

लोक सेवा आयोग
कर्मचारी सञ्चय कोष, प्राविधिक, सूचना प्रविधि, छैटौं, सहायक प्रबन्धक (सिस्टम) पदको खुला
प्रतियोगितात्मक लिखित परीक्षा
२०८२।०३।०७

पत्र : द्वितीय
समय : ३ घण्टा

पूर्णाङ्क : १००

विषय : सेवा सम्बन्धी (प्राविधिक विषय)

प्रत्येक Section को उत्तर छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ । अन्यथा उत्तरपुस्तिका रद्द हुनेछ ।

Section : "A"

50 Marks

1. Explain how CPU pipelining improves performance and describe pipeline hazard with its effects. Describe how Memory Mapped I/O distinguishes memory from I/O devices. Give an example diagram showing RAM and I/O address allocation. Explain the role of DMA in data transfer and how it improves performance over traditional I/O. 3+3+4=10
2. You are analyzing the operating system of a high-performance file server used in a research data center. The system experiences slowdowns due to massive I/O requests and frequent user access to files.

In this context, answer the followings:

5+5=10

- a) Explain how the organization of I/O devices and I/O software layers can affect overall system performance. Use examples involving disk and network I/O.
 - b) Describe how file system implementation (e.g., inode-based or FAT) and directory structure impact file access time.
3. Explain the concept of datagram and virtual circuits in the context of the network layer. Describe the role of the Internet Protocol (IP) in packet forwarding and addressing. 6+4=10
 4. Answer the followings: 4+(2+2+2)=10
 - a) Explain the differences between Structural and Object-Oriented Programming using examples from C and C++.
 - b) A C program uses a struct to manage car data (model, year, max speed) with separate input/display functions. Redesign it in C++ using OOP:
 - i) Create a Car class with private members for model, year and speed, a constructor and a display() method.
 - ii) Derive a SportsCar class adding a private top_speed member and also override the display() method.
 - iii) Add evaluatePerformance() in SportsCar to print "High-Performance Vehicle" if top_speed ≥ 200 km/h, else "Standard Performance Vehicle".
 5. A national retail chain wants to implement a distributed database system that supports sales tracking, inventory management and customer behavior analysis across multiple branches. The database must be secure, reliable and scalable.

In this context answer the followings:

5+5=10

- a) Define a distributed database system and explain advantages it offers for the retail chain.
- b) Describe how data mining can help to analyze customer buying patterns and improve business decisions.

Contd...

Section : "B"

50 Marks

6. Explain the importance of software process in software development with a real world example. Explain how programming standards and procedures are maintained during software development process. 5+5=10
7. A retail company is launching an E-commerce platform with inventory management and order tracking: 3+3+4=10
 - a) Explain how an ERP system can improve inventory control and streamline sales through real-time data sharing. Discuss two helpful ERP modules that would this platform.
 - b) Identify key security risks in online transactions and suggest technical and procedural solution.
 - c) Draw a sequence diagram showing the HTTP request-response cycle for order placement, involving client, web server and database.
8. You are developing a library management system that must support efficient book searching, borrowing and returning operations. The system should also handle thousands of book entries and manage borrower details. 3+3+4=10
 - a) Propose a suitable data structure for storing and searching book information. Justify your choice with reference to time complexity and space efficiency.
 - b) Suppose each book is represented as a node in a Binary Search Tree (BST). Explain how insertion and search operations work in BST with an example.
 - c) If the system also needs to maintain a waiting list for popular books, which linear data structure would you use and why? Briefly describe its operations.
9. Discuss the different types of machine learning methods and mention their applications. Also, state the concepts of natural language processing and its applications. 6+4=10
10. A government agency wants to develop a cloud-based health information system that securely stores large volumes of patients' data, provides real-time access to authorized personnel across the country and can perform data analytics to identify disease trends. They also want to integrate IoT devices (e.g., wearable health monitors) and ensure secure communication over the internet. 3+3+4=10
 - a) Explain how cloud computing architecture helps in scalability, availability and cost-effectiveness for this kind of application.
 - b) Elaborate the role of IoT in real-time health monitoring and what communication protocols or layers it might involve.
 - c) What are the key cryptographic mechanisms and network security practices that must be employed to secure patient data during transmission and storage? Explain.

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