FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2025 FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT

Roll Number

COMPUTER SCIENCE, PAPER-I

TIME ALLOWED: THREE HOURS **PART-I (MCQs) : MAXIMUM 30 MINUTES**	**(PART-I MCQs) MAXIMUM MARKS: 20** **(PART-II) MAXIMUM MARKS: 80**

NOTE: (i) First attempt **PART-I (MCQs)** on separate **OMR Answer Sheet** which shall be taken back after **30 minutes.**
(ii) Overwriting/cutting of the options/answers will not be given credit.
(iii) There is **no negative** marking. All MCQs must be attempted.

PART-I (MCQs)(COMPULSORY)

Q.1. (i) Select the best option/answer and fill in the appropriate Box ☐ on the **OMR Answer Sheet.(20x1=20)**
(ii) Answers given anywhere else, other than OMR Answer Sheet, will not be considered.

1. **What is the degree of leaf node in a tree?**
(A) 0 (B) 1 (C) 2 (D) None of these
2. **What is the main goal of Capability Maturity Model Integration (CMMI)?**
(A) To enhance maturity of software process (B) To increase the quality of software
(C) To provide user friendly experience (D) None of these
3. **Which type of software testing is used to confirm whether the software is according to customer's requirements?**
(A) Performance testing (B) Acceptance testing (C) Regression testing (D) None of these
4. **Which of the following is commonly used for measuring the performance of supercomputers?**
(A) Gigahertz (GHz) (B) Teraflops (Tflops) (C) Petabyte (PB) (D) None of these
5. **Which software development model uses iterative cycles and continuous development?**
(A) Agile model (B) Spiral model (C) V-model (D) None of these
6. **Which of the following is the false statement in C language?**
(A) static a = 10; (B) static int func (int); (C) static static int a; (D) None of these
7. **Which programming language uses the concept of friend function?**
(A) Python (B) Java (C) C# (D) None of these
8. **What is meant by refactoring code in SDLC?**
(A) To modify the functionality of software (B) To improve the code quality
(C) To find out bugs in a software (D) None of these
9. **What is the main purpose of using Trojans?**
(A) To get passwords (B) To delete data (C) To corrupt files (D) None of these
10. **What is the correct data structure for implementing Huffman algorithm?**
(A) Priority queue (B) Linked list (C) Binary Tree (D) None of these
11. **Which asymptotic notation gives the strict upper bound for a function?**
(A) Omega notation (B) Big O notation (C) Theta notation (D) None of these
12. **Which one of the following is the fastest way of searching for a given key?**
(A) Sorted array (B) Linked list (C) Binary search tree (D) None of these
13. **What is the role of parser?**
(A) To check logical errors (B) To find syntax errors
(C) To identify run-time errors (D) None of these
14. **Which optimization method involves minimizing the memory access count in a program?**
(A) Constant folding (B) Register allocation (C) Instruction scheduling (D) None of these
15. **What is the output of the following code?**

```
int main(){
int a = 40;
int* ptr = &a;
int& ref = *ptr;
ref = 60;
cout << a;
}
```

(A) 40 (B) 60 (C) Error (D) None of these
16. **The process of deleting an element from an empty stack is called:**
(A) Overflow (B) Deletion (C) Underflow (D) None of these
17. **How is the head node deleted in a doubly circular linked list?**
(A) By adjusting the prev pointer of the new head node to null.
(B) By setting the next pointer of prev node to point to new head.
(C) By pointing the next pointer of last node to null. (D) None of these

18. **Which technique works by selecting the local optimal choice at each step?**
(A) Dynamic Programming (B) Divide and Conquer (C) Greedy Algorithm (D) None of these

19. **What is the time complexity of searching for an element in a hash table?**
(A) O (1) (B) O (n) (C) O (nlogn) (D) None of these

20. **Which phase of compiler is responsible for abstract syntax tree (AST) generation?**
(A) Syntax analysis (B) Semantic analysis (C) Lexical analysis (D) None of these

PART-II

NOTE: (i) **Part-II** is to be attempted on the separate **Answer Book.**
(ii) Attempt **ONLY FOUR** questions from **PART-II**, by selecting **TWO** questions from **EACH SECTION**. **ALL** questions carry **EQUAL** marks.
(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
(iv) Write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(vi) Extra attempt of any question or any part of the question will not be considered.

SECTION-A

Q. No. 2. **(a)** How is the Generative AI creating impacts on our society? Discuss the benefits and challenges associated with its use. Support your answer by adding examples. **(6)**

(b) Provide a comparison of different data storage devices in terms of speed, size, access time and cost. **(6)**

(c) What are Two's Complement numbers? Explain the working of it with examples. Discuss the practical scenarios where these numbers are used. **(8)**

Q. No. 3. **(a)** What is the difference between shallow copy and deep copy of creating objects in C++. Discuss the cases where a specific copy should be used by providing examples. **(6)**

(b) State the difference between const keyword and static keyword in C++. Illustrate each keyword with suitable examples. **(6)**

(c) Explain the role of pure virtual functions in implementing abstract classes in C++. How do they differ from virtual functions? Give an example of C++ classes where both types of functions are used. **(8)**

Q. No. 4. **(a)** Write a C++ program to output the arithmetic series of n terms. The series formula for calculating the sum of n terms is as follows: $S_n = \frac{n}{2}$ [2a + (n-1) d] , with values a = 5, d= 3 and n= 6, where a = first term, d= common difference and n = number of terms. **(6)**

(b) Write a C++ program to calculate and display the product of two matrices of order 2 x 2. The program should prompt the user to provide values of both matrices **(6)**

(c) Write a C++ program to demonstrate the two different complex numbers using structure. The program should use function to calculate the sum of complex numbers and display their result in the specific format such as (a + bi), where a and b are the real and imaginary part respectively and i is imaginary unit such as $i = \sqrt{-1}$. **(8)**

SECTION-B

Q. No. 5. **(a)** Demonstrate the use of stream insertion and extraction operators for creating custom objects. Provide a suitable coding example for illustrating the functional difference between them. **(10)**

(b) Implement a Book Management System consisting of three different classes. The book class should have data members such as book name, ISBN number, and publication year. The author class should have attributes such as author name, and author email. The publisher class contains attributes such as publisher name, publisher email and publisher address. Each book has an author and a publisher. The author and publisher are created and destroyed with books. When the book is deleted, the corresponding author and publisher should also be deleted. Write a C++ code of this system and explain how the composition relationship is used in this system. **(10)**

Q. No. 6. **(a)** What are self-balancing Binary Search Trees? Under what circumstances, the self-balancing Binary Search Trees are preferred over Binary Search Tree? **(6)**

(b) Give pseudocode of implementing Fibonacci sequence recursively. Find the time complexity of this approach and explain how it is calculated. **(6)**

(c) Suppose you are the owner of a small manufacturing company that delivers goods to customers. During the sale season, you received a huge number of orders. To efficiently manage the orders, you need to sort the packages based on their weights. You are provided with the weights of 10 parcels (in kilograms) as shown below. Use the quick sort method to sort these parcels in ascending order. **(8)**

Weights: [30, 45, 10, 20, 75, 15, 85, 40, 05, 65]

Clearly indicate the choice of pivot and reason for it. Provide a graphical representation with explanation at each step.

Q. No. 7. **(a)** A project management involves different types of planning stages to finalize the project. Discuss the different types of planning phases conducted during software development with list of specific tasks performed during each planning stage. **(6)**

(b) Illustrate the difference between software validation and software verification testing techniques. Give examples to strengthen your answer. Clearly elaborate the case where each type of technique should be used. **(6)**

(c) What is the Software Process Improvement (SPI) framework? Highlight the different steps of SPI framework and the key elements involved. Also provide the description of the models used within SPI framework and how to determine the projects for which SPI framework should be used. **(8)**

Q. No. 8. **(a)** Create a regular expression for the language that always starts with string " baa ". Also draw the deterministic finite automata (DFA) for such language. Provide a clear explanation of each step. **(6)**

(b) What is Instruction Scheduling? Explain its role during code generation process. **(6)**

(c) What is a parse tree? How the parse tree is used to check whether a specific string belongs to a language or not. Provide example to elaborate this. **(8)**

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