PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE, ETC -2021

CASE NO. 3C2022

SUBJECT: COMPUTER SCIENCE (PAPER-I)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE:

i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

NOTE: Attempt FIVE Questions in All. Attempt at least ONE question from each Section.

SECTION-A

Q No.1: a) Convert decimal number "25" into binary number using the binary notation method.

b) Write down the names of five devices that uses embedded operating system.

c) What are machine independent languages? Give the names of two machine independent languages.

(8+5+7=20 Marks)

Q No.2: a) What will be the output of the following code?

```
int main()
{
float value =3;
if ( value >=4 )
cout<<"Report is positive";
else
cout<<"Report is Negative";
return 0;
}
```

b) Which devices are used by AI agents for the following purposes?

1. To perceive the environment.
2. To affect the environment.

c) Find any errors in the following function prototypes:

1. int sum(int x,y);
2. int sum(int x,int y)
3. int sum(int x,void y);

(6+8+6=20 Marks)

SECTION-B

Q No.3: **a)** Write down the names of 5 main components of data communication.

b) Consider the data rate of the signal as 2Kbps having duration of noise signal 1/100 seconds. Calculate the number of impacted /effected bits.

c) Which TCP/IP layer is used for internet working? Write the layer name. Also mention the type of address which is used on this layer.

(5+10+5=20 Marks)

Q No.4: **a)** Simplify the following Boolean expression so that it uses minimum number of gates.

$$\overline{\left(\overline{A+B+C+\overline{D}}\right)+\left(\overline{ABC}\right)}$$

b) Draw the circuit diagram of NAND based S-R Latch.

(12+8=20 Marks)

Q No.5: **a)** In case of memory segmentation, what will be the system behavior when it meets a segment fault?

b) What is the difference between computer organization and computer architecture? Write two attributes of both computer organization and computer architecture.

(8+12=20 Marks)

SECTION-C

Q No.6: **a)** Which method is better to implement "List" if we are not sure about the number of elements that will be inserted in the list? Give reason to support your answer.

b) Given input {23, 46, 12, 59, 78, 87, 2, 3} and a hash function **h(x) =x mod 11**, show the resulting "Chaining hash table".

(8+12=20 Marks)

Q No.7: **a)** Draw an AVL tree from the following nodes in the given order:

17, 18, 5, 15 and 7

Show all the steps (insertions and rotations) pictorially.

b) Differentiate between Turnaround time and Response time.

c) Suppose a deadlock occurs in the system and the deadlock detection algorithm detects a deadlock then how these deadlocks will be recovered? Mention any two method names.

(8+6+6=20 Marks)

Q No.8: **a)** Critical section problem has different hardware and software based solution. You have to write an algorithm that shares two variables among processes.

b) In memory management, how does a page fault occur and who is responsible to handle page fault if it occurs?

(12+8=20 Marks)

A) Considering the above CHART table and write queries to solve the following problems

i. Retrieve the account with the highest balance **(2 marks)**

ii. Calculate the total balance of each account_ type **(2 marks)**

B) Write a procedure that deducts 10,000 and updates all balances that are greater than 50,000. For example if the balance is 70,000 then it deducts 10,000 and saves the remaining 60,000 back to the database. **(4 marks)**

C) List the different ways that we can execute a stored procedure in SQL Server. **(3 marks)**

D) Create a temporary table that have the same schema as of charts table and copy the data from charts table to the new table **(3 marks)**

4. Explain how the following objects increases performance and in which operations **(3 marks)**

a. stored procedures

b. indexes

5. Define triggers and explain the different types of triggers in SQL Server **(3 marks)**

Q.No.7

A) Show the printout of following program code. **(2 marks)**

```
public class Test
{
        public static void main(String[] args)
        {
                double[][] m = {{1, 2, 3}, {1.5, 2.5, 3.5}, {0.1, 0.1,
        0.1}};
                System.out.println(sum(m));
        }
        public static double sum(double[][] m)
        {
                double sum = 1;
                for (int i = 0; i < m.length; i++)
                {
                        sum += m[i][i];
                        return sum;
                }
        }
}
```

B) What is the difference between pointer and reference? Explain the working of both pointer and reference variable? What is difference between pointer to reference and reference of a pointer? **(4 marks)**

C) What is the significance of Fibonacci sequence? **(1 mark)**

D) Write a program that takes the maximum range for calculating the Fibonacci and then calculate the Fibonacci series of numbers. **(4 marks)**

E) Explain Polymorphism, virtual functions, inheritance with the help of C++ code **(6 marks)**

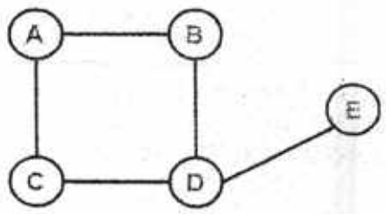
F) Write a sample code to explain object oriented exception handling in C++. How this is different in Java? **(3 marks)**

Q.No.8

A) In a road network graph, vertices represent intersections and edges represent roads. If we want to model both one-way and two-way roads, what kind of graph that will be and why? **(2 Marks)**

B) Suppose a graph has 11 vertices and 19 edges. Each of the odd-degree vertices has degree 3 and each of the even-degree vertices has degree 4. Find the numbers of the odd-degree and the even-degree vertices? **(2 marks)**

C) Determine whether the following graph is a bipartite graph. **(1 mark)**



D) Draw a directed weakly connected graph of your choice. **(1 mark)**

E) Draw a tree using the following information: **(3 marks)**

i The parent of h is g.

ii The ancestors of d are (from top to bottom) g, f and l.

iii e, k and l are siblings.

iv The descendants of h are a, b, l and j.

v a, b, c and d are leaves at level 3.

vi a and b has no other siblings.

vii e, j and k are leaves.

viii The tree is balanced.

F) A full m-ary tree has 136 vertices. Among them, 109 are leaves. Calculate the values of m, and the number of edges in the tree. **(3 marks)**

G) In a game of UNO, there are cards of 4 colors- red, green, blue and yellow. There are 25 cards for each color (there are some special cards, but we will not be considering them now). A player is dealt 7 cards in a round. **(4 marks)**

i Explain why there is no guarantee that a player will get at least 2 red cards.

ii How many cards should be picked to ensure that he gets at least 2 red cards?

H) A coin is tossed 6 times such that every time it can land either on heads or tails. How many possible outcomes contain an odd number of heads? **(2 marks)**

I) There are n1 computer science courses and n2 computer engineering courses available at a certain university. A student has to select r1 courses from computer science courses and r2 courses from computer engineering courses. If the order of the courses taken are important, then how many ways can a student complete the courses? **(2 marks)**

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NOTE: Attempt any FIVE Questions in All. Calculator is allowed (not programmable)

Q.No.1

A) What are the sorting algorithms? Describe the importance/application of any 4 sorting algorithms in modern computing. **(5 Marks)**

B) Discuss the space and time complexity of any of 5 sorting algorithms. **(10 Marks)**

C) Outline the psedocode and flow diagram of the ShellSort. **(5 Marks)**

Q.No.2

A) What is a Binary Search Tree (BST)? What is its searching complexity? **(2 Marks)**

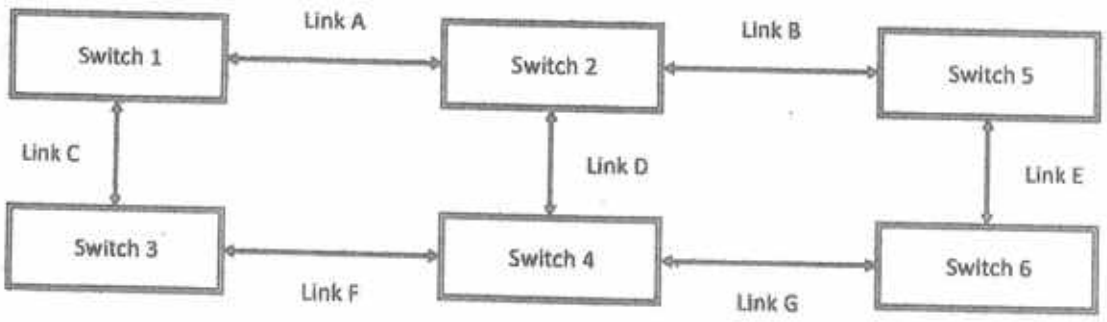
B) Make a BST for the following sequence of numbers. **(3 Marks)**

99, 45, 36, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48, 11

C) Traverse the tree in Pre-order and Post-order **(3 Marks)**

D) With an ASCII encoding (8 bits per character) the 13-character string "computer science" requires 128 bits to send. You can use Huffman's algorithm to construct a tree that is used for data compression. Calculate minimum bits of stream using Huffman's algorithm to send the given string. **(6 Marks)**

E) What is MaxHeap and Minhap? Sort the numbers (7, 6, 6, 1, 9, 2, 2, 4, 4, 0, 1) in ascending order by using heap sort. **(6 Marks)**



Q.No.3

The network illustrated above represents an Ethernet Layer-2 network that uses spanning-tree to compute forwarding tables. Assume all links have a link-weight of one.

[Note: Tie-breaking/leader-elections use the switch identifier from this diagram.]

A) Compute the steady state routing/forwarding table for Switch 3. **(4 marks)**

B) Noting which switches recomputed a solution, enumerate the changed forwarding tables in switches of this network resulting from the complete failure and removal of link D. **(9 marks)**

C) Following the removal of Link D, a new link H is added between Switch 1 and 4; however, this link fails frequently. Denied access to monitor the network-traffic, outline a diagnostic strategy to identify the faulty Link H, making clear how the network-operator might use interrogation of network switch forwarding tables. **(4 marks)**

D) Now suppose the switches do not permit interrogation of switch forwarding tables and that the link status information is untrustworthy. Outline other techniques that might be used to identify the failed link. **(3 marks)**

Q.No.4

A) Describe the main processes in a modern software development environment, and the tools used to support them. **(6 marks)**

B) If the software were safety-critical, such as the control software for a car's anti-lock braking system (ABS), which other processes might be added? **(4 marks)**

C) You are developing control software for a car whose latest model will have a network connection. Software upgrades will be delivered over the air rather than at service visits, so that any security vulnerabilities can be patched quickly. This in turn means that you will have to provide patches, to deal with both security and safety issues for the next 25 years. Discuss how this is likely to affect your development process, and the implications it will have for costs. **(10 marks)**

Q.No.5

A) What are interrupts and exceptions? How to handle the interrupts and exceptions in the operating system? **(4 Marks)**

B) What is paging? Explain paging in the context of virtual memory. **(4 Marks)**

C) What are semaphores? Explain with the help of examples that how the process can enter into the critical section. **(4 Marks)**

D) What is the banker's algorithm? How does it work? Explain with the help of examples **(4 Marks)**

E) What is the role of API, ABI and ISA in operating systems? **(4 marks)**

Q. No. 6

CHART		
ACCOUNT_NO	ACCOUNT_TYPE	BALANCE
400	Asset	8,900.02
408	Asset	77,522.08
412	Asset	6,598.32
440	Asset	51,7302.56
640	Asset	6,500.00
420	Expense	17,924.52
560	Expense	85,147.20
416	Income	21,5876.25
480	Income	6,598.32
800	Liability	70,200.00
840	Liability	856.19
880	Liability	546,987.12
920	Revenue	2,365.00