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कर्मचारी सञ्चय कोष, प्राविधिक, सूचना प्रविधि, छैटौँ, सहायक प्रबन्धक (सिस्टम) पदको खुला प्रतियोगितात्मक लिखित परीक्षा

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२०८२/०३/०६

- 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.

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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.

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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.

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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

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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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- The End -

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२०८२/०३/०६

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संस्थान्न तयारी

- पत्र: प्रथम
- समय: २ घण्टा १५ मिनेट
- पूर्णाङ्क: १००

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- विषय: प्राविधिक विषय तथा व्यवस्थापन

विषयगत

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समय : १ घण्टा ३० मिनेट

अङ्क : ५०

1. कार्यालयमा गुनासो व्यवस्थापन गर्न किन आवश्यक छ? स्पष्ट गर्दै गुनासो व्यवस्थापनका लागि अवलम्बन गर्न सकिने उपायहरू छोटकरीमा लेख्नुहोस्। २+३=५
2. सामूहिक सौदाबाजीमा ट्रेड युनियनको भूमिकालाई प्रभावकारी बनाउने उपायहरू सुझाउँदै ट्रेड युनियन र व्यवस्थापनबिचको सम्बन्ध व्यवस्थित गर्न कस्तो रणनीतिहरू अवलम्बन गर्न सकिन्छ? छोटो चर्चा गर्नुहोस्। ३+२=५
3. कर्मचारी सञ्चय कोष जस्ता सेवामूलक सरकारी संस्थामा व्यवस्थापन सूचना प्रणालीलाई व्यवस्थित गर्नको लागि के-कस्ता कदमहरू चाल्नु पर्दछ? लेख्नुहोस्। ५
4. विद्यमान अवस्थामा सार्वजनिक सेवा प्रवाहको क्रममा सेवा प्रदायकले सामना गर्नु परेका समस्याहरू विश्लेषण गर्दै तिनको समाधानका उपायहरू बुँदागत रूपमा प्रस्तुत गर्नुहोस्। ३+२=५
5. कर्मचारी सञ्चय कोषको कार्यक्षेत्रहरू उल्लेख गर्दै यसका भावी कार्यक्रम प्रस्तुत गर्नुहोस्। ५
6. सामाजिक सुरक्षा प्रणालीका आधारभूत मान्यताहरू के के हुन्? अन्तर्राष्ट्रिय अभ्याससमेतका आधारमा लेख्नुहोस्। ५
7. नेपालमा सामाजिक संरक्षण कार्यक्रमहरू (जस्तै: वृद्ध भत्ता, एकल महिला भत्ता आदि) ले गरिबी न्यूनीकरणका साथै सामाजिक समावेशीकरणमा खेलेको भूमिकामाथि प्रकाश पार्दै यस्ता कार्यक्रमहरूको दिगोपनमा असर पार्ने कारक तत्त्वहरूको छोटो विश्लेषण गर्नुहोस्। ३+२=५
8. अन्तर्राष्ट्रिय श्रम संगठनको संक्षिप्त परिचय दिँदै यसका मुख्य कार्यहरू उल्लेख गर्नुहोस्। २+३=५
9. कर्मचारी सञ्चय कोष, सूचना तथा सञ्चार प्रविधि नीति, २०७२ ले लिएका प्रमुख नीतिहरूको चर्चा गर्नुहोस्। ५
10. नेपालको संविधानका मुख्य विशेषताहरू उल्लेख गर्नुहोस्। ५

:: समाप्त ::

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KEY [B]

- पत्र: प्रथम
- समय: २ घण्टा १५ मिनेट
- पूर्णाङ्क: १००

विषय : प्राविधिक विषय तथा व्यवस्थापन

उत्तरपुस्तिकामा प्रश्नपत्रको KEY अनिवार्य रूपले उल्लेख गर्नुपर्नेछ। उल्लेख नगरेमा उत्तरपुस्तिका रद्द हुनेछ। परीक्षामा calculator, mobile प्रयोग गर्न पाइनेछैन।

Objective | Time : 45 minutes | Marks : 50x1=50

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Multiple Choice

1. Suppose two IPv6 nodes want to interoperate using IPv6 datagrams, but they are connected to each other by intervening IPv4 routers. The best solution here is .....

   A) use dual-stack approach

   B) tunneling

   C) no solution

   D) replace the system

2. Which layer of the TCP/IP stack corresponds to the OSI model transport layer?

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A) Host to Host

B) Application

C) Internet

D) Network Access

3. Which of the following pairs can be used to send and retrieve e-mails (in that order)?

A) IMAP and POP3

B) SMTP and POP3

C) SMTP and IMAP

D) IMAP and SMTP

4. Which OOP concept allows one interface to be used for different data types?

A) Inheritance

B) Encapsulation

C) Polymorphism

D) Abstraction

5. Which among the following is an unconditional control structure?

A) goto

B) for

C) do-while

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D) if-else

6. Dynamic memory allocation helps to allocate memory during .....

A) static linking

B) the compile time

C) both compile and run time

D) run time

7. What is the output of this C code?

C

```
#include <stdio.h>
void main()
{
   char *s = "hello";
   char *p = s;
   printf("%c\t%c", *(p + 3), s[1]);
}
```

```[cite: 13]

A) h e[cite: 13]

B) l l[cite: 13]

C) l o[cite: 13]

D) l e[cite: 13]

8. By default how the values are passed in C++?

A) call by value

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```

B) call by reference

C) call by pointer

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D) call by name

9. Which of the following is not Armstrong's Axiom?

A) Reflexivity rule

B) Transitivity rule

C) Pseudotransitivity rule

D) Augmentation rule

10. To remove a relation from an SQL database, we use the ..... command.

A) Delete

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B) Purge

C) Remove

D) Drop table

11. The number of entity-sets participating in a relationship is known as the .....

A) degree

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B) cardinality

C) participation constraint

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D) modality

12. Which normal form eliminates transitive dependencies?

A) 1NF

B) 2NF

C) 3NF

D) BCNF

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13. Which of the following techniques is commonly used to enforce database security?

A) Encryption of sensitive data

B) Data normalization

C) Query optimization

D) Redundant storage

14. In the context of software engineering what does the term "MVC" stand for?

A) Model Validation Controller

B) Model View Controller

C) Main View Control

D) Module View Control

15. The .... determines whether the project should go forward.

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A) feasibility assessment

B) opportunity identification

C) system evaluation

D) program specification

16. What type of software testing is generally used during software maintenance?

A) Regression Testing

B) System Testing

C) Integration Testing

D) Unit Testing

17. What is cyclomatic complexity used to measure?

A) Code execution speed

B) Number of test cases needed

C) Program complexity based on control flow

D) Memory usage

18. Which of the following is a technique used to improve fault tolerance in software systems?

A) Code obfuscation

B) Redundant systems and failover mechanisms

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C) Debugging and testing only

D) Using single-threaded processing

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19. Which of the following is true only for XML but not HTML?

A) It is derived from SGML

B) It describes content and layout

C) It allows user defined tags

D) It is restricted only to be used with web browsers

20. Which protocol is used for secure web browsing?

A) HTTP

B) FTP

C) SMTP

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D) HTTPS

21. Which of the following is not the element associated with HTML table layout?

A) Size

B) Spanning

C) Alignment

D) Color

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22. ..... is the information gathering phase in ethical hacking from the target user.

A) Reconnaissance

B) Scanning

C) Gaining access

D) Maintaining access

23. Which of the following information security technology is used for avoiding browser based hacking?

A) Anti-malware in browsers

B) Remote browser access

C) Adware remover in browsers

D) Incognito mode in a browser

24. Which of the following operations is used to restore the balance of an AVL tree after an insertion or deletion?

A) Merge

B) Rotation (single or double)

C) Traversal

D) Sorting

25. A binary search tree whose left subtree and right subtree differ in height by at most 1 unit is called .....

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A) AVL tree

B) B tree

C) Lemma tree

D) B+ tree

26. What is the time complexity to insert a node based on key in a priority queue?

A) O(n log n)

B) O(log n)

C) O(n)

D) O(n^2)

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27. The worst case occurs in linear search algorithm when item is .....

A) somewhere in the middle of the array

B) not in the array at all

C) the last element in the array

D) the last element in the array or is not there at all

28. What is the maximum height of an AVL tree with 'n' nodes?

A) n log n

B) n

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C) log n

D) log n / 2

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29. Which of the following protocols is used to link all the devices in the IoT?

A) HTTP

B) UDP

C) SNMP

D) TCP/IP

30. Which of the following machine learning algorithms is based upon the idea of bagging?

A) Decision tree

B) Random forest

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C) Classification

D) Regression

31. In public key cryptography, the public key is used for .....

A) decryption only

B) key generation

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C) encryption and signature verification

D) hashing

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32. What manages the effects of change throughout the software process?

A) Software project tracking and control

B) Software configuration management

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C) Software maintenance

D) Technical review

33. Which of the following best describes PaaS (Platform as a Service)?

A) Provides virtual machines and storage only

B) Offers a platform allowing customers to develop, run and manage applications

C) Delivers software over the internet on a subscription basis

D) Only offers infrastructure-level access to hardware

34. What is the primary characteristic of supervised learning?

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A) It requires labeled training data

B) It operates without any training data

C) It focuses on clustering data

D) It does not require a target variable

35. The proposition (A -> B) and (B -> A) is a .....

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A) Absurdity

B) Contingency

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C) Contradiction

D) Classification

36. Among the following which is not a horn clause?

A) p

B) not p or q

C) p -> q

D) p -> not q

37. In the Minimax algorithm, what does the "min" part represent?

A) The maximum possible score the opponent can achieve

B) The minimum possible score the player can achieve

C) The minimum number of moves required to win

D) The minimization of the opponent's advantage

38. In AI, with the given options below, which is not the required property of knowledge representation?

A) Inferential Efficiency

B) Inferential Adequacy

C) Representational Verification

D) Representational Adequacy

39. The associatively mapped virtual memory makes use of .....

A) Translation Look-aside Buffer

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B) Page Table

C) Frame Table

D) Truth Table

40. The check bit is grouped with the information bit as specified by a .....

A) Parity error bit

B) Parity check bit

C) Parity check code

D) Parity check matrix

41. The condition flag Z is set to 1 to indicate .....

A) the operation has resulted in an error

B) the operation requires an interrupt call

C) the result is zero

D) there is no empty register available

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42. What determines the number of I/O devices controlled by Direct Memory Access (DMA)?

A) Number of DMA registers

B) Number of channels of DMA

C) Number of internal registers

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D) Number of buffer registers

43. The effective address in indexed addressing is calculated as .....

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A) Operand + Register

B) Instruction Address + Operand

C) Base Register + Index Register

D) Address stored in the register

44. System call interface helps in .....

A) accessing system call only by the kernel mode

B) mapping a request of system call from user mode to kernel mode

C) to act as bridge between user and OS

D) blocking the unwanted system call access from user mode

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45. Consider a machine with 64 MB physical memory and a 32-bit virtual address space. If the page size is 4KB, what is the approximate size of the page table?

A) 2 MB

B) 6 MB

C) 8 MB

D) 24 MB

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46. What is meant by compaction?

A) A technique for overcoming internal fragmentation

B) A paging technique

C) A technique for overcoming external fragmentation

D) A technique for compressing the data

47. Which of the following is a synchronization tool?

A) Thread

B) Pipe

C) Socket

D) Semaphore

48. Suppose that a process is in "Blocked" state waiting for some I/O service. When the service is completed, it goes to the ..... state.

A) Running

B) Ready

C) Suspended

D) Terminated

49. A subset of a network that includes all the routers but contains no loops is called .....

A) spanning tree

B) spider structure

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C) spider tree

D) binary tree

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50. In CIDR notation, what does the suffix "/24" represent in the IP address 192.168.1.0/24?

A) The number of hosts on the network

B) The number of subnets created

C) The number of bits used for the network prefix

D) The number of broadcast addresses available

-The End-

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