



Answer the following questions:

Question [1] (25 marks) [ILOs: a1,b1,b2,c1,c2,c3,c4]

**a) What is the meaning of: Data Structures, Trees, and Graphs?
(Explain your answer by details.)**

Data Structure is a way of collecting and organizing data in such a way that we can perform operations on these data in an effective way. Data Structures is about rendering data elements in terms of some relationship, for better organization and storage

In simple language, **Data Structures** are structures programmed to store ordered data, so that various operations can be performed on it easily.

A **tree** is a data structure made up of nodes or vertices and edges without having any cycle. The tree with no nodes is called the null or empty tree. A tree that is not empty consists of a root node and potentially many levels of additional nodes that form a hierarchy.

A **graph** is a pictorial representation of a set of objects where some pairs of objects are connected by links. The interconnected objects are represented by points termed as **vertices**, and the links that connect the vertices are called **edges**.

b) What is the output of the following C program?

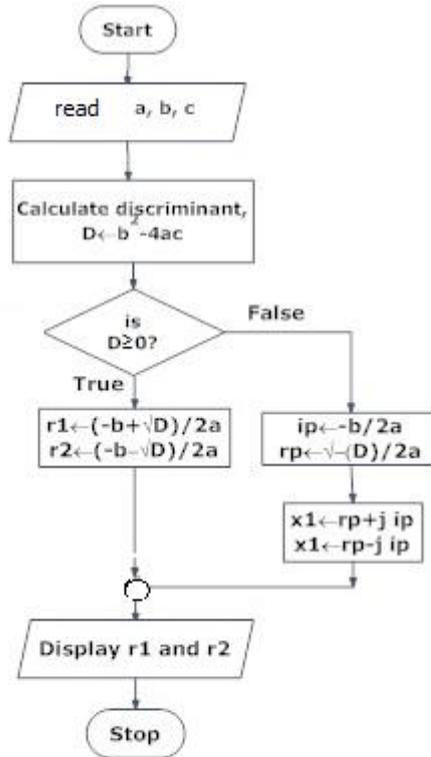
```
#include <stdio.h>
void main()
{ int i,j;
  for (i=1; i<=9; i=i+1)
  { for(j=1;j<=9;j++)
    if(j>i)
      printf("\t");
    else
      printf(" %d*%d=%d\t", i,j,i*j);
    printf("\n");
  }
}
```

The output is:

```
1*1=1
2*1=2   2*2=4
3*1=3   3*2=6   3*3=9
4*1=4   4*2=8   4*3=12  4*4=16
5*1=5   5*2=10  5*3=15  5*4=20  5*5=25
6*1=6   6*2=12  6*3=18  6*4=24  6*5=30  6*6=36
7*1=7   7*2=14  7*3=21  7*4=28  7*5=35  7*6=42  7*7=49
8*1=8   8*2=16  8*3=24  8*4=32  8*5=40  8*6=48  8*7=56  8*8=64
9*1=9   9*2=18  9*3=27  9*4=36  9*5=45  9*6=54  9*7=63  9*8=72  9*9=81
```



c) Draw a flowchart, write an algorithm and write a C program to compute all roots of the equation: $ax^2 + bx + c = 0$



The algorithm is:

Step 1: input a, b, c

Step 2: Calculate discriminant
 $D \leftarrow b^2 - 4ac$

Step 3: If $D \geq 0$

$r1 \leftarrow (-b + \sqrt{D}) / 2a$

$r2 \leftarrow (-b - \sqrt{D}) / 2a$

Display r1 and r2 as roots.

Else

Calculate real part and imaginary part

$rp \leftarrow b / 2a$

$ip \leftarrow \sqrt{-D} / 2a$

Display $rp + j(ip)$ and $rp - j(ip)$ as roots

C program:

```
#include <stdio.h>
#include <math.h>
void main()
{ double a, b, c, determinant, root1,root2, realPart, imaginaryPart;
  printf("Enter coefficients a, b and c: ");
  scanf("%lf %lf %lf",&a, &b, &c);
  determinant = b*b-4*a*c;
  if (determinant >= 0)
  {
    root1 = (-b+sqrt(determinant))/(2*a);
    root2 = (-b-sqrt(determinant))/(2*a);
    printf("root1 = %.2lf and root2 = %.2lf",root1 , root2);
  }
  else
  {
    realPart = -b/(2*a);
    imaginaryPart = sqrt(-determinant)/(2*a);
    printf("root1 = %.2lf+%.2lfi and root2 = %.2f-%.2fi", realPart, imaginaryPart, realPart, imaginaryPart);
  }
}
```

Question [2] (60 marks) [ILOs: a1,b3,b4,b7,c1,c2,c3,c4]

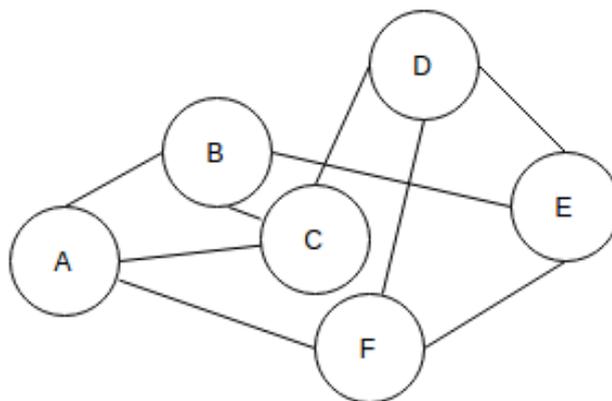
أجب عن هذا السؤال بالورقة المخصصة لذلك والموجودة في نهاية ورقة الإجابة

• **Write True (T) or False (F) for the following sentences:**

- 1) An algorithm is a sequence of unambiguous instructions for solving a problem. (T)
- 2) Process of inserting an element in stack is called **Push**. (T)
- 3) Time complexity of bubble sort in best case is $O(n)$. (T)
- 4) The following C loop is run forever: **for(;;) printf(" welcome");** (T)
- 5) There are 2 errors in the following C code: **scanf("%d, %d",&a,b);** (T)
- 6) An algorithm should exhibit at least two output. (F)
- 7) Flowchart is a mathematical tool representing the defined solution of a problem. (F)
- 8) There are no errors in the following C code: **printf("x=",x);** (F)
- 9) There are no errors in the following C code: **for(i=5; i<=10; ++);** (F)
- 10) There is 1 error in the following C code: **scanF("%d",&a);** (T)
- 11) A queue is FIFO (First In First Out) list. (T)
- 12) Switch statement can have any number of case instances. (T)
- 13) continue keyword skip one iteration of loop. (T)



- 14) The keywords cannot be used as variable names. (T)
- 15) Functions can be called either by value or reference. (T)
- 16) The output of: `printf("%10.5f ", 65.5);` is `65.55555` (F)
- 17) There are no errors in the following C code: `if(x=5) printf("%d",x);` (F)
- 18) `continue;` statement is used to break any loop. (F)
- 19) There are 2 errors in the following C code: `int area(int L, int W) L*W;` (F)
- 20) Functions cannot return more than one value at a time. (T)
- 21) A function cannot be defined inside another function. (T)
- 22) After each iteration in bubble sort, at least one element is at its sorted position. (T)
- 23) The correct size of the datatypes is `char < int < double`. (T)
- 24) Process of removing an element from stack is called **Pop**. (T)
- 25) A do-while loop is used to ensure that the statements within the loop are executed at least twice. (F)
- 26) Every function must return a value. (F)
- 27) The following C loop is run for 1 time: `while(1) {printf("x=%f ",x);}` (F)
- 28) Maximum number of arguments that a function can take is 12. (F)
- 29) `=` is used for comparison, whereas, `==` is used for assignment of two quantities. (F)
- 30) The given Graph is regular. (T)





• **Select the suitable answer of the following:**

- 31) A procedure for solving a problem in terms of actions and their order, is called as
a) Algorithm b) Program instructions c) Template d) All of them
- 32) An artificial and informal language that helps programmers to develop algorithms, is called
a) Instruction code b) Pseudocode c) Algocode d) Control code
- 33) Which of the following is used to terminate the function declaration?
a) : b)) c) ; d) none of the mentioned
- 34) Which is more effective while calling the functions?
a) call by value b) None of them c) call by pointer d) call by reference
- 35) How many minimum number of functions are need to be presented in C language?
a) 0 b) 3 c) 2 d) 1
- 36) The switch statement is also called as:
a) choosing structure b) certain structure c) selective structure d) none of the mentioned
- 37) Which of the following correctly declares an array?
a) int array; b) int array[10]; c) array{ 10}; d) array array[10];
- 38) What is the index number of the last element of an array with 7 elements?
a) 6 b) 7 c) 0 d) Programmer-defined
- 39) Which of the following accesses the fifth element stored in array?
a) array[4]; b) array[5]; c) array(5); d) array;
- 40) Which of the following gives the memory address of the first element in array?
a) array[0]; b) array; c) array(2); d) array[1];
- 41) Which looping process is best used when the number of iterations is known?
a) do-while b) while c) for d) None of these
- 42) It is guaranteed that a _____ has at least 1 Byte and a _____ has at least 2 Bytes.
a) int, float b) char, int c) bool, char d) char, short
- 43) A well designed computer program must be:
a) correct and accurate b) easy to understand c) flexible d) all of them
- 44) Number of error in following program is:
#include<studio.h>
void main(){print ("Good Luck in Your C course.\n");}
a) Zero b) None of these c)4 d) 2
- 45) Number of error in following program is:
#include<stdio.h>
void Main(){printf("How are you?\n");}
a) 2 b) Zero c) 1 d)None of these
- 46) Number of error in the following C code is: **printf("How are you?\n");**
a) 2 b)Zero c)1 d)None of these
- 47) Number of error in the following C code is: **printF("How are you?\n")**
a) 2 b)Zero c)1 d)None of these



- 48) The output of the following C program is:
`#include<stdio.h>`
`void main(void){int i=0; while(1){printf(" %d", ++i); if(i==4) break;}}`
a) 1 2 3 4 b) 1 2 3 c) i=1 i=2 i=3 i=4 d) Non of these
- 49) The output of the following C program is:
`#include<stdio.h>`
`void main(void){int i; for(i=1; i<=3; i++)`
`{printf("%d", i); if(i==3) continue; printf("%d",i);}}`
a) 112233 b) 11223 c) 123123 d) 332211
- 50) The output of the following C program is:
`#include<stdio.h>`
`int a[3]; void main(void){int i; for (i=0; i<3; i++) printf("a[%d]=%d", i, a[i]);}`
a) a[0]=1a[1]=2a[2]=3 b) 000 c) a[0]=0a[1]=0a[2]=0 d) 123
- 51) The format identifier `%i` is also used for _____ data type?
a) char b) double c) float d) int
- 52) Which data type is most suitable for storing a number 65000 in a 32-bit system?
a) double b) int c) long d) short
- 53) What is the size of an int data type?
a) 4 Bytes b) 8 Bytes c) 1 Byte d) Depends on the system/compiler
- 54) What is the size of float in a 32-bit compiler?
a) 1 Byte b) 2 Bytes c) 8 Bytes d) 4 Bytes
- 55) `%f` access specifier is used for
a) Integer type b) Character type c) Floating type d) String type
- 56) What is the output of: `int main() {float a = 5.47772222222; printf("%f", a); }`
a) 5.4777222 b) 5.477722 c) 5.478 d) 5.48
- 57) Which data type is suitable for storing a number like? **10.0000000001**
a) double b) float c) int d) Both (b) and (c)
- 58) What is the output of this C code? `void main() { int i = 7; i = i / 4; printf("%d\n", i); }`
a) Run time error b) 1 c) 3 d) Compile time error
- 59) What is the value of x in this C code? `void main() { int x = 4 * 5 / 2 + 9; }`
a) 6.75 b) 1.85 c) 19 d) 3
- 60) Which of the following is not an arithmetic operation?
a) `a *= 20;` b) `a /= 30;` c) `a %= 40;` d) `a != 50;`