

Computing Fundamentals and Programming (CE-100)
Batch 2019 (Electronic Engineering)
Chapter 7: Software Programming & Languages

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Critical thinking is essential to the problem-solving process of the systems development life cycle (SDLC) in general and of programming is particular.

Programming: A Five Step Procedure

Programming is a method of problem solving that employs algorithms. An algorithm is a set of ordered steps used to solve a problem. (Algorithm essentially means the same thing as logic).

Program: A program (also called software) is a list of instructions that the computer must follow to process data into information. The instructions consist of statements written in programming language.

Traditionally, the steps of the program development cycle are as follows

- Clarify the programming needs
- Design the program
- Code the program
- Test the program
- Document and maintain the program

Programming constitutes Phase IV (Develop/acquire the system) of Systems Development Life Cycle (SDLC)

The First Step: Clarify the Programming Needs

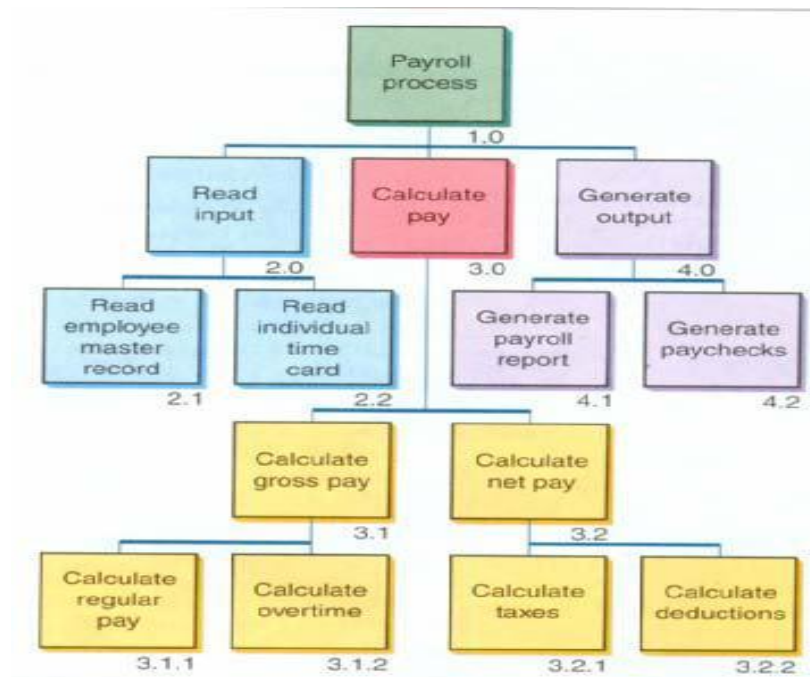
- Clarify Objectives and users
 - Write a statement of the objectives you are trying to accomplish – the problem you are trying to solve.
 - Identify users of the programs, will they be inside people or outside or both?
- Clarify desired outputs
 - What kind of hardcopy is required?
- Clarify desired inputs
 - What kind of input data is needed?
- Clarify the desired processing
 - How input data will be processed to get the desired output?

- Double-check the Feasibility of Implementing the program
 - Programmers decide that they can buy existing software and modify it rather than write it from scratch.
- Document the analysis

The Second Step: Design the Program

Structured programming takes a top-down approach that breaks programs into modular forms. It also uses standard logic tools called control structures. In structured programming the software is designed in three mini steps.

- Determine the program logic, using a top-down approach
 - Top down program design can be represented graphically in a hierarchy chart. Here is an example



- Design details, using Pseudo code, Flow Charts and Control Structures

Once the essential logic of the program has been determined, through the use of top-down programming and hierarchy charts, now we can go to work on the details

There are two ways to show

details ○ Pseudo code

- It is a tool for designing a program in narrative form using normal human language statements to describe the logic and programming flow.
- Example is here

If a list of payroll tasks looks like this:

```
Read name, hourly rate, hours worked
Calculate gross pay and net pay
Write name, gross pay and net pay
Write name, gross pay, net pay
```

The pseudocode would look like this:

```
READ name, hourly rate, hours worked
Gross pay = hourly rate times hours worked
Net pay = Gross pay minus 15
WRITE name, Gross pay, Net pay
```

- Program flow chart
 - It graphically represents the detailed series of steps (algorithms or logical flow) needed to solve a programming problem.
 - It is discussed in detail at the end.
- Do a structured walkthrough
 - In this phase a programmer leads other people in the development team through a design segment.
 - It is the process in which fellow programmers, users etc scrutinize (“walk through”) the programmer’s design work

The Third Step: Code the program

- Select the appropriate programming language
- Follow the syntax

The Fourth Step: Test the program

- Perform desk checking
 - It is simply reading through, or checking, the program to make sure that it’s free of errors and that the logic works
- Debug the program (also called alpha testing)
 - It means detecting, locating and removing all errors in a computer program.
 - Mistakes may be syntax or logical errors
- Run Real-world data (also called beta testing)
 - After desk-checking and debugging the program may run fine in laboratory however it then needs to be tested with real data, called beta testing.

The Fifth Step: Document and Maintain the program

- Prepare User documentation
 - When you buy a spreadsheet program it is usually accompanied by user documentation so a programmer should also include it for his commercial software
- Prepare Operator documentation
 - The people who run large computers are called computer operators.

- Write Programmer Documentation
 - Programmer documentation offers the keys to understanding the program's underlying logic and operation
- Maintain the program
 - Maintenance is any activity designed to keep programs in working condition, error free and up to date.

Five Generations of Programming Languages

Programming language is a set of rules that tells the computer what operations to perform.

First Generation: (1945)

- Machine Language
- Used 0 and 1
- It is machine dependent

Second Generation: (mid 1950s)

- Assembly Language
- It allows programmers to use abbreviations or easily remembered words instead of numbers.
- For example MP means multiply
- It is also machine dependent
 - Language Translators
 - Assemblers
 - Compilers
 - Interpreters

Third Generation: (Early 1960s)

- High level languages
 - It is an English-like language
 - Most of them are not machine dependent
- Examples: FORTRAN, COBOL, C, BASIC, PASCAL etc
- These languages are also called procedural languages (you need to tell what to do and how to do)

Fourth Generation: (Early 1970s)

- Very high-level languages
 - These are often called 4 GLs, for 4th Generation languages.
 - These are non procedural languages.
 - 4 GLs are also called RAD (rapid application development) tools
- Examples: Report Generators, SQL (Structured query language)








First Generation: (Early 1980s)

- Natural Languages
 - It is of two types
 - First one is ordinary human language
 - The second are programming languages that use human language to give people a more natural connection with computers.
 - These languages are a part of field of Artificial Intelligence (AI)
 - AI is a group of related technologies that attempt to develop machines to emulate human-like qualities, such as learning, reasoning, communicating, seeing and hearing.

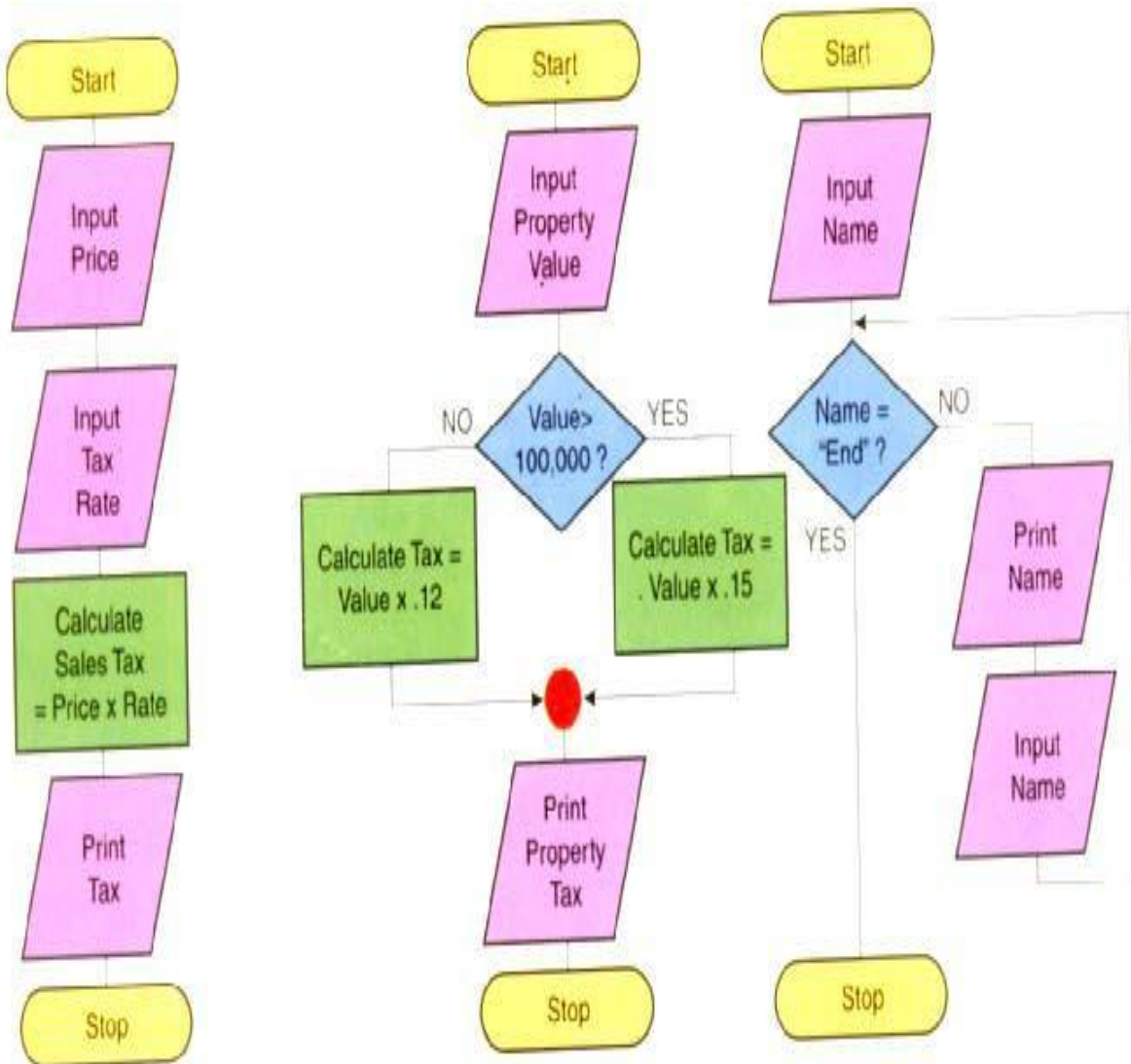
Internet Programming

- HTML (Hypertext Markup language)
 - It is an authoring language for creating web documents
- XML (extensible Markup language)
 - For making the web work better
- VRML (Virtual reality markup language)
 - It is a type of programming language used to create three-dimensional web pages.
 - You need to have VRML browser plug-in – for example Netscape Live3D.
- JAVA
 - It is used for creating interactive web pages.
- Active X
 - Also used for creating interactive web pages
 - It is developed by Microsoft as an alternative to JAVA for creating interactivity on web pages

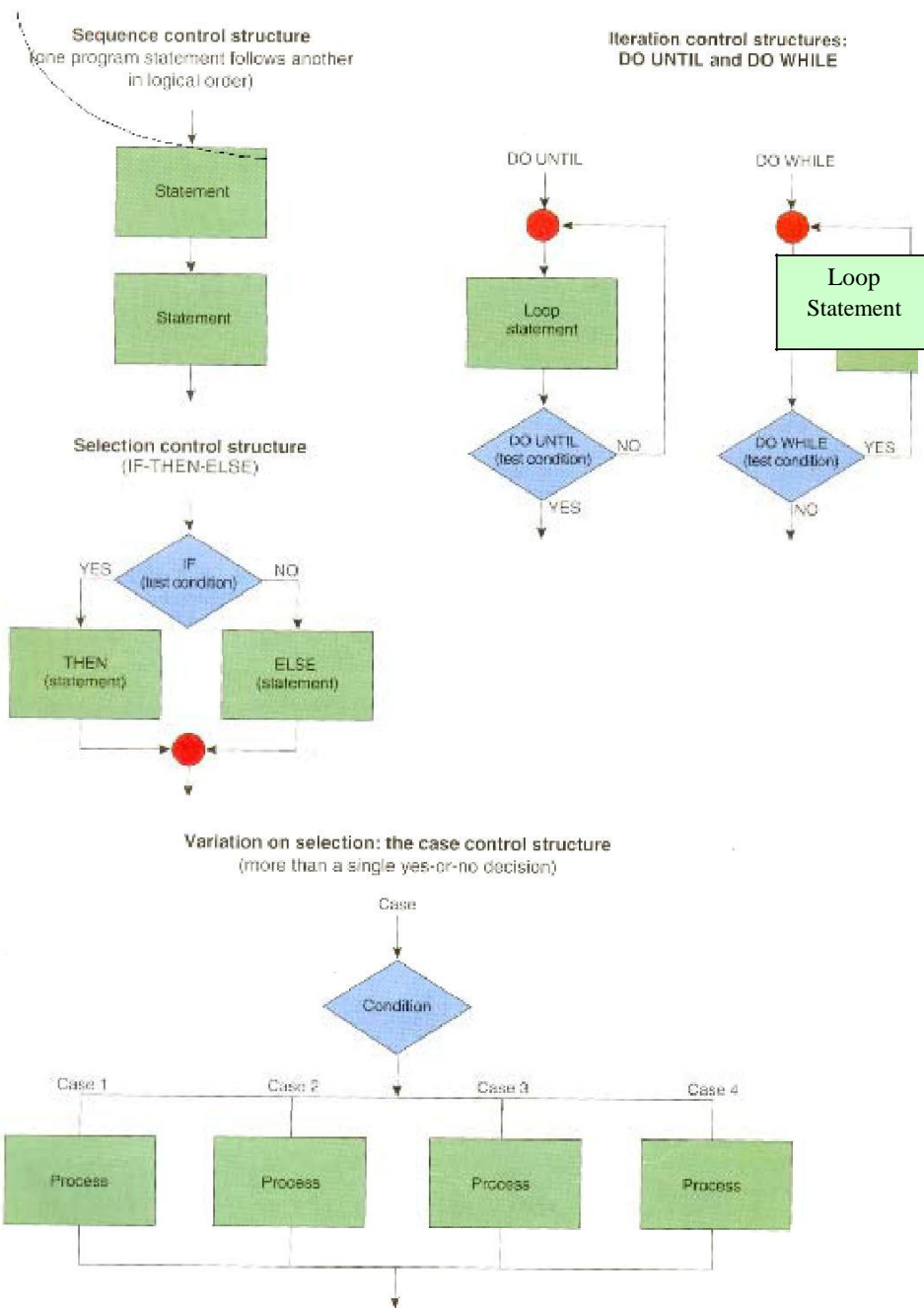
ANSI Standard Symbols for Program flow charts

Symbol	Name	Use
	Terminal	Indicates the beginning and end of a program.
	Process	A calculation or assigning of a value to a variable.
	Input/Output (I/O)	Any statement that causes data to be input to a program (INPUT, READ) or output from the program, such as printing on the display screen or printer.
	Decision	Program decisions. Allows alternate courses of action based on a condition. A decision indicates a question that can be answered <i>yes</i> or <i>no</i> (or <i>true</i> or <i>false</i>).
	Predefined Process	A group of statements that together accomplish one task. Used extensively when programs are broken into modules.
	Connector	Can be used to eliminate lengthy flowlines. Its use indicates that one symbol is connected to another. Also used as the termination of IF-THEN-ELSE logic. (See Figure 10.5.)
	Flowlines and Arrowheads	Used to connect symbols and indicate the sequence of operations. The flow is assumed to go from top to bottom and from left to right. Arrowheads are only required when the flow violates the standard direction.

Three Sample Flow Charts



The Four Control Structures



Exercise Questions

Solve the following questions and submit it as an assignment

Q1) you want to write a program for generation of series of prime numbers in C.

Write the following series of steps

- Write Pseudo code (algorithm)*
- Draw Program Flowchart*
- Write code in any language that you know*
- Perform alpha and beta testing and write brief report*

Q2) you want to write a program for sorting of integer numbers in a one dimensional array. Write the following series of steps

- Write Pseudo code (algorithm)*
- Draw Program Flowchart*
- Write code in any language that you know*
- Perform alpha and beta testing and write brief report*