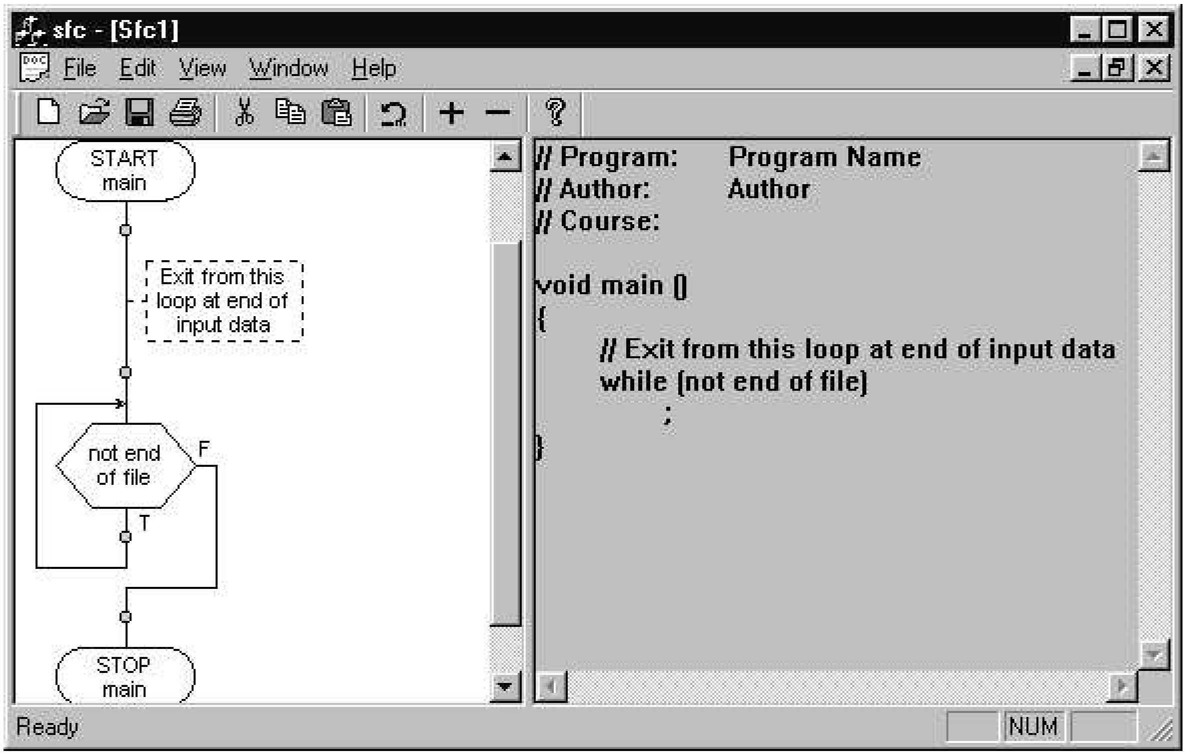
Documentation can be added to a flow chart at structure insertion points. Double click on the insertion point to display the control structure dialog box. After selecting the comment option, a dialogue box for entering the contents of the comment will be displayed:



Enter comment: Exit from this loop at end of input data

Select format: ● ○

After entering the comment in the dialog box and selecting the desired format, left click on OK or press the Enter key. The new comment will then be displayed in the flow chart in a dashed box to the left or right of the line of flow of the flow chart structure:



```
// Program:     Program Name
// Author:      Author
// Course:

void main ()
{
        // Exit from this loop at end of input data
        while (not end of file)
                ;
}
```

9. Modifying Control Structures

The contents of a control structure can be modified by double clicking the left mouse button while pointing to the symbol representing the control structure. The current contents will be displayed in the appropriate dialog box. After the contents have been modified, click on OK or press the enter key to save the modification. The modified structure will be displayed in the flow chart.

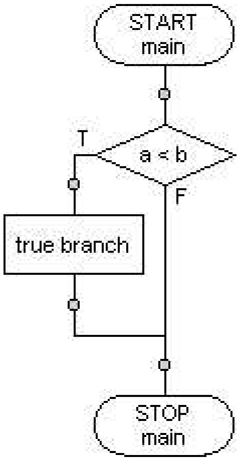
10. Transforming Control Structures

The transform option can be used to change the type of a control structure. For example, a single branch decision structure can be changed to a dual branch decision or a test at the top loop can be changed to a test at the bottom loop.

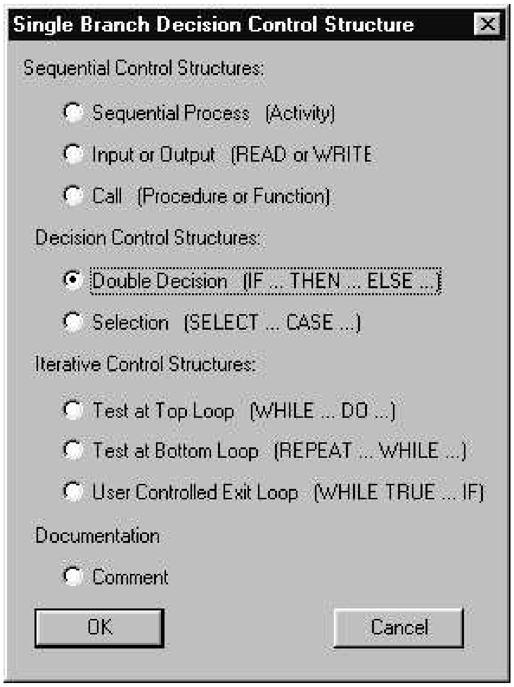
To transform a control structure:

Select the structure by left clicking on the symbol representing the structure.
Then:
Select the transform option in the edit menu.
OR
Right click on the structure and select the transform option in the pop-up menu.

Select the desired structure and click on OK.



Before



Single Branch Decision Control Structure ☒

Sequential Control Structures:

○ Sequential Process (Activity)

○ Input or Output (READ or WRITE

○ Call (Procedure or Function)

Decision Control Structures:

● Double Decision (IF ... THEN ... ELSE ...)

○ Selection (SELECT ... CASE ...)

Iterative Control Structures:

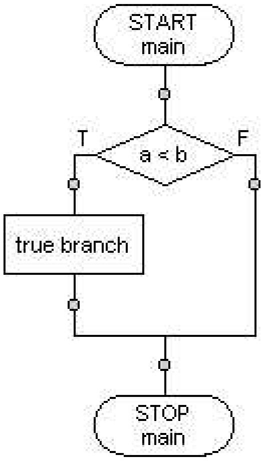
○ Test at Top Loop (WHILE ... DO ...)

○ Test at Bottom Loop (REPEAT ... WHILE ...)

○ User Controlled Exit Loop (WHILE TRUE ... IF)

Documentation

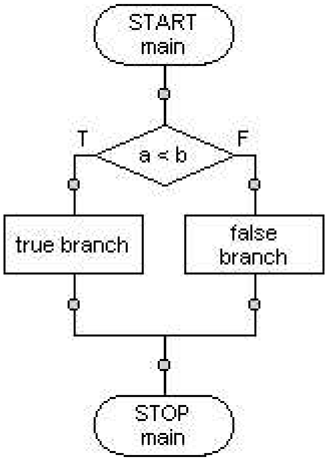
○ Comment



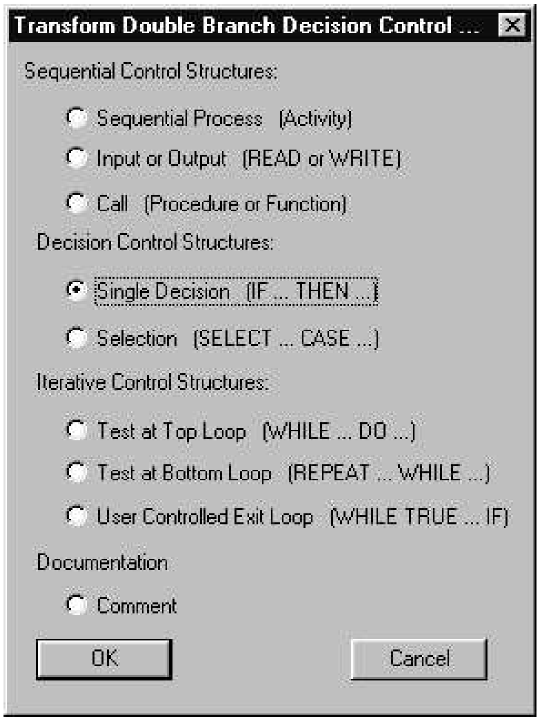
After

The text entry dialog box for the new structure will be displayed so that you may verify the textual contents of the structure and, if applicable, select a format for the new structure. The new structure will replace the original structure in the flowchart.

In some cases, flow chart structures will be lost when a transformation is performed. For example, in the following example, where a double decision structure is transformed into a single decision structure, the false branch is lost:



Before



Transform Double Branch Decision Control ...

Sequential Control Structures:

○ Sequential Process (Activity)

○ Input or Output (READ or WRITE)

○ Call (Procedure or Function)

Decision Control Structures:

● Single Decision (IF ... THEN ...)

○ Selection (SELECT ... CASE ...)

Iterative Control Structures:

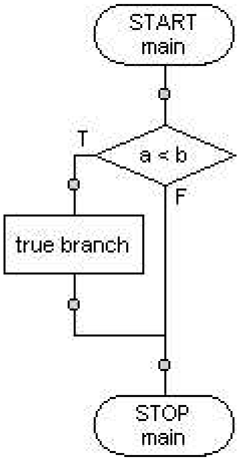
○ Test at Top Loop (WHILE ... DO ...)

○ Test at Bottom Loop (REPEAT ... WHILE ...)

○ User Controlled Exit Loop (WHILE TRUE ... IF)

Documentation

○ Comment



After

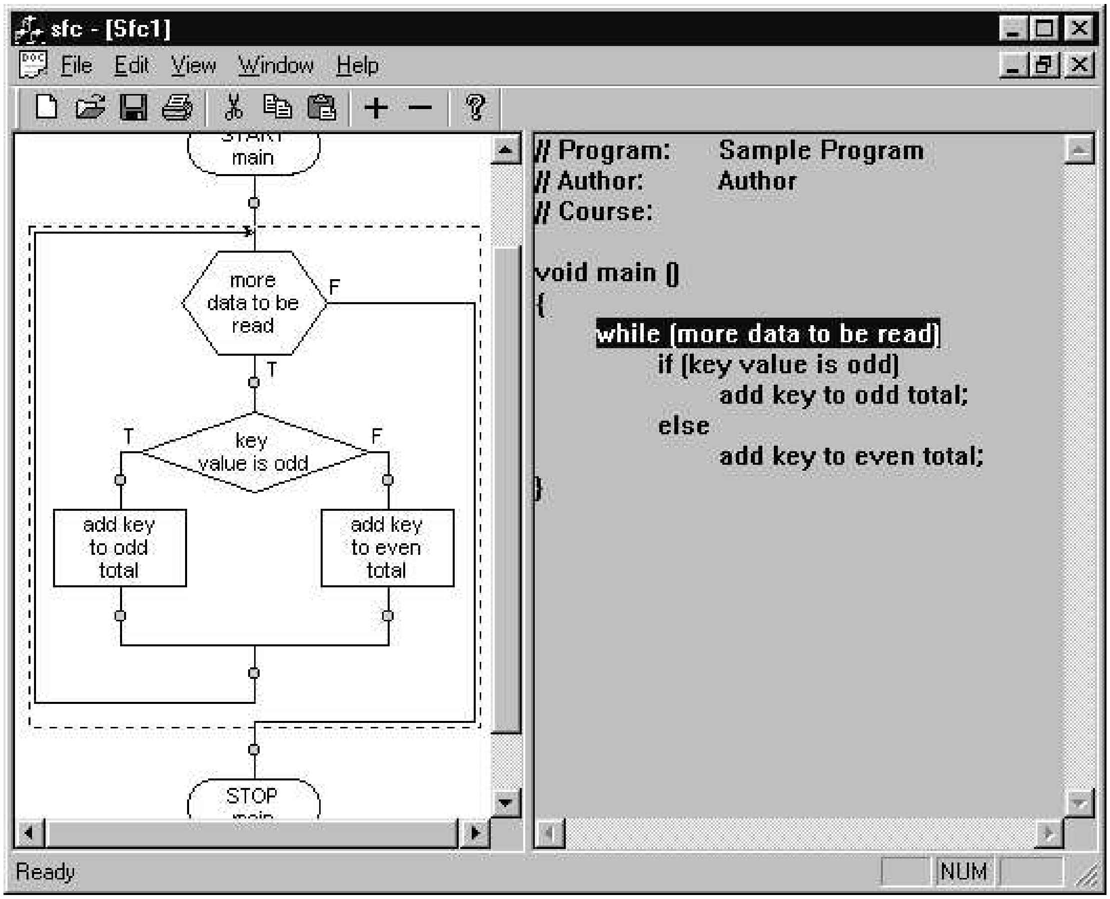
The following table describes the actions performed when a structure is transformed to a different structure. (N/A = Not applicable; N/I = Not implemented)

From/To	Seq.	I/O	Call	Single	Double	Sel.	Top	Bottom	User	Count	Com.
Sequential	N/A	OK	OK	OK	OK	OK	OK	OK	OK	N/I	OK
Input or Output	OK	N/A	OK	OK	OK	OK	OK	OK	OK	N/I	OK
Subroutine Call	OK	OK	N/A	OK	OK	OK	OK	OK	OK	N/I	OK
Single Branch	True branch lost	True branch lost	True branch lost	N/A	OK	OK	OK	OK	OK	N/I	True branch lost
Double Branch	T/F branches lost	T/F branches lost	T/F branches lost	False branch lost	N/A	OK	False branch lost	False branch lost	OK	N/I	T/F branches lost
Selection	All branches lost	All branches lost	All branches lost	First branch kept	First / default kept	N/A	First branch kept	First branch kept	First / default kept	N/I	All branches lost
Test at Top	Loop body lost	Loop body lost	Loop body lost	OK	OK	OK	N/A	OK	OK	N/I	Loop body lost
Test at Bottom	Loop body lost	Loop body lost	Loop body lost Loop body lost	OK	OK	OK	OK	N/A	OK	N/I	Loop body lost
User Controlled	Pre/post exit body lost	Pre/post exit body lost	Pre/post exit body lost	Post exit body lost	OK	OK	Post exit body lost	Post exit body lost	N/A	N/I	Pre/post exit body lost
Counting	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/A	N/I
Comment	OK	OK	OK	OK	OK	OK	OK	OK	OK	N/I	N/A

11. Using Cut, Copy, and Paste to Modify Flow Charts

Cut, copy, and paste can be used to remove, move, or duplicate control structures, functions, and procedures in a flow chart.

To select the control structure, procedure, or insertion point that will be the target of the cut, past or copy command, point to the structure symbol and click the left mouse button. The current (selected) component will be outlined with a dashed line box in the flow chart. If the selected component is a control structure, the text associated with the structure will be highlighted in the pseudo code.



```
// Program:     Sample Program
// Author:      Author
// Course:

void main ()
{
        while (more data to be read)
                if (key value is odd)
                        add key to odd total;
                else
                        add key to even total;
}
```

To cut a control structure:

Select the structure by left clicking on the symbol representing the structure.
Then:

Select the cut option in the edit menu.

OR

Click on the scissors icon in the tool bar.

OR

Right click on the structure and select the cut option in the pop-up menu.

The control structure will be removed from the flow chart and placed on the control structure clipboard.

To copy a control structure:

Select the structure by left clicking on the symbol representing the structure.
Then:
Select the copy option in the edit menu.
OR
Click on the duplicate icon in the tool bar.
OR
Right click on the structure and select the copy option in the pop-up menu.

A copy of the control structure will be placed on the control structure clipboard.

To paste a control structure:

Select an insertion point by left clicking on the small shaded circle representing the control structure insertion point.
Then:
Select the copy option in the edit menu.
OR
Click on the paste from clipboard icon on the tool bar.
OR
Right click on the insertion point and select the paste option in the pop-up menu.

If a *control structure* insertion point has been selected, a copy of the control structure most recently placed on the clipboard by a cut or copy command will be inserted at the selected control structure insertion point.

If a *subroutine* insertion point has been selected, a copy of the subroutine most recently placed on the clipboard by a cut or copy command will be inserted at the selected subroutine insertion point.

If a *case option* insertion point has been selected, a copy of the case option most recently placed on the clipboard by a cut or copy command will be inserted at the selected case option insertion point.

Copying Flow Chart or Pseudo Code Statements into Other Applications

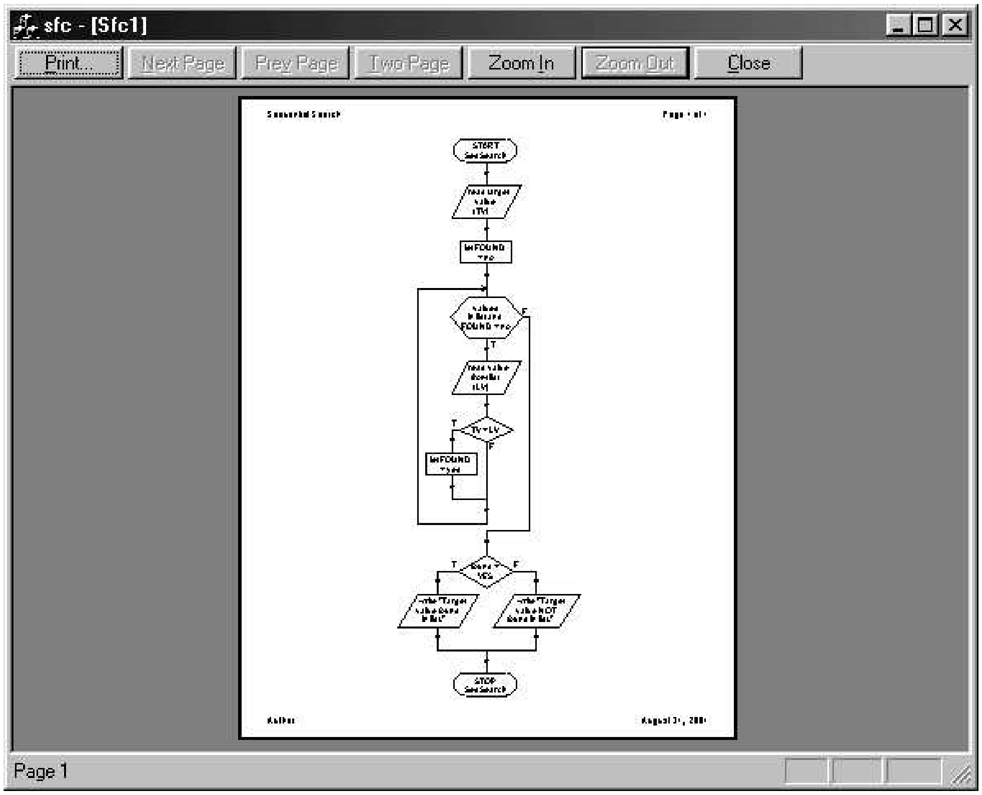
Segments of a flow chart can be copied and pasted as figures to word processing, drawing, presentation graphics, and other applications by selecting the segment, using the SFC Edit/Copy command to copy the graphic to the system clip board and pasting it into the other application. Similarly, segments of pseudo code can be copied and pasted as text into other applications.

12. Printing a Structured Flow Chart

To preview a printed Structured Flow Chart:

Select the Print Preview option on the File menu.

The printed version of the flow chart will be displayed. Each procedure will be displayed on a separate page. Each procedure is scaled to fit within the margins of an 8 ½ “ by 11” page.



To print a Structured Flow Chart:

Select the Print option on the File menu.

OR

Click on the printer icon on the tool bar.

13. Viewing and Printing Pseudo Code

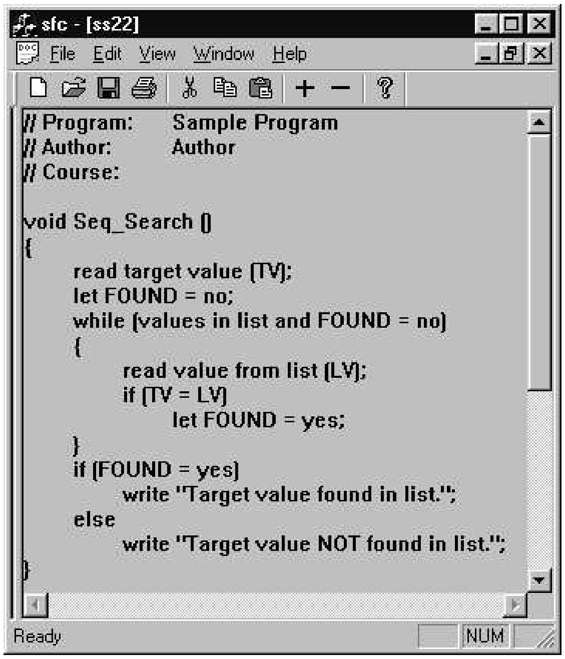
Pseudo code will be automatically generated for a Structured Flow Chart as it is being created.

To select the Pseudo Code Style:

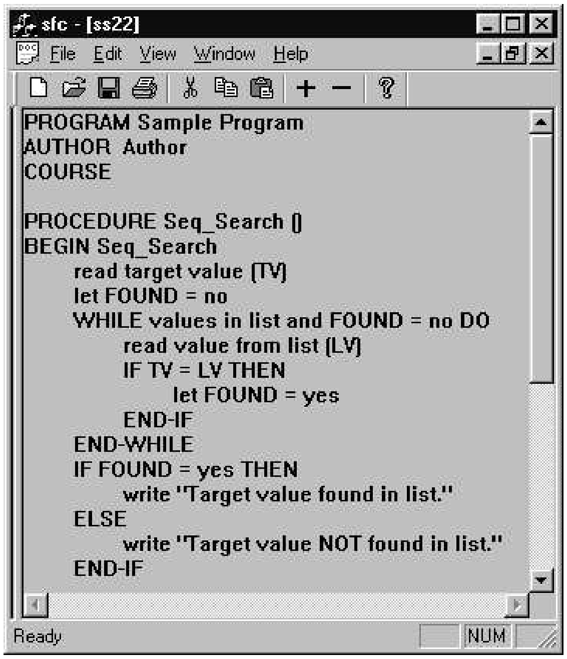
Select the C++ Style option on the View menu (default).

OR

Select the Generic Style option on the View menu.



```
// Program:    Sample Program
// Author:     Author
// Course:

void Seq_Search ()
{
        read target value (TV);
        let FOUND = no;
        while (values in list and FOUND = no)
        {
                read value from list (LV);
                if (TV = LV)
                        let FOUND = yes;
        }
        if (FOUND = yes)
                write "Target value found in list.";
        else
                write "Target value NOT found in list.";
}
```



```
PROGRAM Sample Program
AUTHOR  Author
COURSE

PROCEDURE Seq_Search ()
BEGIN Seq_Search
        read target value (TV)
        let FOUND = no
        WHILE values in list and FOUND = no DO
                read value from list (LV)
                IF TV = LV THEN
                        let FOUND = yes
                END-IF
        END-WHILE
        IF FOUND = yes THEN
                write "Target value found in list."
        ELSE
                write "Target value NOT found in list."
        END-IF
```

To preview the printed Pseudo Code:

After left clicking in the pseudo code frame,

Select the Print Preview option on the File menu. The printed version of the pseudo code will be displayed.

To print the pseudo code:

After left clicking in the pseudo code frame,

Select the Print option on the File menu.

OR

Click on the printer icon on the tool bar.

14. Saving a Structured Flow Chart

A structured flow chart can be saved as a file on a disk.

To save a structured flow chart:

Select the Save option on the File menu.

OR

Click on the disk icon on the tool bar.

To save a structured flow chart using a different name:

Select the SaveAs option on the File menu.
Click on a file name or enter a new name in the dialog box.
Click on the OK button or press the enter key.

15. Closing a Structured Flow Chart View

To close a structure flow chart view window:

Select the Close option on the File menu.

OR

Click on the X button in the upper right corner of the structured flow chart view frame.

16. Exporting SVG and TXT files

The ExportAs option of the File menu can be used to create Scalable Vector Graphics (.svg) or text (.txt) files.

Scalable Vector Graphics (SVG) is a graphics format designed by Adobe and based on XML. SVG files can be viewed using the Adobe SVG Viewer. SVG files can be incorporated into web pages. Since SVG files are text files, they can be modified using a text editor.

To save a structured flow chart as an SVG file:

Select the ExportAs option on the File menu.
Select Scalable Vector Graphic Files (.svg) as the Save as type
Click on a file name or enter a new name in the dialog box.
Click on the OK button or press the enter key.

The pseudo code associated with a flow chart can be exported to a text file for further editing or compiling. The pseudo code file will be written using the format (Generic or C++) selected from the View menu.

To save a structured flow chart as a text file:

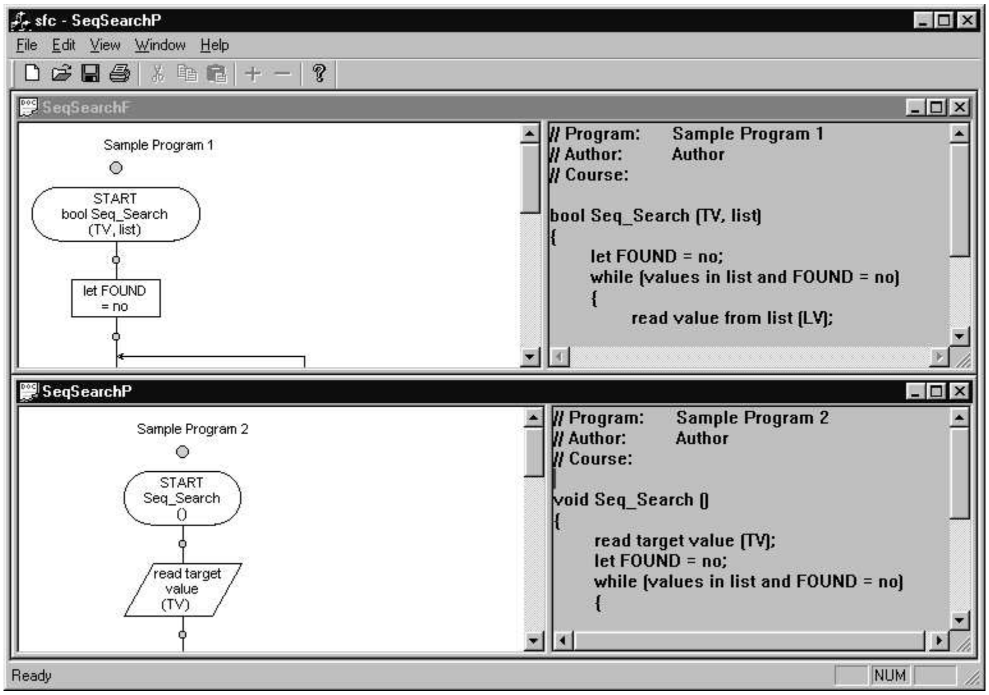
Select the ExportAs option on the File menu.
Select Text Files (.txt) as the Save as type
Click on a file name or enter a new name in the dialog box.
Click on the OK button or press the enter key.

17. Editing Multiple Structured Flow Charts

Using multiple windows, two ore more flow charts can be edited at the same time. Follow the instructions in sections 4 or 5 to open a second new or existing flow chart.

To view multiple flow charts one above the other:

Select the Tile option on the windows menu.



```
// Program:     Sample Program 1
// Author:      Author
// Course:

bool Seq_Search (TV, list)
{
      let FOUND = no;
      while (values in list and FOUND = no)
      {
            read value from list (LV);
```

```
// Program:     Sample Program 2
// Author:      Author
// Course:

void Seq_Search ()
{
      read target value (TV);
      let FOUND = no;
      while (values in list and FOUND = no)
      {
```

Control structures or procedures cut or copied from one structured flow chart can be pasted to the appropriate type of insertion point in another flow chart.

18. Exiting from SFC

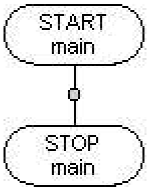
To exit from SFC:

Left click on the X button on the upper right corner of the SCF main window.

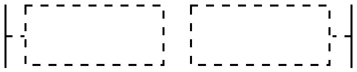
OR

Select the Exit option in the File menu.

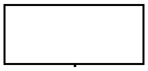
Appendix A : Flow Chart Symbols



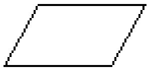
Subroutine START/STOP with
Control Structure Insertion Point



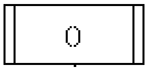
Comment (2 formats)



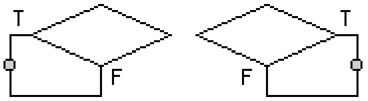
Sequential Process or Activity



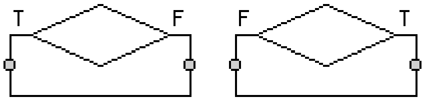
Input or Output



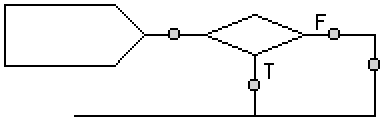
Subroutine Call



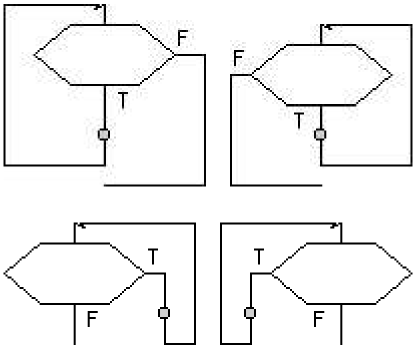
Single Branch Decision (2 formats)



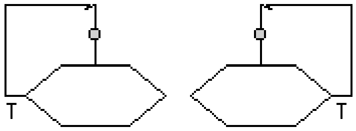
Double Branch Decision (2 formats)



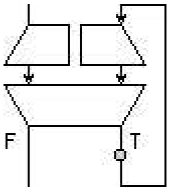
Case Statement with Case Option



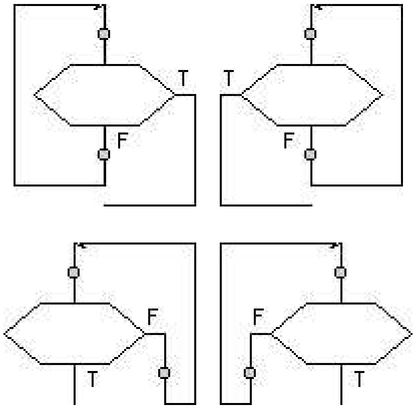
Test at Top Loop (4 formats)



Test at Bottom Loop (2 formats)



Counting Loop



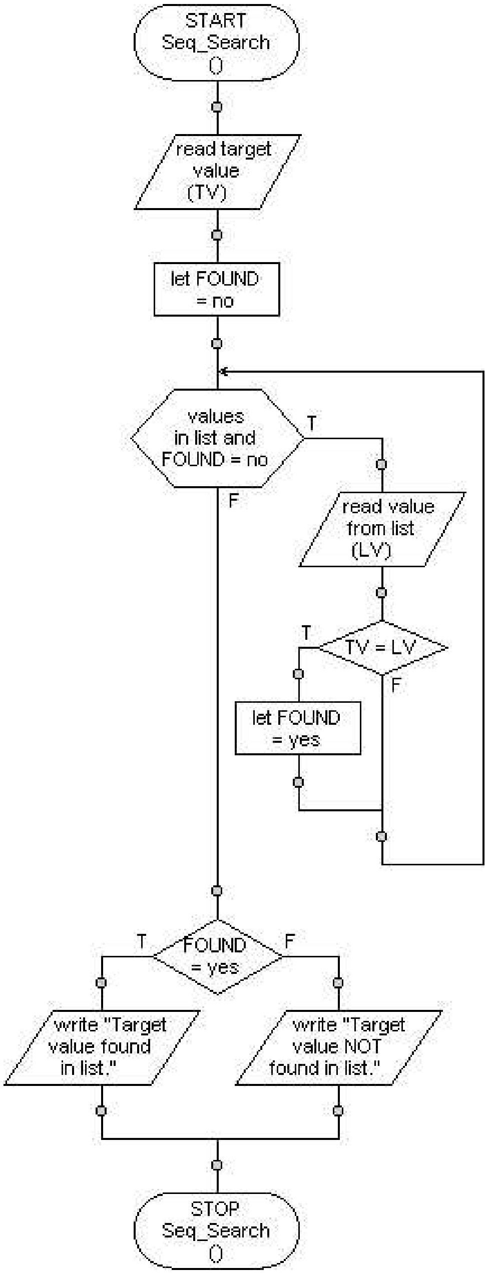
User Controlled Exit Loop (4 formats)

Appendix B : Examples

Example 1 Sequential Search

This example illustrates a procedure implementation of the Sequential Search algorithm. The flow chart, its Generic style pseudo code, and its C++ style pseudo code are shown.

Flow Chart



Generic Style Pseudo Code

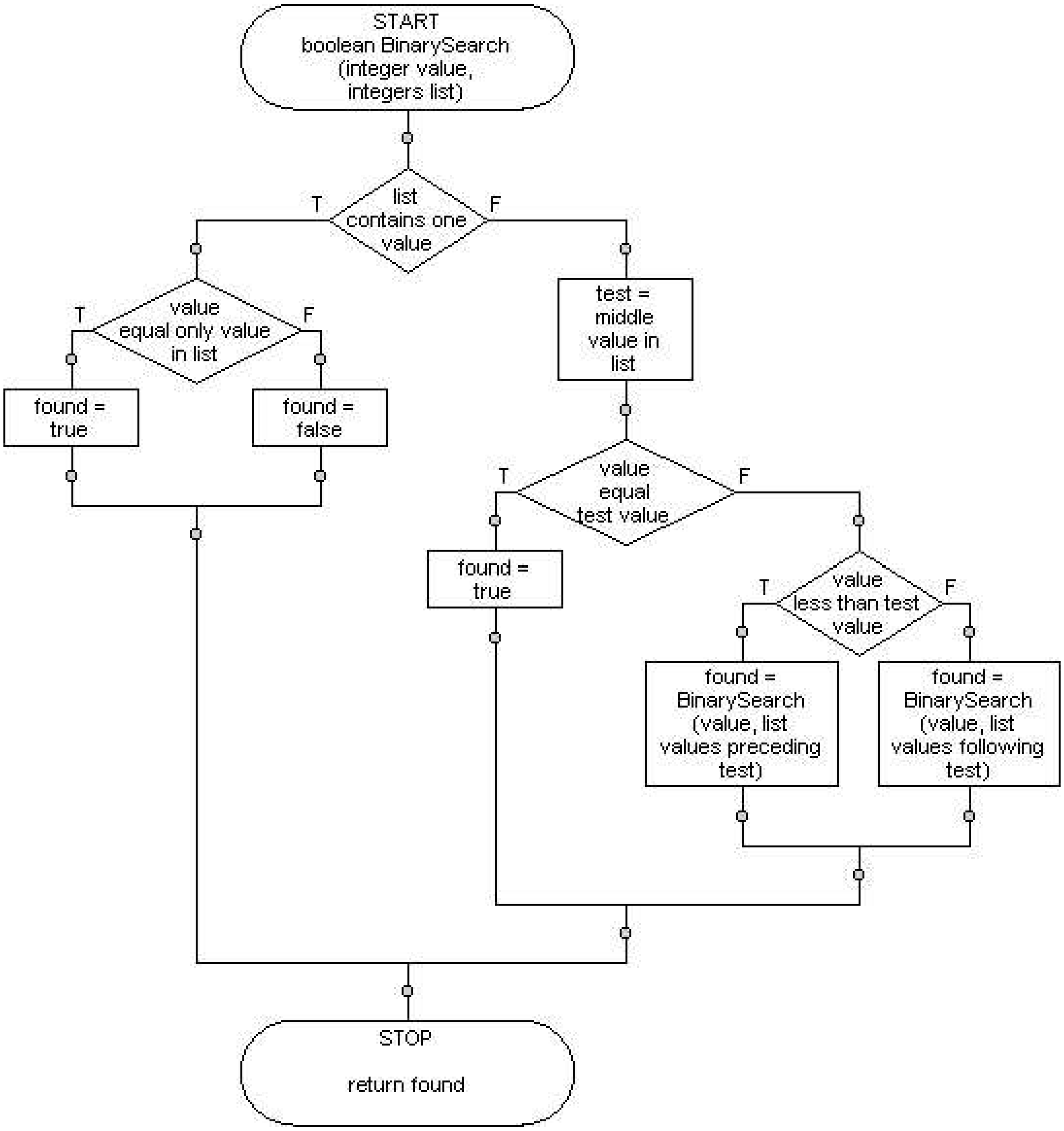
```
PROCEDURE Seq_Search ()
BEGIN Seq_Search
    read target value (TV)
    let FOUND = no
    WHILE values in list and FOUND = no DO
        read value from list (LV)
        IF TV = LV THEN
            let FOUND = yes
        END-IF
    END-WHILE
    IF FOUND = yes THEN
        write "Target value found in list."
    ELSE
        write "Target value NOT found in list."
    END-IF

END Seq_Search
```

C++ Style Pseudo Code

```
void Seq_Search ()
{
    read target value (TV);
    let FOUND = no;
    while (values in list and FOUND = no)
    {
        read value from list (LV);
        if (TV = LV)
            let FOUND = yes;
    }
    if (FOUND = yes)
        write "Target value found in list.";
    else
        write "Target value NOT found in list.";
}
```

Example 2 Binary Search

This example illustrates a function implementation of the Binary Search algorithm. The flow chart, its Generic style pseudo code, and its C++ style pseudo code are shown.


START
boolean BinarySearch
(integer value,
integers list)
list contains one value
T
F
value equal only value in list
T
F
found = true
found = false
test = middle value in list
value equal test value
T
F
found = true
value less than test value
T
F
found = BinarySearch (value, list values preceding test)
found = BinarySearch (value, list values following test)
STOP
return found

Generic Style Pseudo Code

```
FUNCTION BinarySearch (integer value, integers list) RETURNING boolean
BEGIN BinarySearch
    IF list contains one value THEN
        IF value equal only value in list THEN
            found = true
        ELSE
            found = false
        END-IF
    ELSE
        test = middle value in list
        IF value equal test value THEN
            found = true
        ELSE
            IF value less than test value THEN
                found = BinarySearch (value, list values preceding test)
            ELSE
                found = BinarySearch (value, list values following test)
            END-IF
        END-IF
    END-IF
    RETURN found
END BinarySearch
```

C++ Style Pseudo Code

```
boolean BinarySearch (integer value, integers list)
{
    if (list contains one value)
    {
        if (value equal only value in list)
        {
            found = true;
        }
        else
            found = false;
    }
    else
    {
        test = middle value in list;
        if (value equal test value)
        {
            found = true;
        }
        else
            if (value less than test value)
            {
                found = BinarySearch (value, list values preceding test);
            }
            else
                found = BinarySearch (value, list values following test);
    }
    return found;
}
```