A flow chart serves several functions.
- It helps you clarify the contents of your program.
- It helps you understand the logical flow - what happens in the program.
- It helps you design what the use experience will be.

This document looks at:
- Flow Control
- Types of Control Statements
- Commonly used flow chart symbols
- Examples
A computer program performs a series of instructions.

Flow control allows us to choose which set of instructions it should perform and in what order.

It also allows us to vary these instructions under certain conditions. If we wanted our program to function in a simple linear fashion we wouldn't need flow control.

Most control structures use an operand, such as =, < or >, to define a condition. What action is performed depends upon whether or not the condition is met.
One common control statement is "if...then"

```java
if (a > b) {
    do_this_function
} else {
    do_that_function
}
```

In this example, \((a > b)\) is the condition, and the program decides to do one of two functions depending on the outcome of this condition.
Sequential Statements
Functions are called in the order they appear in the program.
Sequential statements are often used for assignment, computations, input and output

Looping Statements (Iteration)
looping statements repeat until a condition has been satisfied
for
while
repeat with

Branching Statements (Selection)
branching statements choose between several options depending on the conditions.
if...then
if...then...else
switch or case
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Start, Quit, or End" /></td>
<td>Indicates the <strong>beginning or end</strong> of the flowchart (i.e. Start, Quit, or End).</td>
</tr>
<tr>
<td><img src="image" alt="Logical Flow" /></td>
<td><strong>Logical flow</strong> of program</td>
</tr>
<tr>
<td><img src="image" alt="Step or Process" /></td>
<td><strong>Step or Process</strong></td>
</tr>
<tr>
<td><img src="image" alt="Used to test for a condition" /></td>
<td><strong>Used to test for a condition</strong>. <strong>Decision</strong> - indicates a branching in the program, based on conditional statements. Use it to represent an <strong>event which occurs automatically</strong>. Such an event will trigger a subsequent action, for example <code>receive telephone call</code>, or describe a new state of affairs.</td>
</tr>
<tr>
<td><img src="image" alt="Predefined Process" /></td>
<td><strong>Predefined process</strong> - use to indicate a process more fully documented elsewhere</td>
</tr>
<tr>
<td><img src="image" alt="Input or Output" /></td>
<td><strong>Input or output</strong> - indicates that user must input information that will change the course of the program flow (i.e. an online questionnaire form).</td>
</tr>
<tr>
<td><img src="image" alt="Request" /></td>
<td><strong>Request</strong>, where the user is able to request info, a particular subroutine etc. from the program (i.e. Dialogue box for search &amp; search results).</td>
</tr>
<tr>
<td><img src="image" alt="Database" /></td>
<td><strong>Database</strong></td>
</tr>
<tr>
<td><img src="image" alt="Used for Comments" /></td>
<td>Used for comments</td>
</tr>
<tr>
<td><img src="image" alt="On Page Connector" /></td>
<td><strong>On page connector</strong></td>
</tr>
<tr>
<td><img src="image" alt="Off Page Connector" /></td>
<td><strong>Off page connector</strong></td>
</tr>
</tbody>
</table>
Each symbol denotes a type of operation

A note is written inside each symbol to indicate the specific function to be performed

The symbols are connected by flow lines

Flowcharts are drawn and read from top to bottom unless a specific condition or process is met that alters that path

A sequence of operations is performed until an END symbol designates the sequence's end or the end of the program

Sometimes several steps or statements are combined in a single processing symbol for ease of reading

http://www.dmc.dit.ie/maim/projects/aidan/Website/FlowchartConventions.htm
Sequential Statements

When instructions in a computer program are to be executed in the order in which they appear in the code, regardless of any condition specified in the program, then that collection of instructions is referred to as a sequence.

A typical sequence for a handler in Lingo might be:
```plaintext
on mouseUp
    sound playFile 3, "Moo"
    sound playFile 4, "Oink"
    sound playFile 17, "Tweet"
    sound playFile 20, "Woof"
end
```

http://www.dmc.dit.ie/maim/projects/aidan/Website/FlowchartConventions.htm
Looping Statements (Iteration)

In some programming constructs, a series of steps is executed repeatedly until some condition exists or is met. Iteration is the logical control structure used for specifying the repeated execution of a series of steps.

Example of a FOR statement

```plaintext
for(x=1;x<4;x++)
{
    do something...
}
```

- `x=1` - initializes the variable
- `x<4` - sets the condition
- `x++` - increments the variable

http://www.dmc.dit.ie/maim/projects/aidan/Website/FlowchartConventions.htm
Looping Statements (Iteration)

In some programming constructs, a series of steps is executed repeatedly until some condition exists or is met. Iteration is the logical control structure used for specifying the repeated execution of a series of steps.

Example of a WHILE statement

```
while(doctor == busy){
   wait...
}
```
Branching Statements (Selection)

Branching, or selection, statements choose between several options depending on the conditions.

Example of an **IF...THEN** statement

```java
if (today==Monday)
    ... go to Intro to Web Programming...
```

Flow Control Examples

http://www.dmc.dit.ie/maim/projects/aidan/Website/FlowchartConventions.htm
Branching Statements (Selection)
branching, or selection, statements choose between several options depending on the conditions.

Example of an **IF…ELSE** statement

```java
if (today==Monday){
    ... go to Intro to Web Programming...
} else{
    ... do homework ...
}
```

[Flowchart image showing the logic for deciding between going to Intro to Web Programming and doing homework depending on if today is Monday or not.]
Branching Statements (Selection) 
branching, or selection, statements choose between several options depending on the conditions.

Example of a Nested IF…ELSE statement

if (today==Monday){
    if (time==10 am){
        ... go to Video Class...
    } else{
        if (time==8 pm){
            ... go to Intro to Web Programming...
        }
    }
}

} else{
    ... do homework
}

http://www.dmc.dit.ie/maim/projects/aidan/Website/FlowchartConventions.htm
Branching Statements (Selection)
branching, or selection, statements choose between several options depending on the conditions.

Example of a CASE or SWITCH statement

```java
switch (time){
    case(10 am)
        ... go to Video Class...
    case(1 pm)
        ... go to Lunch...
    case(2 pm)
        ... go to Writing Lab...
    case(8 pm)
        ... go to Intro to Web Programming...
}
```

http://www.dmc.dit.ie/maim/projects/aidan/Website/FlowchartConventions.htm
an example of a flowchart for “what to do today?”

BEGIN

Check the Weather Channel

Is this true? → Rain predicted?

yes → if yes, follow this flow

no → if no, follow this flow

do this → Play Golf

STOP

The Weather Channel is ch 61 on Cox Cable

← comment

do this → Stay home and do housework

STOP
an example of a flowchart for filling the gas tank

TRIGGER
- low petrol warning light comes on, or fuel gauge shows fuel is low

1. locate and drive into petrol station, stop at pump
   - Refer to Table A for brand selection

   - remote filler cap release?
     - YES release filler cap
     - NO unscrew filler cap

2. unscrew filler cap

3. leded petrol?
   - YES select ‘leaded’ pump handle
   - NO select ‘unleaded’ pump handle

4. insert nozzle and squeeze handle

5. 1 Refer to ‘Decide fill level’ flowchart
   - pump display will show amount
   - replace nozzle, replace cap, and close cover

TARGET
- tank recharged, ready to drive off
- go to pay booth and pay

from http://deming.eng.clemson.edu/
an example of a flowchart for finding the best way home

- Leaving the Office
- Check the Time and Weather
  - Weather Clear?
    - Yes
    - Before 5:00pm?
      - Yes
      - Check for congestion on primary route
        - Primary congested?
          - No
          - Take Alternate "A" Home
          - Arrive Safely
          - Divert to Alternate "B"
          - Take the Primary Route Home
          - Arrive Safely
        - Yes
      - No
      - Take Alternate "A" Home
      - Arrive Safely
      - Divert to Alternate "B"
      - Take the Primary Route Home
      - Arrive Safely
    - No
  - No
- Arrive Safely
Recipe for Sponge Cake

1. Mix together 4 oz. sugar and 4 oz. butter.
2. Stir in 2 eggs.
4. Put into tins.
5. Bake at 400 degrees until golden brown.
6. Remove from oven and eat.
7. END
Examples

START

Mix together 4 oz. sugar 4 oz. butter

Stir in two eggs.

Stir in 4 oz. flour.

Put in tins.

Bake for 5 mins.

Is it brown?

no

yes

END

from http://www.howell1964.freeserve.co.uk/
Flow Control

Types of Control Statements

Commonly used flow chart symbols

Examples