Laboratory Manual for

PROGRAMMING FOR PROBLEM SOLVING (BE01000121)

B.E. Semester-1
Electrical Engineering

Government Engineering College, Bhuj

Directorate of Technical Education, Gandhinagar, Gujarat

Government Engineering College, Bhuj

<u>Certificate</u>

This is to certify that Mr./Ms. ____ Enrollment No.____________________of B.E. 1st Semester Electrical Engineering of this Institute (GTU Code:<u>015</u>) has satisfactorily completed the Practical/Tutorial work for the subject ___________________________________ for the academic year 2025-26.

Place: ___________

Date: ___________

Name and Sign of Faculty member

Head of the Department

Preface

Main motto of any laboratory/practical/field work is for enhancing required skills as well as creating ability amongst students to solve real time problem by developing relevant competencies in psychomotor domain. By keeping in view, GTU has designed competency focused outcome-based curriculum for engineering degree programs where sufficient weightage is given to practical work. It shows importance of enhancement of skills amongst the students and it pays attention to utilize every second of time allotted for practical amongst students, instructors and faculty members to achieve relevant outcomes by performing the experiments rather than having merely study type experiments. It is must for effective implementation of competency focused outcome-based curriculum that every practical is keenly designed to serve as a tool to develop and enhance relevant competency required by thevariousindustryamongeverystudent.Thesepsychomotorskillsareverydifficult to develop through traditional chalk and board content delivery method in the classroom. Accordingly, this lab manual is designed to focus on the industry defined relevant outcomes, rather than old practice of conducting practical to prove concept and theory.

By using this lab manual students can go through the relevant theory and procedure in advance before the actual performance which creates an interest and students can have basicidea prior to performance. This in turn enhancespre-determine doutcomes amongst students. Each experiment in this manual begins with competency, industry relevant skills, course outcomes as well as practical outcomes (objectives). The students will also achieve safety and necessary precautions to be taken while performing practical.

This manual also provides guidelines to faculty members to facilitate student centric lab activities through each experiment by arranging and managing necessary resources in order that the students follow the procedures with required safety and necessary precautions to achieve the outcomes. It also gives an idea that howstudents will be assessed by providing rubrics.

C programming is a general-purpose, procedural, imperative computer programming language.C is robust language and has rich set of built-in functions, data types and operators which can be used to write any complex program.Program written in C are efficient due to availability of several data types and operators.C has the capabilities of an assembly language (low level features) with the feature of high level language so it is well suited for writing both system software and application software.C is highly portable language i.e. code written in one machine can be moved to other which is very important and powerful feature.

Utmost care has been taken while preparing this lab manual however always there is chances of improvement. Therefore, we welcome constructive suggestions for improvement and removal of errors if any.

CourseOutcomes(COs):

CO-1: Identifyfundamentalprogrammingconstructssuchasvariables,datatypes,operators, expressions, control structures, functions and basic data structures.

CO-2: Explain the principles of programming and software development, including the structure and operation of algorithms, flowcharts, and pseudocode.

CO-3: Developsimpleprogramsusingappropriatedatastructuresandstandardlibraries.

CO-4: Applyprogrammingconstructssuch asloops, conditional statements, and functionsto solve basic engineering problems.

CO-5: Debugandtroubleshoot programmingerrorsbysystematicallytestingandrefiningcode.

Sr. No.	Objective(s)ofExperiment	CO 1	CO 2	CO 3	CO 4	CO 5
1.	Writeanalgorithm&drawaflowchartforfollowing problems. (a) acceptingtwonumbersandperformingaddition, subtraction, division and multiplication on them (b) tocheckwhethergivennumberisevenorodd (c) tofindoutfactorialofagivennumber“n”.	√	√			
2.	Writeanalgorithm&drawaflowchartforfollowing problems. (a) toprintfirst10Fibonaccinumbers (b) tofindoutlargestnumberfromthreenumbers (c) tofindoutrootsofquadraticequation ax^2+bx+c.	√	√			
3.	WriteaCprogramforfollowingproblems. (a) Writeaprogramto thatperformsascalculator (addition, multiplication, division, subtraction). (b) Write a program to find area of triangle(a=h*b*.5) a = area h = height b = base (c) WriteaCprogramtocomputesimpleinterest using the formula Si=p*r*n/100	√		√		
4.	WriteaCprogramforfollowing problems. (a) WriteaCprograminterchangetwonumbers. (b) WriteaprogramtocomputeFahrenheitfromcentigrade (f=1.8*c +32) (c) WriteaCprogramtocalculateyear,monthand daypassedforgivennumberofdays.	√		√		
5.	WriteaCProgramforfollowingproblemsusing branching, iteration and recursion. (a) Writeaprogramtoreadmarksofastudentfrom	√			√	

	keyboard whether the student is pass or fail(using if else) (b) Write a program to read three numbers from keyboardandfindoutmaximumoutofthesethree. (nested if else) (c) Write a C program that uses else-if ladder to check whether entered character is uppercase, lowercase, digitorspecialcharacter.					
6.	WriteaCProgramforfollowingproblemsusingbranching, iteration and recursion. (a) Write a C program to read no 1 to 7 and print relatively day Sunday to Saturday. (Switch statement) (b) Write a C program to find factorial of a given number. (c) Writeaprogramtoprintfollowingpatterns: i)* ii) * iii)* ** * * ** ** * ** * * * * (d) Writeaprogramthatprintsfollowingpatterns: i)A ii) 1 AB 2 3 ABC 456	√			√	
7.	WriteaCProgramusingconceptof function. (a) Write a program that defines a function to add first n numbers. (b) Write a program using function to find maximum number from two numbers. (c) Writeafunctionintheprogramtoreturn1if numberisprimeotherwisereturn0	√			√	
8	WriteaCProgramusing conceptoffunction. (a) Writeaprogramtoexchangetwonumbersby using function (b) Writeaprogramtoreversethenumberusing function. (c) Writeaprogramtogeneratefirstnnumberof Fibonacciseriesusingrecursion.	√			√	
9	WriteaCProgramusingtheconceptofanarray. (a)Write a C program to find out the Maximum andMinimumnumberfromgiven10numbersinan	√			√	

	array. (b) Write a program to sort the elements of an array in ascending order. (c) Write a C program to read 10 numbers from user andstoretheminanarray.DisplaySum,Minimumand Averageofthenumbers					
10	WriteaC Programusingtheconceptofpointer,structure&File. (a) Writeaprogramtoaccesselementsusingpointer. (b) Design a structure student_record to contain name, branch and total marks obtained. Develop a program to read data for 10 students in a class and print them. (c) A file named data contains series of integer numbers. Write a c program to read all numbers from file and then write all odd numbers into file named “odd” and write all even numbers into file named“even”.Displayallthecontentsofthesefile on screen (d) Define a structure “personal” that would contain person name, date of joining and salary. Using this structurereadinformationof5peopleandprintthe same on screen. Also display sum of salary of all5 people	√			√	

11	Printtheoutputforfollowingpieceofcode&ifthereis any error present, find out error(s) and correct it:
	1. int main()
	{
	inti=10;
	do {
	printf("%d",i);
	i++;
	}while(i<10);
	return 0;
	}
	2. intfunct1(intn);
	int main()
	{
	intn=10;
	printf("%d",funct1(n));
	return0;
	}
	intfunct1(intx)//function definition
	{
	if(x>0)
	returnx+funct1(x-1);
	}
		√				√

Industry Relevant Skills

The following industry relevant competency are expected to be developed in the student by undertaking the practical work of this laboratory.

1. Willbeabletosolveanyproblembywritinganalgorithm&drawingaflowchart.
2. Will be able to develop an application software by using the concepts of functions, arrays, file management, loops, branching etc…

Guidelines for Faculty members

1. Teacher shouldprovidetheguidelinewithdemonstrationofpracticaltothestudents with all features.
2. Teachershallexplainbasicconcepts/theoryrelatedtotheexperimenttothestudents before starting of each practical
3. Involve all the students in performance of each experiment.
4. Teacher is expected to share the skills and competencies to be developed in the students and ensure that the respective skills and competencies are developed in the students after the completion of the experimentation.
5. Teachers should give opportunity to students for hands-on experience after the demonstration.
6. Teacher may provide additional knowledge and skills to the students even though notcoveredinthemanualbutareexpectedfromthestudentsbyconcernedindustry.
7. Give practical assignment and assess the performance of students based on task

assigned to check whether it is as per the instructions or not.
8. Teacher is expected to refer complete curriculum of the course and follow the guidelines for implementation.

Instructions for Students

1. Students are expected to carefully listen to all the theory classes delivered by the faculty members and understand the COs, content of the course, teaching and examination scheme, skill set to be developed etc.
2. Studentsshallorganizetheworkinthegroupandmakerecordofallobservations.
3. Students shall develop maintenance skill as expected by industries.
4. Studentshallattempttodeveloprelatedhand-onskillsandbuildconfidence.
5. Student shalldevelopthehabitsofevolvingmoreideas, innovations, skillsetc.apartfrom those included in scope of manual.
6. Student shall refer technical magazines and data books.
7. Studentshoulddevelopahabitofsubmittingtheexperimentationworkasperthe schedule and s/he should be well prepared for the same.

CommonSafetyInstructions

Studentsareexpectedto

1) SwitchonthePCcarefully(nottousewethands)
2) ShutdownthePCproperlyattheendofyour Lab
3) Carefullyhandletheperipherals(Mouse,Keyboard,Networkcableetc)
4) UseLaptopinlabaftergettingpermissionfromTeacher

Index
(Progressive Assessment Sheet)

Sr. No.	Objective(s)ofExperiment	Page No.	Date of performance	Date of submission	Assessment Marks	Sign.of Teacher withdate	Remarks
0	Writethe Following 1. Vision&MissionofDTE,GECGandhinagar and Computer Department 2. Program OutcomeofComputerEngineering 3. PSOsandPEOsofComputerEngineering Department 4. CourseoutcomesofPPS						
1	Writeanalgorithm&drawaflowchartfor following problems. (a) accepting two numbers and performingaddition,subtraction,divisionandmultiplicationon them (b) tocheck whethergiven numberiseven orodd. (c)tofindoutfactorialofagivennumber"n".						
2	Writeanalgorithm&drawaflowchartfor following problems. (a) toprintfirst10Fibonaccinumbers (b) tofindoutlargest numberfromthree numbers (c) tofindoutrootsofquadraticequation ax2+bx+c.						
3	WriteaCprogramforfollowing problems. (a) Write a program to that performs as calculator(addition,multiplication,division, subtraction). (b) Writeaprogramtofindareaoftriangle (a=h*b*.5) a = area h = height b = base (c) WriteaCprogramtocomputesimple interestusingtheformulaSi=p*r*n/100						
4	WriteaCprogram forfollowingproblems. (a) WriteaCprogramtointerchangetwonumbers. (b) WriteaprogramtocomputeFahrenheitfrom centigrade (f=1.8*c +32) (c) Write aCprogramtocalculateyear,month anddaypassedforgivennumberofdays.						
5	WriteaCProgramforfollowingproblemsusing branching, iterationandrecursion.						

	(a) Write a program to read marks of a student from keyboard whether the student is pass or fail(using if else) (b) Writeaprogramtoreadthreenumbers from keyboard and find out maximum out of these three. (nested if else) (c) WriteaCprogramthatuseselse-if ladder to check whether entered character is uppercase, lowercase, digitorspecialcharacter.						
6	Write a C Program for following problems using branching, iteration and recursion. (a) Write a C program to read no 1 to 7 and print relatively day Sunday to Saturday. (Switch statement) (b) Write a C program to find factorial ofa given number. (c) Writeaprogramtoprintfollowing patterns i)* ii) * iii)* ** * * ** ** * ** * * * * (d) Writeaprogramthatprintsfollowing patterns: i)A ii) 1 AB 2 3 ABC 456						
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8	WriteaCProgramusing conceptoffunction.						

	(a) Writeaprogramtoexchangetwonumbers by using function (b) Writeaprogramtoreversethenumber using function. (c) Writeaprogram togeneratefirst n number ofFibonacciseries usingrecursion.						
9	WriteaCProgramusingtheconceptofanarray. (a) Write a C program to find out the Maximum and Minimum number from given 10 numbers in an array. (b) Writeaprogramtosorttheelementsof an array in ascending order. (c) Write a C program to read 10 numbersfrom user and store them in an array. DisplaySum,MinimumandAverageof thenumbers						
10	Write a C Program using the concept of pointer, structure & File. (a) Write a program to access elements using pointer. (b) Design a structure student_record to contain name, branch and total marksobtained. Develop a program to read data for 10 students in a class and print them. (c) A file named data containsseriesof integer numbers. Write a c program to read all numbers from file and then write all odd numbers into file named “odd” and write all even numbers into file named “even”. Display all the contents of these file on screen (d) Define a structure “personal” that would contain person name, date of joining and salary. Usingthis structureread informationof 5 people and print the same on screen. Also display sum of salary of all 5 people.						
11	Print the output for following piece of code & if there is any error present, find out error(s) and correct it: 1.int main() {						

	inti=10;
	do {
	printf(“%d”,i);
	i++;
	}while(i<10);
	return 0;
	}
	
	intfunct1(intn);
	int main()
	{
	intn=10;
	printf("%d",funct1(n));
	return0;
	}
	intfunct1(intx)//function definition
	{
	if(x>0)
	returnx+funct1(x-1);
	}						

Total							

DTEs'Vision:

Vision:

- ✓ To provide globally competitive technical education
- ✓ Remove geographical imbalance and in consistencies
- ✓ Develop student friendly resources with a special focus on girls' education and support to weaker sections
- ✓ Develop programs relevant to industry and create a vibrant pool of technical professionals

Vision and Mission of GEC Bhuj:

Vision:

- ✓ To optimize perseverance, quality and ethics in the higher technical education and research as can groom the learners into the owners of global trends in engineering.

Mission:

- ✓ To facilitate the learners with fundamental and advanced technical knowledge in theory and practice
- ✓ To facilitate the learning with concerned industrial exposure to the obtaining technology
- ✓ To help the learners acquire professional ethics, acumen and zeal for research and entrepreneurship

Vision and Mission of electrical Department:

Vision:

- ✓ To empower Electrical Engineers with technical expertise, social responsibility and adaptability to vibrant industries.

Mission:`

- ✓ To provide sound fundamental knowledge and skill of electrical engineering field.
- ✓ To provide platform for higher study, entrepreneurship and placement.
- ✓ To produce Electrical Engineers with an attitude to adapt themselves to changing technological environment.
- ✓ To create lifelong learning environment in department.

ProgrammeOutcomes(POs)

1. Engineering knowledge: Apply the knowledge of mathematics, science,engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

2. Problem analysis: Identify, formulate, review research literature, and analyzecomplex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/developmentofsolutions:Designsolutionsforcomplexengineeringproblemsand design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conductinvestigationsof complexproblems:Useresearch-basedknowledgeandresearch methodsincludingdesignofexperiments,analysisandinterpretationofdata,andsynthesisofthe information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques,resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextualknowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professionalengineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and needfor sustainable development.

8. Ethics: Apply ethicalprinciplesandcommitto professional ethicsandresponsibilitiesand norms of the engineering practice.

9. Individual and team work: Function effectivelyasan individual, andasamember or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activitieswith the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understandingof the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the needfor,andhave the preparationand abilityto engage in independent and life-long learning in the broadest context of technological change.

ProgramSpecificOutcomes(PSOs)

Graduates will be able to demonstrate fundamental knowledge of Electrical Power system, Electrical Machines, Power Electronics using appropriate concepts.

Graduates will be able to design Electrical Machines ,Transmission lines and Power apparatus.

Graduates will be able to develop support system based on renewable and sustainable energy sources.

ProgramEducationalObjectives(PEOs)

To implant a strong foundation in the Electrical Engineering fundamentals to solve and analyze the Electrical Engineering problems. (Core Technical)

To produce graduates who are well placed in the field of Electrical Engineering and contributing towards nation development. (Placement and Entrepreneurship)

Building a professional culture within the department community that embodies the ethics and honesty. (Ethics)

CO-1: Identify fundamental programming constructs such asvariables, data types, operators, expressions, control structures,functions and basic data structures.

CO-2: Explain the principles of programming and softwaredevelopment, including the structure and operation of algorithms,flowcharts, and pseudocode.

Algorithm

Analgorithmisasequenceofinstructionsthatarecarriedoutinapredeterminedsequencein order to solve a problem.

Featuresofthe algorithm

Itdefinesseveralimportantfeaturesofthealgorithm,including:

Inputs:Algorithmsmustreceiveinputsthatcanberepresentedasvaluesordata.

Output: The algorithm should produce some output. It can be a consequence of a problem or asolution designed to solve it.

Clarity: Algorithms must be precisely defined, using unambiguous instructions that a computer or other system can follow unambiguously.

Finiteness:Thealgorithmrequiresalimitedsteps.Itmeansthatitshouldbeexitedafter executing a certain number of commands.

Validity: The algorithm must be valid. In other words, it should be able to produce a solution to the problem that the algorithm is designed to solve in a reasonable amount of time.

Effectiveness:Analgorithmmustbeeffective, meaningthatitmustbeabletoproduceasolution to the problem it is designed to solve in a reasonable amount of time.

Generality:Analgorithmmustbegeneral,meaningthatitcanbeappliedtoawiderangeof problems rather than being specific to a single problem.

How to write an algorithm?

Step1:First define the problem which you want to solve.

Step2:Think out the steps to solve the problem, arrange all those stepsintosequentialorderso we can realize the correct solution for the problem.

Step3:Writeanalgorithminpseudocodeoraprogramminglanguage. Step 4:

Test your algorithm to make sure it is correct and efficient.

ExampleofAlgorithm:

Algorithm for finding the average of three numbers is as follows−

Step1: Start

Step 2:Read 3numbersa,b,c

Step 3: Compute sum = a+b+c

Step4:Computeaverage=sum/3

Step 5: Print average value

Step6: Stop

Algorithm for finding the area of rectangle is as follows–

Step1:Start

Step2:ReadBreadth(b)andLength(l)fortheRectangle. Step 3:

Calculate Area (a) = Length * Breadth

Step4:PrintArea(a)

Step 5: Stop

Algorithm for finding the larger number from the two numbers is as follows–

Step1:Start

Step2:ReadTwoNumbersa,b.

Step3:Comparetwonumbers.IF(a>b)thengotostep5. Step 4:

Print “b is greater”, go to step 6.

Step5:Print“aisgreater”,gotostep6. Step 6:

Stop

Flowchart

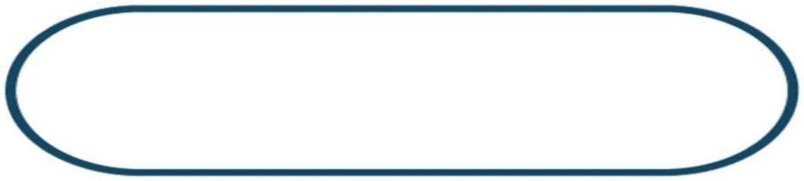
Diagrammatic representation of an algorithm is called flow chart.

Flowchart Symbols

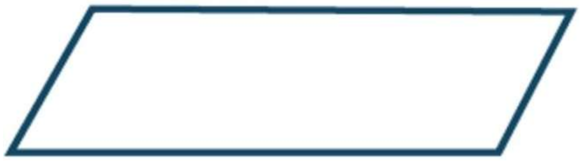
The different flowchart symbols have different conventional meanings.

The various symbols used in Flowchart Designs are given below.

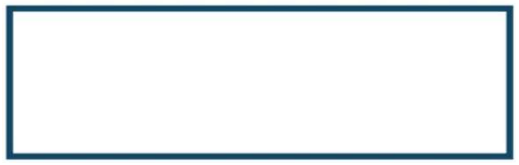
Terminal Symbol: Intheflowchart,itisrepresentedwiththehelpofacirclefordenotingthe start and stop symbol. The symbol given below is used to represent the terminal symbol.



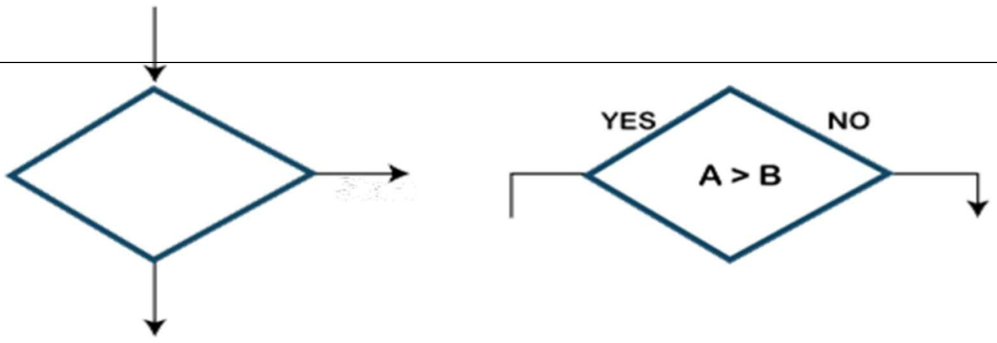
Input/output Symbol: The input symbol is used to represent the input data, and the output symbol is used to display the output operation.



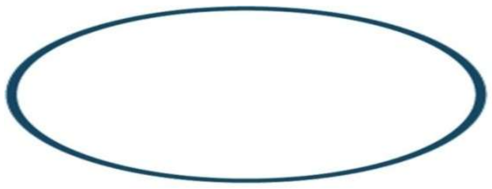
Processing Symbol: It is represented in a flowchart with the help of a rectangle box used to represent the arithmetic and data movement instructions. The symbol given below is used to represent the processing symbol.



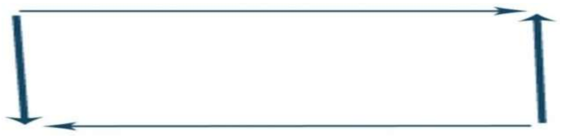
Decision Symbol: Diamond symbol is used for represents decision-making statements. The symbol given below is used to represent the decision symbol.



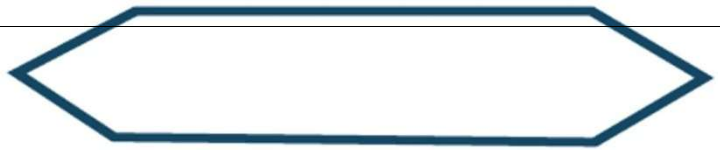
Connector Symbol: The connector symbol is used if flows discontinued at some point and continued again at another place. The following symbol is the representation of the connector symbol.



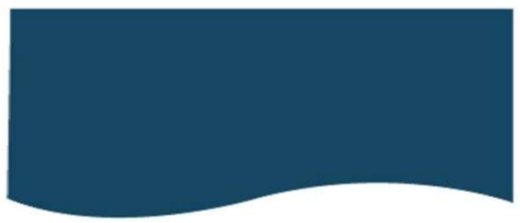
Flow lines:It represents the exact sequence in which instructions are executed. Arrows are used to represent the flow lines in a flowchart. The symbol given below is used for representing the flow lines:



Hexagon symbol (Flat):It is used to create a preparation box containing the loop setting statement. The symbol given below is used for representing the Hexagon symbol.



Internal storage symbol: The symbol given below is used to represent the internal storagesymbol.



Advantages of Flowchart in C:

Following are the various advantages of flowchart:

Communication:Aflowchartisabetterwayofcommunicatingthelogicofaprogram.

Synthesis: Flowchart is used as working models in designing new programs and software systems.

Efficient Coding: Flowcharts act as a guide for a programmer in writing the actual code in ahigh-level language.

Proper Debugging: Flowchart help in the debugging process.

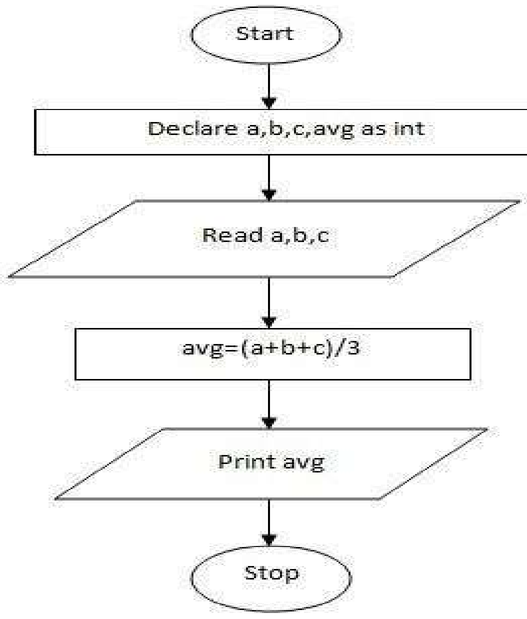
Effective Analysis: Effective analysis of logical programs can be easily done with the help of a related flowchart.

Proper Documentation: Flowchart provides better and proper documentation. It consists of various activities such as collecting, organizing, storing, and maintaining all related program records.

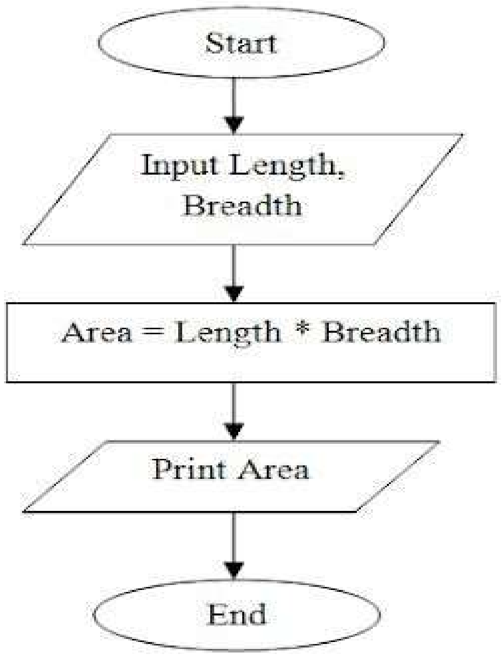
Testing: A flowchart helps in the testing process.

Examples of flowchart

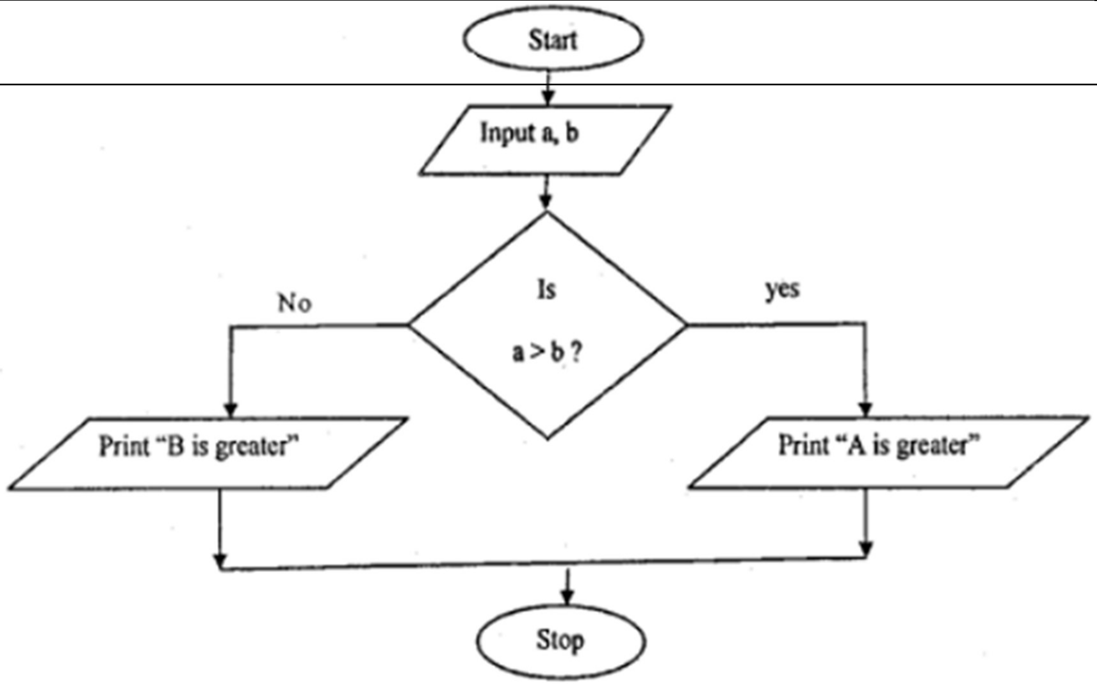
Draw a flowchart for finding average of 3Numbers.



Design flowchart for calculating the area of a rectangle.



Design a flowchart to find out greater number from the two numbers.



Comparison of Algorithm and Flowchart

Algorithm	Flowchart
An algorithm is aprocedureorsetofrules that defines how a program is to be executed.	A flowchart is agraphicalrepresentationof the steps a program takes to process data.
An algorithm does not include any sort of geometrical pattern.	Itutilizesdifferenttypesofgeometricalshapes, symbols, and patterns.
An algorithm demands the knowledge of a computer programming language.	A Flowchart doesn't demand the knowledge of a computer programming language.
It is difficult to debug the errors in algorithms.	Itiseasytodebugtheerrorsinflowcharts.

Practical-1

AIM: Write an algorithm & draw a flowchart for following problems.

(a) Accepting two numbers and performing addition, subtraction, division and multiplication on them

(b) To check whether given number is even or odd.

(c) To find out factorial of a given number "n".

Solution:

Rubrics Wise Marks Obtained:

Knowledge of subject (2)		Programming Skill		Teamwork(2)		Communication Skill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

Practical-2

AIM: Write an algorithm & draw a flowchart for following problems.

(a) To print first 10 Fibonacci numbers

(b) To find out largest number from three numbers

(c) To find out roots of quadratic equation ax^2+bx+c.

Solution:

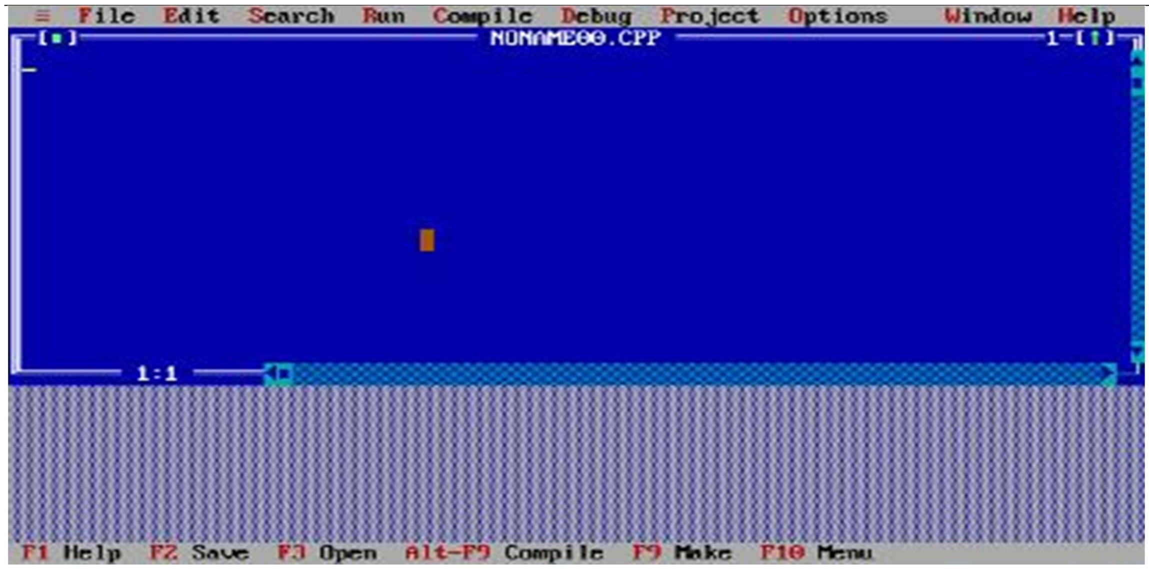
Rubrics Wise Marks Obtained:

Knowledge of subject (2)		Programming Skill		Teamwork(2)		Communication Skill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

CO-3 : Develop simple programs using appropriate data structures and standard libraries.

C is a programming language to communicate a set of instructions to the computer to perform some tasks. The set of instructions is known as a program. The program is written by a human being who is known as a programmer or a developer. The program is then compiled by a compiler to convert the C program into binary executable file. If the program is written properly as per the C programming language convention then the compiler will not generate any error, otherwise it shows all the errors with their location and suggestions to correct those.Here we will use the TURBO C or TURBO C++ compiler to perform our practical tasks. Once the program is compiled successfully, it gets converted into binary executable file known as .exefile. That executable file is known to computer and thus it is also referred as machine code. A binary executable file contains only ‘0’ and‘1’ within it. The‘0’ indicates OFF and ‘1’ indicates ON state. Based on the executable instructions in binary format the computer enables and disables its circuitry to perform various operations to fulfil the task mentioned in the program.
The above isjust abrief overviewof the entire lifecycle of aprogram. Tomake it simple wethe programmer or a developer are just concerned with writing proper C language code using editor of TURBO C compiler.
To start with this we require TURBO C/C++ compiler of 64bits version for Windows operating system of 64bits. Download the same from the link: https://www.filehorse.com/download-turbo-c/
Complete the installation and once the installation is done open the TURBO C++ compiler from the desktop icon: by double clicking it. The below window will be visible soon.


≡ File Edit Search Run Compile Debug Project Options Window Help
NONAME00.CPP
1:1
F1 Help F2 Save F3 Open Alt-F9 Compile F9 Make F10 Menu

Inabovewindowobservethings:

1) Darkblueareaistheprogrammingorcodingsection.

2) Topleftlightbluesquareistoclosethecoding section.

3) Toprightlightbluearrowistominimizeandmaximisethecodesection.

4) The number near the light blue arrow at the top right corner is the code section window number. Which we can call/use by Alt+No.To toggle between open code section windows.

5) The name NONAME00.CPPis thedefaultfile name of our programwhich requires to be changed while saving the program.

6) The top bar is the menu bar which contains several menu options like, File, Edit, Search, Run, Compile, Debug,etc.ThesemenuItem'sname'sfirstletterisofREDcolorwhichindicates the shortcut to open that menu item through Alt+Letter(having RED color).

7) Thebelow statusbar showstheshort cutsto seethehelp thorough F1 key, F2 to Save, F3 to Open file, Alt+F9 to Compile the code and F9 to make and F10 for the menu.

Among all the above features of TURBO C compiler, to make our task simple and easy we areconcerned with only the following options.

a)	Filemenu	{New,Open,Save,Saveas,closemenuitems}
b)	Compilemenu	{Compile-Alt+F9}
c)	Runmenu	{Run-Ctrl+F9}

Astudentshouldfollowgoodhabitstosavehistime,effortsandpreservehis/herwork.

a) Alwaysopenanewcodesection,whichdoesnothaveanypastcode.
b) Writeyourowncodeonyourownwithoutdependinguponothers.
c) Dosaveforevenaminorchangein program.
d) Giveagoodnametotheprogram andsavetheprogram totheappropriatelocationviathe navigation window of the TURBO C compiler. Use save as an option to change either the file name or the location of the file.
e) Oncesaved,thencompile,useshortcutkeyandmakeahabitofit.
f) Oncecompiled,dorun,useashortcutkeyandmakeahabitofit.
g) Seetheoutput.Ifyouroutputiscorrect,writedowntheprograminyourfilepagesor take a back up of your code either into pen drive, or online in gmail or g-drive.
h) Oncedone,help your friendswith their coding. Thiswill help youin termsof revision and better idea of the programing.
i) Oncecompletedyourlabwork,SHUTDOWNthemachineandSWITCHOFFthe machine, lights and fans not in use. Make an entryinto LAB master and leave quietly.

Structure of C Program

The basic structure of a C program is divided into 6 parts which makes it easy to read,modify, document, andunderstandina particular format.C program must follow thebelow-mentioned outline in order to successfully compile and execute.

Documentation
PreprocessorSection
Definition
GlobalDeclaration
Main() Function
UserdefinedFunctions

1. Documentation

Thissectionconsistsofthe descriptionoftheprogram, thenameoftheprogram,andthecreation date and time of the program. It is specified at thestart of theprogram inthe form of comments. Documentation can be represented as:

//description,nameoftheprogram,programmername,date,timeetc.

2. Preprocessor Section

All the header files of the program will be declared in the preprocessor section of the program. Headerfileshelpustoaccessother'simprovedcodeintoourcode.Acopyofthesemultiplefiles is inserted into our program before the process of compilation.

Example:

```
#include<stdio.h>
#include<math.h>
```

3. Definition
Thedefinesectioncomprisesofdifferentconstantsdeclaredusingthedefinekeyword.Itisgiven by:
#definea=2
4. GlobalDeclaration
The global declaration section contains global variables, function declaration, and static variables. Variables and functions which are declared in this scope can be used anywhere in the program.
5. MainFunction
Every C program must have a main function. The main() function of the program is written in this section. Operations like declaration and execution are performed inside the curly braces of the main program. The return type of the main() function can be int as well as void too. void() main tells the compiler that the program will not return any value. The intmain() tells the compiler that the program will return an integer value.
Example:
voidmain() or intmain()
6. UserDefinedFunctions
The user defined functions specified the functions specified as per the requirements of the user. For example, color(), sum(), division(), etc.
Example:Tofindthesumoftwonumbersgivenbytheuser.

```
/*Sumoftwonumbers*/
#include<stdio.h>
intmain()
{
inta,b,sum;
printf("Entertwonumberstobeadded");
scanf("%d%d",&a,&b);
    //calculatingsum
sum = a + b;
printf("%d+%d=%d",a,b,sum);
return0;//returntheintegervalueinthesum
}
```

DetailDescriptionofCProgram

/*Sumofthetwonumbers*/	Itisthecommentsection.Anystatementdescribedin it is not considered as a code. It is a part of the description section in a code.The comment line is optional. It can be in a separate line or part of an executable line.
#include<stdio.h>	Itisthestandardinput-outputheaderfile.Itisacommand of the preprocessor section.
intmain()	main() is the first function to be executed in every program. We have used int with the main() in orderto return an integer value.
{… }	Thecurlybracesmarkthebeginningandendofa function. It is mandatory in all the functions.
printf()	The printf() prints text on the screen. It is a function for displaying constant or variables data. Here, 'Enter two numbers to be added' is the parameter passed to it.
scanf()	Itreadsdatafromthestandardinputstreamandwrites the result into the specified arguments.
sum =a+b	Theadditionofthespecifiedtwonumberswillbe passed to the sum parameter in the output.
return0	Aprogramcanalsorunwithoutareturn0function.It simply states that a program is free from error andcan be successfully exited.

Practical -3

AIM: Write a C program for following problems.

(a) Write a program to that performs as calculator (addition, multiplication, division, subtraction).

(b) Write a program to find area of triangle (a=h*b*.5) a=area, h= height b = base

(c)Write a C program to compute simple interest using the formula Si=p*r*n/100

Solution:

Rubrics Wise Marks Obtained:

Knowledge of subject (2)		Programming Skill		Teamwork(2)		Communication Skill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

Practical-4

AIM: Write a C program for following problems.

(a) Write a C program to interchange two numbers.

(b) Write a program to compute Fahrenheit from centigrade (f=1.8*c +32)

(c) Write a C program to calculate year, month and day passed for given Number of days.

Solution:

Rubrics Wise Marks Obtained:

Knowledge of subject (2)		Programming Skill		Teamwork(2)		Communication Skill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

CO-4: Apply programming constructs such as loops, conditional statements, and functions to solve basic engineering problems.

ConditionalStatementinC

Conditional Statements in C programming are used to make decisions based on the conditions. Conditional statements execute sequentially when there is no condition around the statements. If you put some condition for a block of statements, the execution flow may change based on the result evaluated by the condition. This process is called decision making in ‘C.’

IFStatement

It isoneof thepowerfulconditionalstatement. If statement isresponsible for modifyingtheflow of execution of a program.If statement is always used with a condition. The condition is evaluatedfirstbeforeexecutinganystatementinsidethebodyofIf.Thesyntaxforifstatementis as follows:

```
if(condition)
instruction;
```

The condition evaluates to either true or false. True is always a non-zero value, and false is a value that contains zero. Instructions can be a single instruction or a code block enclosed bycurly braces { }.

Followingprogramillustratestheuseofifconstructin‘C’programming:

```
#include<stdio.h>
intmain()
{
        intnum1=1;
        intnum2=2;
        if(num1<num2)                    //test-condition
        {
                printf("num1issmallerthannum2");
        }
        return0;
}
```

Output:

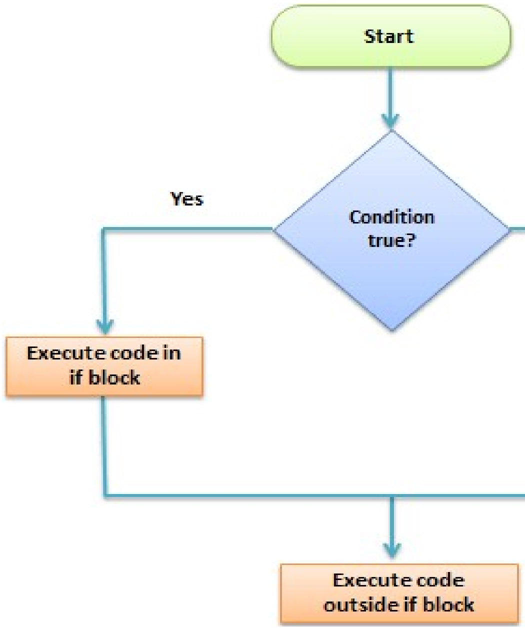
```
num1 is smaller than num2
```

Descriptionofaboveprogram:

1. In the above program, we have initialized two variables with num1, num2 with value as 1, 2respectively.

2. then, we have used if with a test-expression to check which number is the smallest and which number is the largest. We have used a relational expression in if construct. Since the value of num1 is smaller than num2, the condition will evaluate to true.
3. Thus it will print the statement inside the block of If. After that, the control will go outside of the block and program will be terminated with a successful result.

IF-ELSEStatement:



Theif-elseisstatementisanextendedversionofIf. Thegeneralformofif-elseisasfollows: if (test-expression)

```
{
   Trueblockof statements
}
Else
{
   Falseblockofstatements
}
Statements;
```

Inthistypeof aconstruct,ifthevalueoftest-expressionistrue, thenthetrueblockof statements willbeexecuted.Ifthevalueoftest-expressioniffalse, thenthefalseblockofstatementswillbe executed. In any case, after the execution, the control will be automatically transferred to the statements appearing outside the block of If.
Followingprogramsillustratetheuseoftheif-elseconstruct:
Wewillinitializeavariablewithsomevalueandwriteaprogram todetermineifthevalueisless than ten or greater than ten.

```
#include<stdio.h>i

nt main()

{
        intnum=19;

        if(num<10)

        {
                printf("Thevalueislessthan 10");

        }
        else
        {

                printf("Thevalueisgreaterthan 10");
        }
        return0;
}
```

Output:

```
The value is greater than 10
```

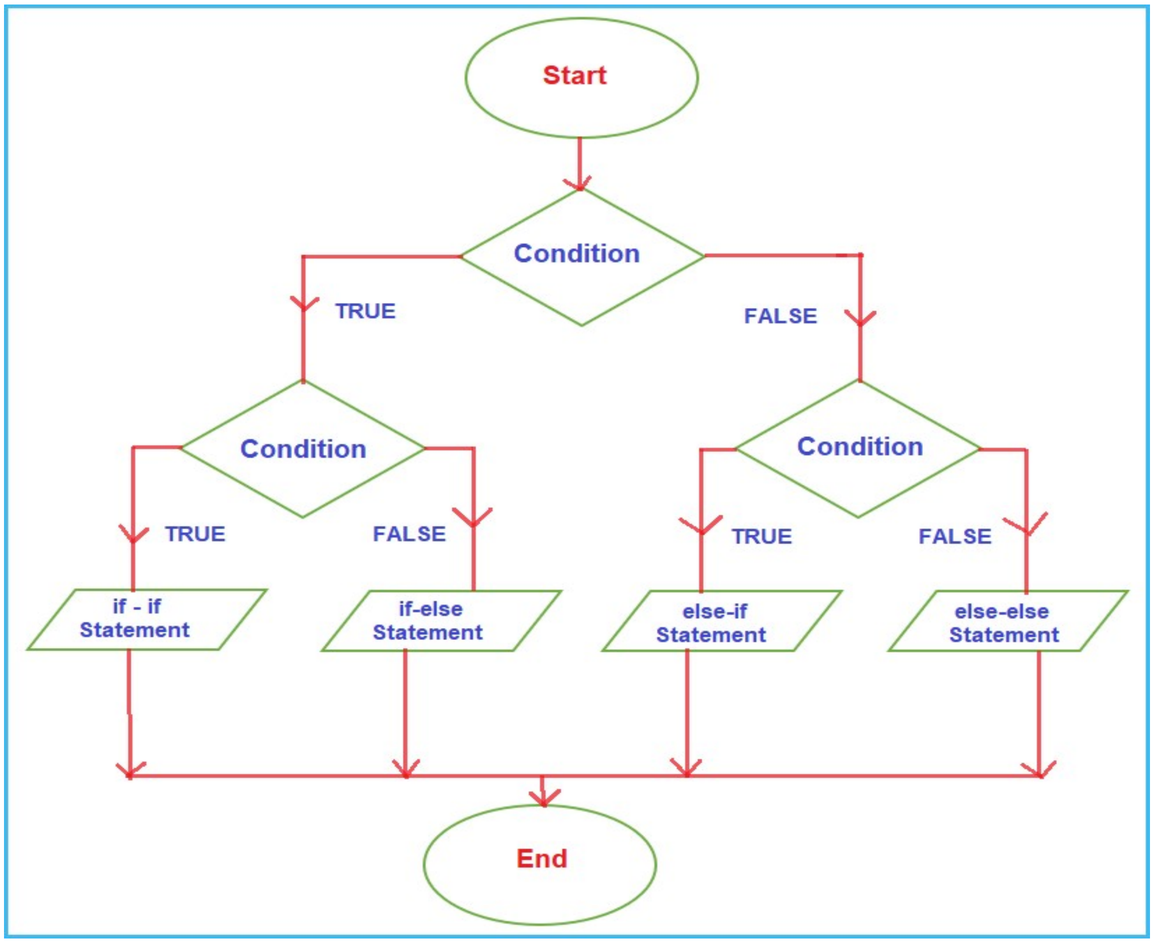
Descriptionofaboveprogram:

1. Wehaveinitializedavariablewithvalue19.Wehavetofindoutwhetherthenumberis bigger or smaller than 10 using a ‘C’ program. Todo this, we have used the if-else construct.
2. Herewehaveprovidedaconditionnum<10becausewehavetocompareourvaluewith10.
3. Asyoucanseethefirstblockisalwaysatrueblockwhichmeans,ifthevalueoftest- expression is true then the first block which is If, will be executed.
4. The second block is an else block. This block contains the statements which will be executedif thevalueof thetest-expressionbecomesfalse. Inour program, thevalueof numisgreaterthan

ten hence the test-condition becomes false and else block is executed. Thus, our output will be from an else block which is "The value is greater than 10". After the if-else, the program will terminate with a successful result.

NestedIF-ELSEStatements:

When a series of decision is required, nested if-else is used. Nesting means using one if-else construct within another one.



Let'swriteaprogramtoillustratetheuseofnestedif-else.

Thebelowprogramchecksifanumberislessorgreaterthan10andprintstheresultusing nested if-else construct.

#include<stdio.h>i

nt main()

```
{
        intnum=1;

        if(num<10)

        {
                if(num==1)
                {
                        printf("Thevalueis:%d\n",num);

                }
                else
                {

                        printf("Thevalueisgreaterthan 1");
                }


        }
        else
        {
                printf("Thevalueisgreaterthan 10");
        }
        return0;
}
```

Output:

```
Thevalueis:1
```

Descriptionofaboveprogram:

1. Firstly,wehavedeclaredavariablenumwithvalueas1.Thenwehaveusedif-elseconstruct.
2. In the outer if-else, the condition provided checks if a number is less than 10. If the condition is true then and only then it will execute the inner loop. In this case, the condition is true hence the inner block is processed.
3. Intheinnerblock, weagainhaveaconditionthatchecksif our variablecontainsthevalue1or not. When a condition is true, then it will process the If block otherwise it will process an else block. In this case, the condition is true hence the If a block is executed and the value is printed on the output screen.

4. Theaboveprogramwillprintthevalueofavariableandexitwithsuccess.

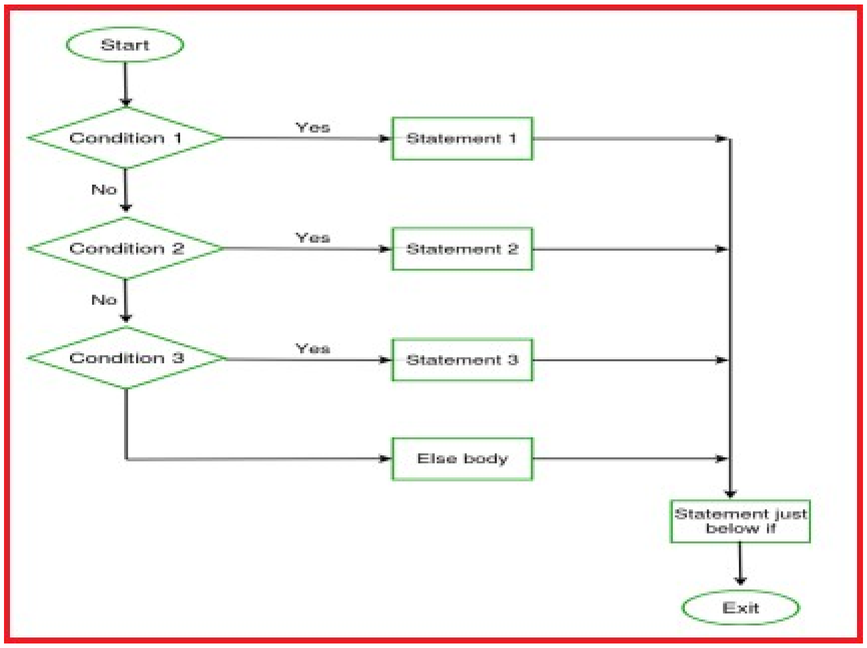
NestedElse-ifstatements(else-ifladders)

Nestedelse-ifisusedwhenmultipathdecisionsarerequired.

Thegeneralsyntaxofhowelse-ifladdersareconstructedin‘C’programmingisasfollows: if (test -expression 1)

```
{
   statement1;
}
elseif(test-expression2)
 {
   Statement2;
}
elseif(test-expression3)
{
   Statement3;
}
elseif(test-expressionn)
{
   Statementn;
}
else
{
default;
}
Statementx;
```

This type of structure is known as the else-if ladder. This chain generally looks like a ladder hence it is also called as an else-if ladder. The test-expressions are evaluated from topto bottom. Wheneveratruetest-expressioniffound, statementassociatedwithitisexecuted. Whenallthen test-expressions becomes false, then the default else statement is executed.



Letusseetheactualworkingwiththehelpofaprogram.

The below program prints the grade as per the marks scoredin a test.We have used the else-ifladder construct in the below program.

```
#include<stdio.h>i

nt main()

{

          intmarks=83;

          if(marks>75)

{

                    printf("Firstclass");

          }

          elseif(marks>65)

{

                    printf("Secondclass");

          }

          elseif(marks>55)

          {
                  printf("Thirdclass");

          }

          Else

          {

                    printf("Fourthclass");

          }

          return0;

}
```

Output:

```
Firstclass
```

Descriptionofaboveprogram:

1. Wehaveinitializedavariablewithmarks.Intheelse-ifladderstructure,wehaveprovided various conditions.

2. Thevaluefrom thevariablemarkswillbecomparedwiththefirstconditionsinceitistruethe statement associated with it will be printed on the output screen.

3. Ifthefirsttestconditionturnsoutfalse,thenitiscomparedwiththesecondcondition.

4. Thisprocesswillgoonuntiltheallexpressionisevaluatedotherwisecontrolwillgooutof the else-if ladder, and default statement will be printed.

LoopsinC:

Loops in programming are used to repeat a block of code until the specified condition is met. A loopstatementallowsprogrammerstoexecuteastatementorgroupofstatements multipletimes without repetition of code.

TherearemainlytwotypesofloopsinCProgramming:

Entry Controlled loops: In Entry controlled loops the test condition is checked before entering the main body of the loop. **For Loop and While Loop** is Entry-controlled loops.

Exit Controlled loops: In Exit controlled loops the test condition is evaluated at the end of the loop body. The loop body will execute at least once, irrespective of whether the condition is true or false. **do-while Loop** is Exit Controlled loop.

For Loop:

for loop in C programming is arepetition control structure that allows programmers to write a loopthatwillbeexecutedaspecificnumberoftimes. forloopenablesprogrammerstoperformn number of steps together in a single line.

WhileLoop:

While loop does not depend upon the number of iterations. In for loop the number of iterations was previously knownto usbut in the Whileloop, the executionisterminated onthebasis of the test condition. If the test condition will become false then it will break from the while loop else body will be executed.

```
initialization_expression;

while(test_expression)
{
    //bodyof thewhile loop

    update_expression;
}
```

do-whileLoop:

The do-while loop is similar to a while loop but the only difference lies in the do-while loop test condition which is tested at the endof the body. Inthe do-while loop, theloop bodywill execute at least once irrespective of the test condition.

```
initialization_expression;
do
{
    //bodyofdo-whileloop


    update_expression;

}while(test_expression);
```

Practical -5

AIM: Write a C Program for following problems using branching, iteration and recursion.

(a) Write a program to read marks of a student from keyboard whether the student is pass or fail (using if else)

(b) Write a program to read three numbers from keyboard and find out maximum out of these three. (Nested if else)

(c) Write a C program that uses else-if ladder to check whether entered character is uppercase, lowercase, digit or special character.

Solution:

Rubrics Wise Marks Obtained:

Knowledge of subject (2)		Programming Skill		Teamwork(2)		Communication Skill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

Practical-6

AIM: Write a C Program for following problems using branching, iteration and recursion.

(a) Write a C program to read no 1 to 7 and print relatively day Sunday to Saturday. (Switch statement)

(b) Write a C program to find factorial of a given number.

(c) Write a program to print following patterns

```
i)*          ii)    *            iii)***
  **              *  *               **
  ** *          *   *   *            *
```

(d) Write a program that prints following patterns:

```
     i) A          ii)    1
        AB              2   3
        A  BC          4  5  6
```

Solution:

Rubrics Wise Marks Obtained:

Knowledge of subject (2)		Programming Skill		Teamwork(2)		Communication Skill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

FunctionsinC

In c, we can divide a large program into the basic building blocks known as function. The function contains the set of programming statements enclosed by {}. A function can be called multiple times to provide reusability and modularity to the C program. In other words, we can say that the collection of functions creates a program. The function is also known as procedureorsubroutinein other programming languages.

AdvantageoffunctionsinC

TherearethefollowingadvantagesofCfunctions.

- Byusingfunctions,wecanavoidrewritingsamelogic/codeagainandagainina program.
- WecancallCfunctionsanynumberoftimesinaprogramandfromanyplaceina program.
- WecantrackalargeCprogrameasilywhenitisdividedintomultiplefunctions.
- ReusabilityisthemainachievementofCfunctions.
- However,FunctioncallingisalwaysaoverheadinaCprogram.

FunctionAspects

TherearethreeaspectsofaCfunction.

Function declarationA function must be declared globally in a c program to tell the compiler about the function name, function parameters, and return type.

Function call Functioncanbecalledfrom anywhere intheprogram. Theparameter list must not differ in function calling and function declaration. We must pass the same number of functionsas it is declared in the function declaration.

Function definition It contains the actual statements which are to be executed. It is the most important aspect to which the control comes when the function is called. Here, we must notice that only one value can be returned from the function.

TypesofFunctions

TherearetwotypesoffunctionsinCprogramming:

Library Functions: are the functions which are declared in the C header files such as scanf(), printf(), gets(), puts(), ceil(), floor() etc.

User-defined functions: are the functions which are created by the C programmer, so thathe/she can use it many times. Itreduces the complexity of abig program andoptimizes the code.

ReturnValue

A C function may or may not return a value from the function. If you don't have to return any value from the function, use void for the return type.

Let'sseeasimpleexampleofCfunctionthatdoesn'treturnanyvaluefromthefunction.

Examplewithoutreturnvalue:

```
void hello(){

printf("helloc");

}
```

If youwanttoreturnanyvaluefrom thefunction,youneedtouseanydatatypesuchasint, long, char, etc. The return type depends on the value to be returned from the function.

Let'sseeasimpleexampleofCfunctionthatreturnsintvaluefromthefunction.

Examplewithreturnvalue:

```
int get(){

return10;

}
```

In the above example, we have to return 10 as a value, so the return type is int. If you want to return floating-point value (e.g., 10.2, 3.1, 54.5, etc), you need to use float as the return type of the method.

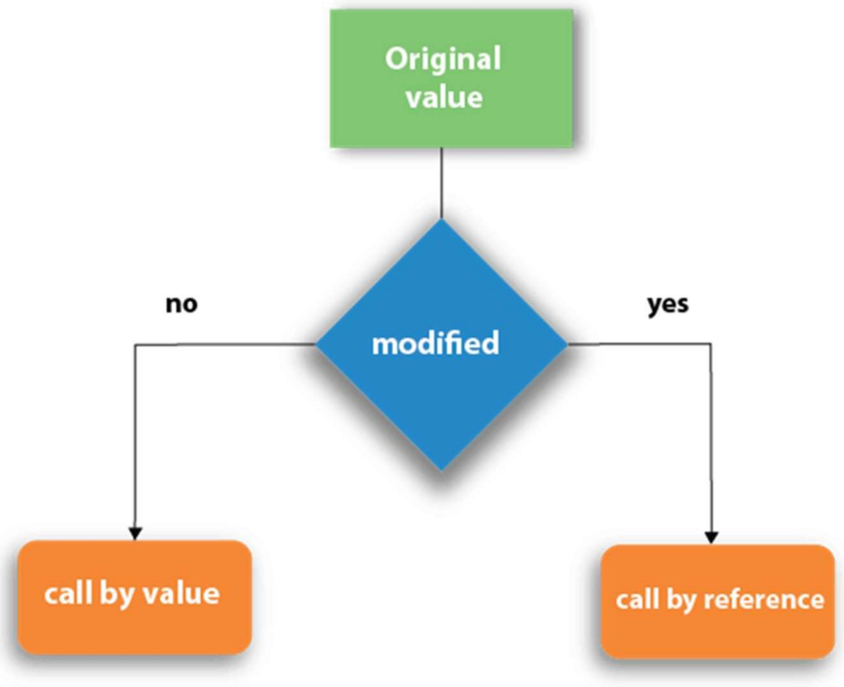
Typesoffunctionsintermsofargumentandreturnvalue:

A function may or may not accept any argument. It may or may not return any value. Based on these facts, There are four different aspects of function calls.

- functionwithoutargumentsandwithoutreturnvalue
- functionwithoutargumentsandwithreturnvalue
- functionwithargumentsandwithoutreturnvalue
- functionwithargumentsandwithreturnvalue

CallbyvalueandCallbyreferenceinC

Therearetwomethodstopassthedataintothefunctionin Clanguage,i.e., callbyvalueandcall by reference.



CallbyvalueandCallbyreferenceinC

Therearetwomethodstopassthedataintothefunctionin Clanguage,i.e., callbyvalueandcall by reference.

CallbyvalueinC

- In call by value method, the value of the actual parameters is copied into the formal parameters. In other words, we can say that the value of the variable is used in the function call in the call by value method.
- In call by value method, we can not modify the value of the actual parameter by the formal parameter.
- In call by value, different memory is allocated for actual and formal parameters since the value of the actual parameter is copied into the formal parameter.
- The actual parameter is the argument which is used in the function call whereas formal parameter is the argument which is used in the function definition.

CallbyreferenceinC

- In call by reference, the address of the variable is passed into the function call as the actual parameter.
- The value of the actual parameters can be modified by changing the formal parameters since the address of the actual parameters is passed.
- In call by reference, the memory allocation is similar for both formal parameters and actual parameters. All the operations in the function are performed on the value stored at the address of the actual parameters, and the modified value gets stored at the same address.

Practical-7

AIM: Write a C Program using concept of function.

(a) Write a program that defines a function to add first “n” numbers.

(b) Write a program using function to find maximum number from two numbers.

(c) Write a function in the program to return 1 if number is prime otherwise return 0

Solution:

RubricsWiseMarksObtained:

Knowledgeof subject (2)		Programming Skill		Teamwork(2)		CommunicationSkill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

Practical-8

AIM: Write a C Program using concept of function.

(a) Write a program to exchange two numbers using function

(b) Write a program to reverse the number usingfunction.

(c) Write a program to generate first “n” number of Fibonacci series using recursion.

Solution:

RubricsWiseMarksObtained:

Knowledgeof subject (2)		Programming Skill		Teamwork(2)		CommunicationSkill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

ArraysinC

Arrays are used to store multiple values in a single variable, instead of declaring separate variablesfor eachvalue.Tocreateanarray, definethedatatype(likeint)andspecifythenameof the array followed by square brackets [].To insertvalues to it, use a comma-separated list, inside curly braces:

IntmyNumbers[]={25,50,75,100};

Wehavenowcreatedavariablethatholdsanarrayoffourintegers.

AccesstheElementsofanArray

To access an array element, refer to its index number.Array indexes start with 0: [0] is the first element. [1] is the second element, etc.

Thisstatementaccessesthevalueofthefirstelement[0]inmyNumbers:

Example

intmyNumbers[]={25,50,75,100};

printf("%d", myNumbers[0]);

//Outputs25

AdvantageofCArray

1) CodeOptimization:Lesscodetotheaccessthedata.

2) Easeoftraversing:Byusingtheforloop,wecanretrievetheelementsofanarrayeasily.

3) Easeofsorting:Tosorttheelementsofthearray,weneedafewlinesofcodeonly.

4) RandomAccess:Wecanaccessanyelementrandomlyusingthearray.

DisadvantageofCArray

1) Fixed Size: Whatever size, we define at the time of declaration of the array, we can't exceed the limit. So, it doesn't grow the size dynamically like LinkedList which we will learn later.

TwoDimensionalArrayinC

The two-dimensional array can be defined as an array of arrays. The 2D array is organized as matrices which can be represented as the collection of rows and columns. However, 2D arrays arecreatedtoimplementarelationaldatabaselookalikedatastructure.Itprovideseaseof holding the bulk of data at once which can be passed to any number of functions wherever required.

DeclarationoftwodimensionalArrayinC

Thesyntaxtodeclarethe2Darrayisgivenbelow.

data_typearray_name[rows][columns];

C Pointers

The pointer in C language is a variable which stores the address of another variable. Thisvariable can be of type int, char, array, function, or any other pointer. The size of the pointer depends on the architecture. However, in 32-bit architecture the size of a pointer is 2 byte.Consider the following example to define a pointer which stores the address of an integer.

int n = 10;

int*p=&n;

Declaringapointer

Thepointerinclanguagecanbedeclaredusing*(asterisksymbol).Itisalsoknownas indirection pointer used to dereference a pointer.

int *a;//pointer to int

char*c;//pointertochar

Pointer to array

intarr[10];

int *p[10]=&arr;

Pointertoafunction

void show (int);

void(*p)(int)=&display;

Pointer to structure

structst {

int i;

floatf;

}ref;

structst*p=&ref;

Advantageofpointer

1) Pointer reduces the code and improves the performance, it is used to retrieving strings, trees, etc. and used with arrays, structures, and functions.

2) Wecanreturnmultiplevaluesfromafunctionusingthepointer.

3) Itmakesyouabletoaccessanymemorylocationinthecomputer'smemory.

Usageofpointer

Thereare manyapplicationsofpointersinclanguage.

1) Dynamicmemoryallocation

In c language, we can dynamically allocate memory using malloc() and calloc() functions where the pointer is used.

2) Arrays,Functions,andStructures

Pointers in c language are widely used in arrays, functions, and structures. It reduces the code and improves the performance.

AddressOf(&)Operator

The address of operator '&' returns the address of a variable. But, we need to use %u to display the address of a variable.

Whyusestructure?

In C, there are cases where we need to store multiple attributes of an entity. It is not necessary that an entity has all the informationof one typeonly. It can have different attributes of different data types. For example, an entity Student may have its name (string), roll number (int), marks (float). To store such type of information regarding an entity student, we have the following approaches:

Construct individual arrays for storing names, roll numbers, and marks.

Useaspecialdatastructuretostorethecollectionofdifferentdatatypes. **What is**

Structure

Structure in c is a user-defined data type that enables us to store the collection of different data types. Each element of a structure is called a member. Structures ca; simulate the use of classes and templates as it can store various informationThe ,struct keyword is used to define the structure. Let's see the syntax to define the structure in c.

```
structstructure_name

{

data_typemember1;

data_typemember2;

    .

    .

data_typememeberN;

};
```

Let'sseetheexampletodefineastructureforanentityemployeeinc. struct

```
employee

{intid;

charname[20];

float salary;

};
```

Declaringstructurevariable

We can declare a variable for the structure so that we can access the member of the structure easily. There are two ways to declare structure variable:

Bystructkeywordwithinmain()function

Bydeclaringavariableatthetimeofdefiningthestructure.

1stway:

Let's see the example to declare the structure variable by struct keyword. It should be declared within the main function.

structemployee

{intid;

charname[50];

float salary;

};

Nowwritegivencodeinsidethemain()function. struct

employee e1, e2;

The variables e1 and e2 can be used to access the values stored in the structure. Here, e1 and e2 can be treated in the same way as the objects in C++ and Java.

2ndway:

Let'sseeanotherwaytodeclarevariableatthetimeofdefiningthestructure. struct

employee

{intid;

charname[50];

float salary;

}e1,e2;

Accessingmembersofthestructure

Therearetwowaystoaccessstructuremembers:

1) By.(memberordotoperator)
2) By->(structurepointeroperator)

Let'sseethecodetoaccesstheidmemberofp1variableby.(member)operator. p1.id

CStructureexample

Let'sseeasimpleexampleofstructureinClanguage.

#include<stdio.h>

#include<string.h>

```
structemployee

{intid;

charname[50];

}e1;//declaringe1variableforstructure int

main( )

{

  //storefirstemployeeinformation

  e1.id=101;

strcpy(e1.name,"SonooJaiswal");//copyingstringintochararray

  //printing first employee information

printf( "employee 1 id : %d\n",

e1.id);printf("employee1name:%s\n",e1.na

me); return 0;

}
```

FileHandlinginC

In programming, we may require some specific input data to be generated several numbers of times. Sometimes, it is not enough to only display the data on the console. The data to be displayed may be very large, and only a limited amount of data can be displayed on the console, and since the memory is volatile, itis impossible to recover the programmatically generated data again and again. However, if we need to do so, we may store it onto the local file system whichis volatile and can be accessed every time. Here, comes the need of file handling in C.

File handling in C enables us to create, update, read, and delete the files stored on the local file system through our C program. The following operations can be performed on a file.

- Creationofthenew file
- Openinganexistingfile
- Readingfromthefile
- Writingtothefile
- Deletingthefile

Functionsforfilehandling

There are many functions in the C library to open, read, write, search and close the file. A list of file functions are given below:

No.	Function	Description
1	fopen()	opensneworexistingfile
2	fprintf()	writedata intothefile
3	fscanf()	readsdatafrom thefile
4	fputc()	writesacharacterinto thefile
5	fgetc()	readsacharacterfromfile
6	fclose()	closesthe file
7	fseek()	setsthefilepointer togivenposition
8	fputw()	writesanintegerto file
9	fgetw()	readsanintegerfrom file
10	ftell()	returnscurrentposition
11	rewind()	setsthefilepointer tothebeginningofthefile

OpeningFile:fopen()

We must open a file before it can be read, write, or update. The fopen() function is used to opena file. The syntax of the fopen() is given below.

FILE*fopen(constchar*filename,constchar*mode); The

fopen() function accepts two parameters:

The file name (string). If the file is stored at some specific location, then we must mention the path at which the file is stored. For example, a file name can be like "c://some_folder/some_file.ext".

The mode in which the file is to be opened. It is a string.We can use one of the following modes in the fopen() function.

Mode	Description
R	opensatextfileinreadmode
w	opensatextfileinwritemode
A	opensatextfileinappendmode
r+	opensatextfileinreadandwritemode
w+	opensatextfileinreadandwritemode
a+	opensatextfileinreadandwritemode
rb	opensabinaryfileinreadmode
wb	opensabinaryfileinwritemode
ab	opensabinaryfileinappendmode
rb+	opensabinaryfileinreadandwritemode
wb+	opensabinaryfileinreadandwritemode
ab+	opensabinaryfileinreadandwritemode

Practical -9

AIM: Write a C Program using the concept of an array.

(a) Write a C program to find out the Maximum and Minimum number from given 10 numbers in an array.

(b) Write a program to sort the elements of an array in ascending order.

(c) Write a C program to read 10 numbers from user and store them in an array. Display Sum, Minimum and Average of the numbers

Solution:

RubricsWiseMarksObtained:

Knowledgeof subject (2)		Programming Skill		Teamwork(2)		CommunicationSkill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

<u>Practical - 10</u>

<u>AIM</u>: Write a C Program using the concept of pointer, structure & File.

(a) Write a program to access elements using pointer.

(b) Design a structure student record to contain name, branch and total marks obtained. Develop a program to read data for 10 students in a class and print them.

(c) A file named data contains series of integer numbers. Write a program to read all numbers from file and then write all odd numbers into file named "odd" and write all even numbers into file named "even". Display all the contents of these file on screen

(d) Define a structure "personal" that would contain person name, date of joining and salary. Using this structure read in formation of 5 people and print the same on screen. Also display sum of salary of all 5 people.

Solution:

RubricsWiseMarksObtained:

Knowledgeof subject (2)		Programming Skill		Teamwork(2)		CommunicationSkill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

CO-5 Debug and troubleshoot programming errors bysystematically testing and refining code.

Debugging in Software Engineering is the process of identifying and resolving errors or bugs in a software system. It’s a critical aspect of software development, ensuring quality, performance, and user satisfaction. Despite being time-consuming, effective debugging is essential for reliable and competitive software products. Debugging is important because it makes sure the software works well and people have a good time using it.

Debugging tools are essential for software development, helping developers locate and fixcoding errors efficiently. With the rapid growth of software applications, the demand for advanced debugging tools has increased significantly. Companies are investing heavily in these tools, and researchers are developing innovative solutions to enhance debugging capabilities. Here are some of the most commonly used debugging tools.

IntegratedDevelopmentEnvironments(IDEs)

IDEslikeVisualStudio,Eclipse,andPyCharmofferfeaturesforsoftwaredevelopment, including built-in debugging tools. These tools allow developers to:
Executecodeline-by-line(stepdebugging)
Stopprogramexecutionatspecificpoints(breakpoints)
Examine the state of variables and memory

StandaloneDebuggers

StandalonedebuggerslikeGDB(GNUDebugger)provide advanceddebuggingfeatures:
Conditional breakpoints and watchpoints
Reversedebugging(runningaprogrambackwards)

LoggingUtilities

Logging utilities log a program’s state at various points in the code, which can then be analyzed to find problems. Logging is particularly useful for debugging issues that only occur in production environments.

StaticCodeAnalyzers

Static code analysis tools examine code without executing it to find potential errors and deviations from coding standards. They focus on the semantics of the source code, helping developers catch common mistakes and maintain consistent coding styles.

DynamicAnalysisTools

Dynamic analysis tools monitor software as it runs to detect issues like resource leaks or concurrency problems. These tools help catch bugs that static analysis might miss, such as memory leaks or buffer overflows.

Testing	Debugging
Testingistheprocesstofindbugsanderrors.	Debuggingistheprocessofcorrectingthebugs found during testing.
The purpose of testing is to identify defects or errors in the software system.	Thepurposeofdebuggingistofixthose defects or errors.
Testingisdonebeforedebugging	Debuggingisdoneaftertesting
Testinginvolvesexecutingthesoftwaresystem with test cases	Debugginginvolvesanalyzingthesymptoms ofaproblemandidentifyingtherootcauseof the problem

Practical -11

AIM: Write output of following a piece of code and if there is any error present in the code, identify the error(s) & correct it.

1.
```
        Intmain ()
{
inti=10;
 do {
          printf("%d",i);
          i++;
     }while(i<10);
return 0;
}
```

2.
```
intfunct1(intn);
int main()
{
         intn=10;
         printf("%d",funct1(n));
         return0;
 }
 intfunct1(intx)//functiondefinition
 {
         if(x>0)
             returnx+funct1(x-1);
  }
```

RubricsWiseMarksObtained:

Knowledgeof subject (2)		Programming Skill		Teamwork(2)		CommunicationSkill (2)		Ethics(2)	
Good (2)	Average (1)	Good (2)	Average (1)	Good (2)	Satisfactory (1)	Good (2)	Satisfactory (1)	Good (2)	Average (1)

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						