FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2024 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. **Which of the following ports is used to connect external devices such as printers, scanners, and cameras to a computer?** (A) USB (Universal Serial Bus) (B) HDMI (High-Definition Multimedia Interface) (C) VGA (Video Graphics Array) (D) None of these
2. **Which type of monitor technology offers the widest viewing angles and accurate color reproduction?**
   (A) CRT (Cathode Ray Tube) (B) OLED (Organic Light-Emitting Diode)
   (C) LCD (Liquid Crystal Display) (D) None of these
3. **Which component is responsible for providing power supply to all other components in a computer system?**
   (A) Power Supply Unit (PSU) (B) Central Processing Unit (CPU) (C) Motherboard (D) None of these
4. **What is an example of system software from the list below?**
   (A) Windows (B) Google Chrome (C) Adobe Photoshop (D) None of these
5. **Which of the following is NOT an agile software development methodology?**
   (A) Scrum (B) Waterfall (C) Kanban (D) None of these
6. **Which was the first purely object-oriented programming language developed?**
   (A) Java (B) C++ (C) SmallTalk (D) None of these
7. **Which language does not allow for inheritance in all four forms?**
   (A) Kotlin (B) Java (C) C++ (D) None of these
8. **Which programming language allows for polymorphism but not classes?**
   (A) C++ programming language (B) Java programming language
   (C) Ada programming language (D) None of these
9. **Which of the following is considered as the world's first antivirus program?**
   (A) Tinkered (B) Reaper (C) Creeper (D) None of these
10. **If an employee requests root access to a UNIX system in which you serve as the administrator, you shouldn't provide them access or this authority unless their job necessitates certain rights and privileges. Which cyber security notion may it be seen as an excellent example of:**
    (A) Least privileges (B) Separation of Privileges (C) Open Design (D) None of these
11. **After a certain amount of time, say thirty minutes, the online application, similar to banking websites, should prompt users to log in again. Which cyber security concept may it be seen as a prime example of:**
    (A) Compromise recording (B) Psychological acceptability (C) Complete mediation (D) None of these
12. **Which of the following malware types does not infect others and duplicate or clone itself?**
    (A) Rootkits (B) Trojans (C) Worms (D) None of these
13. **When compiled, which of the following class of statement often yields no executable code?**
    (A) Assignment statement (B) Structural statements (C) Input and output statements (D) None of these
14. **A high-level language compiler that runs on one computer and generates code for another is known as:**
    (A) One pass compiler (B) Multipass compiler (C) Cross compiler (D) None of these
15. **Compiler can check ____ error.**
    (A) Syntax (B) Content (C) Logical (D) None of these
16. **Select the correct output of the following code.**

```
#include <stdio.h>
int main()
{
  int arr[5]={10,20,30,40,50};
  printf("%d", arr[5]);

   return 0;
}
```

    (A) Garbage value (B) 20 (C) 30 (D) None of these

17. **When we attempt to add the eleventh element to a stack with a size of 10, we encounter a circumstance known as:**
(A) Garbage collection (B) Underflow (C) Overflow (D) None of these

18. **Regarding Binary Trees, which of the following is true?**
(A) Every binary tree has two states: full and complete.
(B) Every binary tree that is full is also a complete binary tree.
(C) All complete binary trees are likewise full binary trees. (D) None of these

19. **What is the name of a linear collection of data components where the linear node is provided by a pointer?**
(A) Linked list (B) Primitive List (C) Node list (D) None of these

20. **How much time would it take to add an element to the linked list asymptotically?**
(A) O (1) (B) O (n) (C) O (n^2) (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.
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SECTION-A

Q. No. 2 **(a)** Discuss the future of Information Technology (IT) in Pakistan and its huge impact on all our daily lives. **(6)**
(b) Discuss the difference between a computer virus a trojan and a worm? **(6)**
(c) Discuss the pros and cons of LaTeX in comparison to other document processors. **(8)**

Q. No. 3 **(a)** Write a program that prompts the user to enter a letter grade A, B, C, D, or F and displays its corresponding numeric value 4, 3, 2, 1, or 0. **(6)**
(b) Write pseudocode OR C-language script for the following expression. **(6)**

$$\vec{a} \cdot \vec{b} = \sum_{i=1}^{n} a_i b_i = a_1 b_1 + a_2 b_2 + \ldots + a_n b_n$$

(c) Write a version of Breadth First Search (BFS) that finds the distances from the start node to each of the others, rather than the actual paths. **(8)**

Q. No. 4 **(a)** Write a program that displays the area and perimeter of a rectangle with the width of 4.5 and height of 7.9 using the following formula: area = width * height. **(6)**
(b) Write a program that reads a Celsius degree from the console, then converts it to Fahrenheit and displays the result. The formula for the conversion is as follows: Fahrenheit = (9 / 5) * Celsius + 32. **(6)**
(c) Write a program that prompts the user to enter the month and year and displays the number of days in the month. For example, if the user entered month 2 and year 2024, the program should display that February 2024 had 29 days. If the user entered month 3 and year 2015, the program should display that March 2015 had 31 days. **(8)**

SECTION-B

Q. No. 5 **(a)** Show the output of the following code? **(6)**

```
public class Test {
public static void main(String[] args) {
 Double x = 3.5;
 System.out.println(x.intValue());
 System.out.println(x.compareTo(4.5));
 }
}
```

(b) Illustrate the difference between overriding and overloading by the piece of pseudocode or program. **(6)**

(c) How do you prevent a class from being extended? How do you prevent a method from being overridden? Exemplify with simple piece of code. **(8)**

Q. No. 6 **(a)** For the following data sets, which sorting algorithms would work well, and which would not? **(8)**

a. 10 floating-point values
b. 1,000 integers
c. 1,000 names
d. 100,000 integers with values between 0 and 1,000
e. 100,000 integers with values between 0 and 1 billion
f. 100,000 names
g. 1 million floating-point values
h. 1 million names
i. 1 million integers with uniform distribution
j. 1 million integers with non-uniform distribution

(b) Write an algorithm that implements binary search recursively. Does this version have any advantages or disadvantages compared to the non-recursive version? **(6)**

(c) Write an algorithm that deletes a specified cell from a doubly linked list. Draw a picture that shows the process graphically. **(6)**

Q. No. 7 **(a)** Discuss the phases of project management including conception and initiation, project planning, project execution, performance/monitoring, and project close. **(6)**

(b) What are the different types of test design techniques? When would you use these types of test design techniques? **(6)**

(c) Exemplify the difference between Quality Assurance, Quality Control, and Testing? **(8)**

Q. No. 8 Write Regular Expression(s) for the following **(5 each)** **(20)**

I. For date Format of standard e.g. (10.03.2024 | 12/30/2023| 01/01/2022)
II. Write a Regular Expression that will match URL e.g. (http://example.edu.pk)
III. Write a Regular Expression that will match an IP address. e.g. 192.168.0.1
IV. Write a Regular Expression that will match an email address. e.g. (abc@example.com)

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COMPUTER SCIENCE, PAPER-II

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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)**
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1. **Which of the following are computer architectures different from conventional von Neumann architecture?** (A) MIT architecture (B) Harvard architecture (C) Turing architecture (D) None of these
2. **A computer is in System mode when:**
   (A) CPU is executing a program which is part of the operating system
   (B) The process execution is halted to listen to device inputs
   (C) The system is switching between processes (D) None of these
3. **Making a system store data in memory contiguously would:**
   (A) Results in lesser computation while searching for data
   (B) Results in more computation while searching data
   (C) Makes storing data very easy as one doesn't have to search for available memory to store
   (D) None of these
4. **Network traffic estimation is:**
   (A) Impossible (B) Easily computable via linear equations
   (C) Can only be solved using AI techniques (D) None of these
5. **The time complexity of finding a shortest path in a network is:**
   (A) Fairly low with Dijkstra's algorithm (B) Very efficient with A* search given spatial heuristics
   (C) Better than the above two using some randomization mechanism in large networks (D) None of these
6. **Which of the following is the most efficient encoding to send data via networks? Also consider the reasoning in your answer.**
   (A) 3-Excess codes because it is not weighted
   (B) Binary, because its representation can be done simply with zeros and ones
   (C) Decimal, because a decimal requires lesser space to represent the same number (D) None of these
7. **Which is better, Time slicing or time sharing?**
   (A) Time slicing is better because it deals with process allocation at the CPU level
   (B) Time sharing is better because it gives multiple users the illusion of each having his own processor
   (C) The comparison is not possible because one is part of the other (D) None of these
8. **Which type of algorithms are applicable to scheduling resources in operating systems?**
   (A) State space search (B) Machine learning (C) Bayesian learning (D) None of these
9. **Which of the following are/is true?**
   (A) In the era of platform independence all Operating systems can be made without considering low level details of machines
   (B) Operating systems can be made without using assembly languages
   (C) Operating systems aren't needed because everything can run on the internet (D) None of these
10. **In the RISC architecture, the _____ is updated whenever a function is called:**
    (A) Frame pointer and Return address registger (B) Stack pointer (C) Both (A) & (B) (D) None of these
11. **A child entity in ER diagrams is:**
    (A) The entity on the one side of a one to many relationship
    (B) Entity that inherits attributes and relations from another entity (C) A row of a table (D) None of these
12. **Boyce Codd Normal Form:**
    (A) Addresses certain type of multivalued dependencies (B) Makes sure that data in each column is atomic
    (C) Makes sure that every determinant is a candidate key (D) None of these
13. **DDL is used to:**
    (A) Represent the database structure (B) Define and manage the structure of a database
    (C) Deals with manipulation of data stored in the database (D) None of these
14. **Dynamic range in image processing is:**
    (A) Refers to span of wavelengths covered by a particular band in a multispectral image
    (B) Maximum or minimum values present in an image
    (C) Range of values spanned by grey scale (D) None of these

15. **Which of the following is true?**
    (A) Brightness gives a measure of degree to which a pure color is diluted by white light
    (B) Saturation gives a measure of degree to which a pure color is diluted by white light
    (C) Hue gives a measure of degree to which a pure color is diluted by white light (D) None of these
16. **SIFT is:**
    (A) An image deblurring algorithm (B) Basic edge detection algorithm
    (C) Used to identify and define local features (D) None of these
17. **Optical character recognition:**
    (A) Cannot be done without non deterministic algorithms
    (B) Can be done without non deterministic algorithms
    (C) Can be done more efficiently and robustly with deterministic algorithms (D) None of these
18. **Which of the following statement/s are true about PHP?**
    (A) Echo and print are same (B) Echo takes a single parameter (C) Both (A) & (B) (D) None of these
19. **Which of the following are true about the Weiner filter?**
    (A) It is a deterministic algorithm (B) It minimizes the quadratic error
    (C) It uses the binary cross entropy (D) None of these
20. **Php allows dynamic code execution using:**
    (A) Eval() (B) Reflection API (C) File Manipulation (D) None of these

PART – II

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(SECTION – A)

Q. No. 2. **(a)** Why are multi-processor systems considered advantageous in computer architecture? How does parallel processing fundamentally improve the performance and scalability of a computer system? **(7)**

(b) How does the choice of architectural level impact the performance of a computer system? Provide a numerical comparison between two different architectural levels, highlighting their strengths and weaknesses. **(7)**

(c) If a processor executes 1 billion instructions per second and has an instruction execution cycle of 4 cycles per instruction. Calculate the overall execution time for a program with 1 million instructions. Discuss how reducing the number of cycles per instruction can impact performance. **(6)**

Q. No. 3. **(a)** Why cache memory is considered a critical component in a computer system? How does the internal and external data representation contribute to optimizing memory usage and system efficiency? **(7)**

(b) Explain the concept of parallelism in computer architecture. How does the internal structure of a microprocessor contribute to parallel processing capabilities? **(7)**

(c) Break down the stages of the instruction execution cycle in a computer system. How do the characteristics of CISC and RISC architectures influence the execution cycle? **(6)**

Q. No. 4. **(a)** Compare the OSI and TCP/IP models in terms of their simplicity and practicality. Why is a layered approach beneficial in network design? **(7)**

(b) Explain how overlay networks and content distribution networks enhance the performance and scalability of internet services? Provide a numerical example to illustrate their impact on content delivery. **(7)**

(c) If the internet were a city, and each device had its own unique street address, how does IP addressing work in this scenario? Explain the purpose of subnetting using a neighborhood analogy. **(6)**

Q. No. 5. **(a)** Compare the file systems of UNIX and Windows in terms of structure, permissions, and file organization. How do these file systems cater to the needs of diverse computing environments? **(7)**

(b) How does an operating system mediate between application programs and the computer hardware? Discuss the key roles and responsibilities of an operating system in managing resources. **(7)**

(c) What is process management in the context of operating systems? How does the operating system handle processes, and what role does it play in multitasking? **(6)**

(SECTION – B)

Q. No. 6. **(a)** Elaborate on the evolution of database systems, highlighting major milestones. Discuss the impact of emerging technologies on the field of database systems. **(7)**

(b) Write a SQL query involving multiple tables and incorporating JOIN operations. Discuss the potential pitfalls and optimizations related to complex SQL queries. **(7)**

(c) What are distributed databases, and why are they used? Discuss the advantages and challenges of managing data in a distributed environment. **(6)**

Q. No. 7. **(a)** Explain the algorithms used for point detection, line detection, edge detection, and boundary detection in digital images. Discuss the strengths and limitations of these techniques. **(7)**

(b) Provide detailed explanations and applications of morphological operators like erosion, dilation, opening, closing, skeletonization, and thinning in image processing. **(7)**

(c) Compare and contrast various image sensing and acquisition techniques. Discuss the advantages and limitations of different methods such as CCD and CMOS. **(6)**

Q. No. 8. **(a)** Develop a numerical comparison between client-side functionalities implemented using different JavaScript patterns. Discuss how these patterns impact code maintainability and performance? **(7)**

(b) Discuss data aspect architectures in web development. How do these architectures address challenges related to data storage, retrieval, and management? **(7)**

(c) Create a numerical comparison of the efficiency of data exchange using different APIs, such as REST and GraphQL. Discuss the considerations in choosing the appropriate API for a given scenario. **(6)**

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