Dhirubhai Ambani Institute of Information and Communication Technology

Ph.D.
Computer Science & Engineering
Sample Question Paper

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1. Let $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & k & -2 \\ 1 & 2 & 2 \end{bmatrix}$ be a given matrix. For $rank(A) = 1$, k should be

   (a) 0

   (b) 4

   (c) $rank(A) = 1$ for all $k \in \mathbb{R}$.

   (d) It is not possible to get $rank(A) = 1$ for any value of k.

   (e) none of the above.

2. Let $S = \{1, 2, 3, 4, 5\}$ be a given set of numbers. We define a binary relation R on S: $\forall a, b \in S, (a, b) \in R \Leftrightarrow |a - b| < 2$. The binary relation R is

   (a) Reflexive, but neither symmetric nor transitive

   (b) Reflexive and anti-symmetric, but not transitive

   (c) Reflexive and symmetric, but not transitive

   (d) Reflexive, Symmetric and transitive

   (e) None of the above

3. Let $f : \mathbb{R} \to \mathbb{R}$ be a function defined as $f(x) = |x - 1|, \forall x \in \mathbb{R}$. Which of the following statement is true?

   (a) f is Continuous and differentiable everywhere

   (b) f is Continuous everywhere but not differentiable at $x = 0$.

   (c) f is Continuous everywhere but not differentiable at $x = 1$.

   (d) f is Neither continuous nor differentiable at $x = 1$.

   (e) None of the above.

4. If we toss a fair dice twice, what is the probability that the sum of numbers obtained will be greater than or equal to 8, given that the first roll of dice gave the number 3?

   (a) $\frac{1}{2}$

   (b) $\frac{1}{3}$

   (c) $\frac{5}{12}$

   (d) $\frac{1}{4}$

   (e) None of the above

5. What is the output of the following C code? Assume all necessary header file are included.

```
int main() {
        int p=5;
        int a= p++ - ++p;
        printf ("%d %d", a, p);
        return 0;
    }
```

   (a) -1 , 7
   (b) -2 , 7
   (c) 0 , 6
   (d) -1 , 6
   (e) -2 , 6

6. A sender and a receiver hosts are separated by one router. The transmission rates between the sending host and the router is R1; between the router and the receiving host is R2. The router stores and forwards packets between the sender and the receiver. What is the total end-to-end delay to send a packet of length L? (Ignore queuing, propagation delay, and processing delay.)

   (a) $\frac{L}{R1} + \frac{L}{R2}$
   (b) $\frac{2L}{R1+R2}$
   (c) $\frac{L}{R1}$
   (d) $\frac{L}{R2}$
   (e) None of these

7. Which of the following statements are True below?

   (i) In TCP, piggybacking means a host can carry data along with an acknowledgment.
   (ii) Suppose Host A is sending Host B a file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receive buffer.
   (iii) The size of the TCP receiver window never changes throughout the duration of the connection.
   (iv) The TCP segment has a field in its header for receiver window.

   Choose the correct option.

   (a) Only (i)
   (b) Only (i) and (ii)
   (c) Only (i), (ii) and (iv)
   (d) Only (i), (iii) and (iv)
   (e) None of these

8. Which of the routing protocol below should be preferred for scalability, VLSM support, Minimal overhead and support for connecting networks using routers of multiple vendors?

   (a) RIP version-2

(b) OSPF

(c) RIP version-1

(d) BGP

(e) None of these

9. A system has P processes that share M common resources. Each process requires a maximum of 4 resources of the same type. What minimum value of M guarantees deadlock can never occur?

   (a) 4P

   (b) 2P

   (c) 2P+4

   (d) 3P+1

   (e) 2P+2

10. Which of these is not typically considered as a File Management System call in linux?

    (a) read()

    (b) write()

    (c) send()

    (d) open()

    (e) All of these

11. Suppose the round robin scheduling and the First Come First Serve scheduling give exactly the same Gantt chart for processes P1, P2, P3 and P4 arrive in this sequence , Which of the following statements is always true? Assume that the CPU has no idle time and P4 completes before the arrival of any new process.

    (a) The waiting time of each process is 0.

    (b) The time quantum given by the round robin algorithm is the same as the burst times of P1, P2, P3

    (c) The time quantum given by the round robin algorithm is the same as the burst times of P2 and P3

    (d) The time quantum given by the round robin algorithm is the same as the burst times of P2, P3 and P4.

    (e) Nothing can be said with certainty

12. Which of the following language is undecidable.

    (a) $L = \{\langle M, w\rangle | M \text{ is a Turing machine that accepts } w\}$

    (b) $L = \{\langle M, w\rangle | M \text{ is a DFA that accepts } w\}$

    (c) $L = \{\langle M, w\rangle | M \text{ is a PDA that accepts } w\}$

    (d) $L = \{\langle M, w\rangle | M \text{ is an NFA that accepts } w\}$

    (e) None of the above.

13. Which of the following statements is incorrect.

    (a) Each regular language is also context free.
    (b) There are languages which are not recursive.
    (c) There are languages which are not recursively enumerable.
    (d) There may be a recursive language which is not recursively enumerable.
    (e) None of the above.

14. Regular expression R = a*b*cb*a* is defined over alphabet {a, b, c}. Which of the following strings is in the language L[R] defined by R?

    (a) aabcbba
    (b) aabcabb
    (c) aabbcaabb
    (d) abccba
    (e) None of the above

15. Consider a relation R(ABCD), and following Functional Dependencies A $\rightarrow$ B, B $\rightarrow$ C, C $\rightarrow$ D. What is the normal form of R?

    (a) 1NF
    (b) 2NF
    (c) 3NF
    (d) BCNF
    (e) None of the above

16. Suppose, left join of two relations R1 and R2, is expressed as follows: SELECT* FROM R1 LEFT JOIN R2 ON (R1.A=R2.B);

    (a) | R1 |
    (b) | R2 |
    (c) <= | R1 |
    (d) > | R1 |
    (e) None of the above

17. Which of the following is incorrect about the "keys" of a relation in the relational model?

    (a) SUPER KEY $\supseteq$ PRIMARY KEY
    (b) PRIMARY KEY = CANDIDATE KEY
    (c) SUPER KEY $\supseteq$ CANDIDATE KEY
    (d) CANDIDATE KEY $\supseteq$ SUPER KEY
    (e) None of the above

18. A queue is implemented using an array such that ENQUEUE and DEQUEUE operations are performed efficiently. Which one of the following statements is CORRECT (n refers to the number of items in the queue)?

    (a) Both operations can be performed in O(1) time

    (b) At most one operation can be performed on O(1) time but the worst-case time for the other operation will be $\Omega(n)$

    (c) The worst-case time complexity for both operations will be $\Omega(n)$

    (d) Worst case time complexity for both operations will be $\Omega(n)$

    (e) None of these

19. The pre-order traversal sequence of a binary search tree is 30, 20, 10, 15, 25, 23, 39, 35, 42. Which one of the following is the post-order traversal sequence of the same tree?

    (a) 10, 20, 15, 23, 25, 35, 42, 39, 30

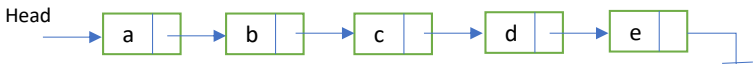
    (b) 15, 10, 25, 23, 20, 42, 35, 39, 30

    (c) 15, 20, 10, 23, 25, 42, 35, 39, 30

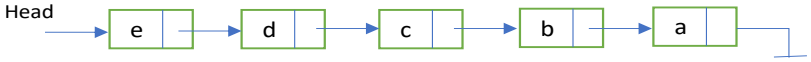
    (d) 15, 10, 23, 25, 20, 35, 42, 39, 30

    (e) None of these

20. Consider the problem of reversing a singly linked list. To take an example, given the linked list below,



    the reversed linked list should look like



    Which one of the following statements is TRUE about the time complexity of algorithms that solve the above problem in O(1) space?

    (a) The best algorithm for the problem takes $\Theta(n)$ time in the worst case.

    (b) The best algorithm for the problem takes $\Theta(n \log n)$ time in the worst case.

    (c) The best algorithm for the problem takes $\Theta(n^2)$ time in the worst case.

    (d) It is not possible to reverse a singly linked list in O(1) space.

    (e) None of these