

## Decision Structure

You use the selection (or decision) structure, when you want a program to make a decision or comparison and then, based on the result of that decision or comparison, to select one of two paths. You can think of the selection structure as being a fork in the road.

### IF...THEN Decision structure

An IF...THEN decision structure is based on evaluating a condition and then take a course of action based on that decision. The syntax is given below:

```
IF condition 1 THEN
```

```
    Instructions when the condition 1 is true
```

```
ELSEIF condition 2 THEN
```

```
    Instructions when the condition 2 is true
```

```
ELSE
```

```
    Instruction when the conditions are false
```

```
END IF
```

Note: The second condition is an optional statement (i.e. if additional conditions are required then they can be added within the IF...THEN structure using the ELSEIF...THEN expression. The ELSE statement is also optional.

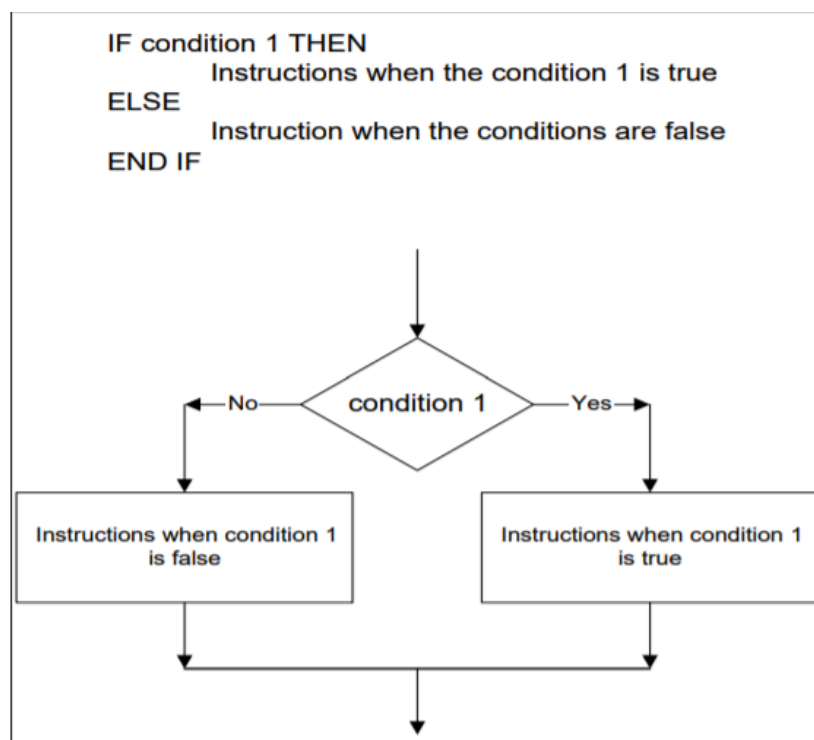


Figure 1 If... Then structure with flow chart

## Nested Selection structures

A nested selection structure is one in which either the true path or the false path includes yet another selection structure. See below for syntax and example:

IF condition 1 THEN

    Instructions when condition 1 is true

    IF condition 2 THEN

        Instructions if condition 2 is true

    ELSE

        Instruction when condition 1 is true and condition 2 is false

    END IF

ELSE

    Instructions when condition 1 is false

END IF

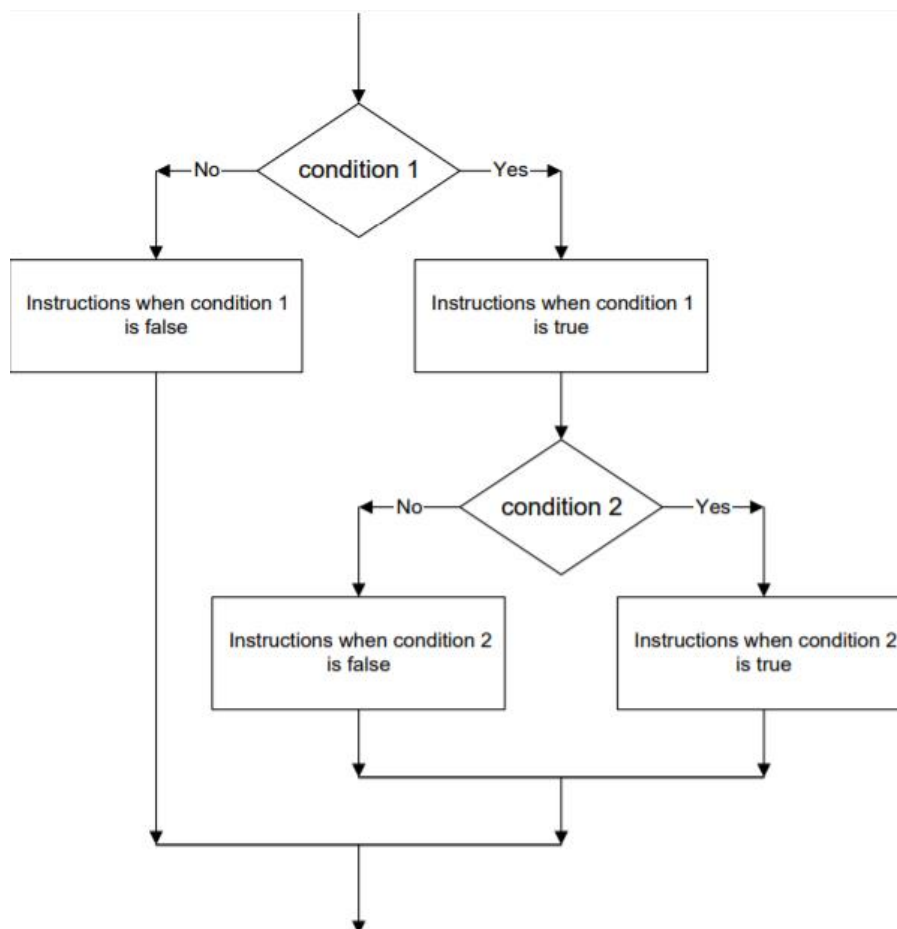


Figure 2 Flow chart of nested if statement

**Example:**

IF person has their high school diploma THEN

    IF person is registered THEN

        Display “You can attend this class”

    ELSE

        Display “You need to register before you can attend this class”

    END IF

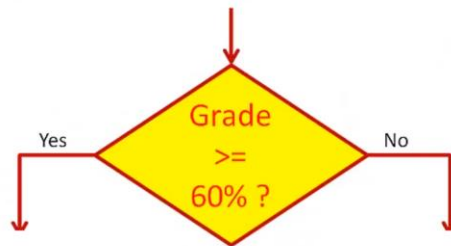
ELSE

    Display “You need to complete your high school equivalences”

END IF

## Decision or Selection

- This shape is used to ask a True/False question and route the program to one of several locations based on the answer to that question



## Print or Display



- This shape is used to have the computer show the user some response or information.



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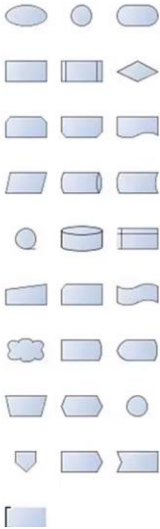
## Summary

- You can identify the following flow chart shapes: **Terminate**, **Process**, **Input/Output (I/O)**, **Decision**, **Print**.
- You are familiar with the basic flow chart shapes we will be using in this course, and can describe the types of action each represents.

# The Shapes We Use

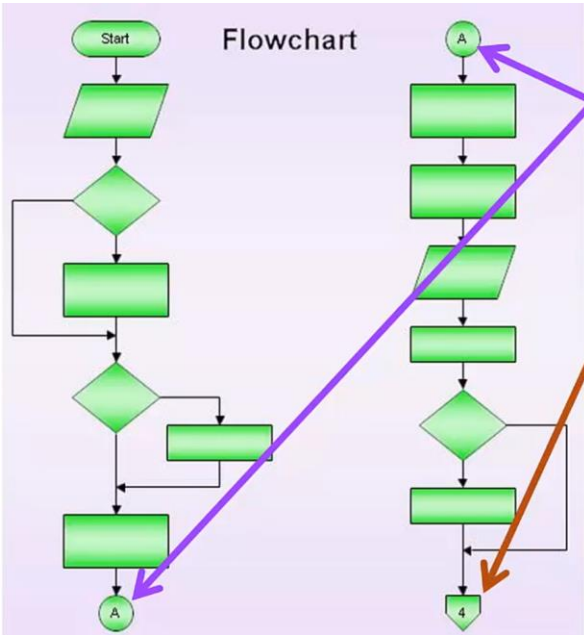
- Basic Flowchart Shapes (US units)
- Process
  - ◇ Decision
  - ▭ Subprocess
  - ◡ Start/End
  - ▭ Document
  - ▭ Data
  - ▭ Database
  - ▭ External Data
  - ▭ Custom 1
  - ▭ Custom 2
  - ▭ Custom 3
  - ▭ Custom 4
  - On-page reference
  - ◡ Off-page reference

These are the flow chart shapes available in three different commercial charting programs.



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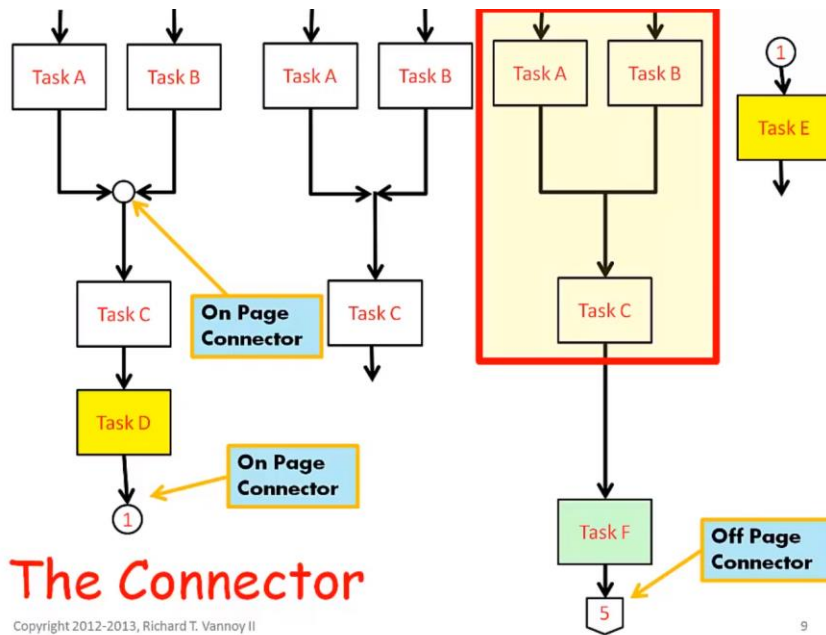


## Connectors

**On-Page:**  
Look for a number or letter. Expect to see a corresponding circle **on this page** where flow continues.

**Off-Page:**  
Look for a number or letter. Expect to see a corresponding shape **on the page indicated (not on this page)** where flow continues.

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## Control Structure Theorem

- 1966 paper by Corrado Böhm and Giuseppe Jacopini.



- Any algorithm can be expressed using only three control structures:

Oooops! My mistake. The gent on the left is Corrado Bohm. The gent on the right is Alan Turing, another famous figure in computing and cryptography.

I could not find a photo of Giuseppe Jacopini.

## Control Structure Theorem

- 1966 paper by Corrado Böhm and Giuseppe Jacopini.



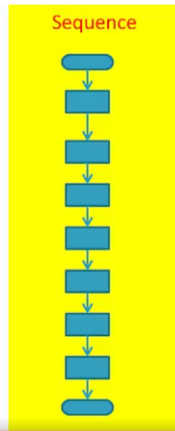
- Any algorithm can be expressed using only three control structures:
  - SEQUENCE** = Executing one step (or set of steps), and then another step (or set of steps).
  - SELECTION** = Executing one STEP (or set of steps) according to the value of a boolean expression (Also called *Decision*)
  - REPETITION** = Executing a step (or set of steps) until a boolean expression is true (Also called *Iteration*)

## Control Structures

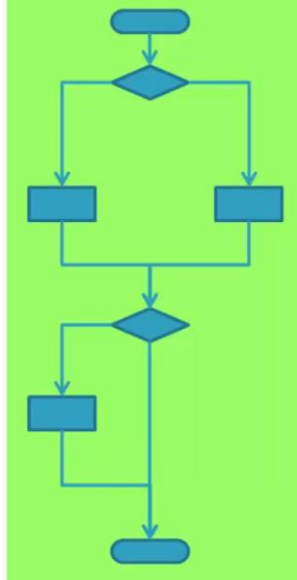
- Something called the “*Structure Theorem*” states that it is possible to write any computer program by using only three control structures.
- These three structures are:
  - **Sequence:** Steps are executed one after the other.
  - **Decision or Selection:** The answer to one or more True/False questions determine which operation or steps to execute next.
  - **Repetition or Loops:** Continue repeating the performance of some step or sequence of steps as long as some condition is met.

# Control Structures

- The main focus of this course is to have you understand and effectively utilize three structures!

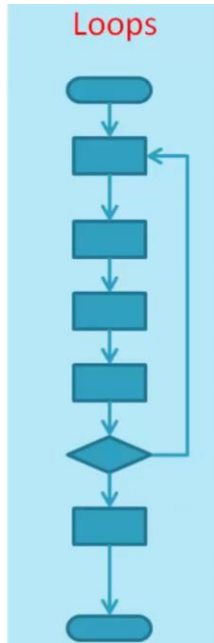


## Selection/Decision





## Loops



Loops will be covered in unit 6.