

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY,
BATHINDA

Ph.D. Entrance Examination Computer Science and Engineering

- Q1. A box contains 1000 light bulbs. The probability that there is at least 1 defective bulb in the box is 0.1, and the probability that there are at least 2 defective bulbs is 0.05. What is the probability that the box contains at most 1 defective bulb?
- 0.50
 - 0.90
 - 0.95
 - None of these
- Q2. If $P(A) = 7/11$, $P(B) = 6/11$ and $P(A \cup B) = 8/11$, then $P(A \cap B) =$ _____
- $3/5$
 - $2/3$
 - $1/2$
 - 1
- Q3. If $P(A \cap B) = 1/2$, $P(\bar{A} \cap \bar{B}) = 1/2$, and $2P(A) = P(\bar{A}) = X$, value of X is
- $3/5$
 - $2/3$
 - $1/2$
 - 1
- Q4. Which of the following represents the correct relationship between Mean, Median and Mode?
- Mode = 3 Median - 2 Mean
 - Mode = 3 Mean - 2 Median
 - Mode = 2 Median - 3 Mean
 - Mode = 2 Mean - 3 Median
- Q5. Let S1 and S2 be two empty stacks. An element popped out of S1 can either be printed immediately or pushed to S2. An element popped out of S2 can only be printed. If three elements are pushed in S1, i.e. $Push(S1, 'd')$; $Push(S1, 'c')$; $Push(S1, 'b')$; $Push(S1, 'a')$; then which of the following output is not possible?
- acbd
 - badc
 - cbda
 - cdab
- Q6. The order of four algorithms $X1, X2, X3, X4$ are $\log n$, $\log(\log n)$, $n \log n$ and $n/\log n$. The correct arrangement based on their decreasing complexity is
- $X3, X4, X1, X2$
 - $X3, X2, X1, X4$
 - $X1, X2, X3, X4$
 - $X1, X2, X4, X3$
- Q7. A single pointer maintained to the front of a circular queue ensures the following operations in constant time assuming singly circular linked list is used to implement a circular queue
- Enqueue
 - Dequeue
 - Both Enqueue and Dequeue
 - Neither Enqueue nor Dequeue

Q8. Determine the minimum number of pointers needed to remove the dependency of all the following operations in a singly linked list on its length?

- Delete the first element
- Insert a new element as a first element
- Delete the last element of the list
- Add a new element at the end of the list

- a) Single pointer at the last node.
- b) Two pointers, one at the first node and another at the last node.
- c) Three pointers, one at the first node, second at the second-last node, and third at the last node.
- d) Two pointers, one at the first node and another at the second-last node.

Q9. A doubly linked list is declared as

```
struct node
{
int data;
struct node *next;
struct node *prev;
}*X;
```

Which of the following segments of code removes the element pointed to by X from the doubly linked list, if it is assumed that X points to neither the first nor the last element in the list?

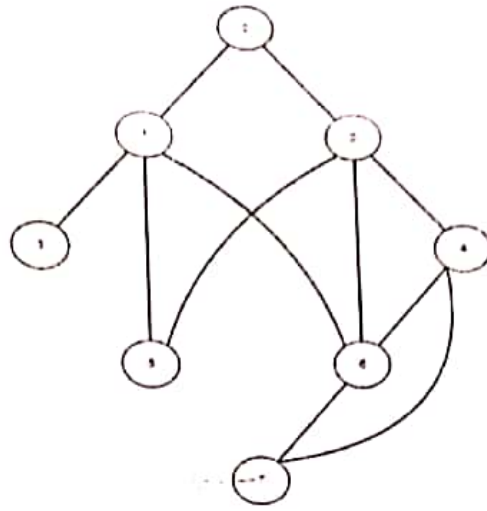
- a) $X \rightarrow prev \rightarrow next = X \rightarrow next$; $X \rightarrow next \rightarrow prev = X \rightarrow prev$;
- b) $X \rightarrow prev \rightarrow next = X \rightarrow prev$; $X \rightarrow next \rightarrow prev = X \rightarrow next$;
- c) $X \rightarrow prev \rightarrow prev = X \rightarrow next$; $X \rightarrow next \rightarrow next = X \rightarrow prev$;
- d) $X \rightarrow prev \rightarrow prev = X \rightarrow prev$; $X \rightarrow next \rightarrow next = X \rightarrow next$;

Q10. Given the following input (4532, 3214, 1681, 2489, 7849, 0351, 5663, 8259) and the hash function $x \bmod 10$, which of the following statements are true?

- i. All elements hash to the same value
- ii. 8259, 2489, 7849 hash to the same value
- iii. 0351, 1681 hash to the same value
- iv. Each element hashes to a different value

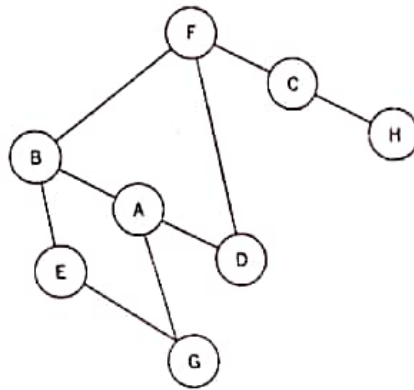
- a) i or iv only
- b) ii only
- c) iii only
- d) ii and iii only

Q11. What is the correct sequence of nodes visited after applying DFS on following graph? Assume the starting vertex to be 0.



- a) 0,1,2,3,4,5,6,7
- b) 0,1,3,2,4,6,5,7
- c) 0,1,3,5,2,4,6,7
- d) None of the above

Q12. How many zeros will be there in the adjacency matrix of the following graph?



- a) 56
- b) 46
- c) 18
- d) None of the above

Q13. The octal equivalent of hexadecimal number 9DFB.ABCD is

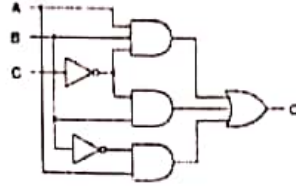
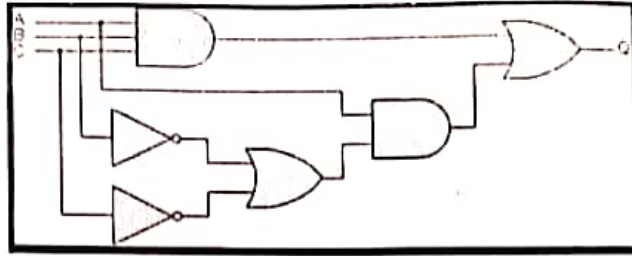
- a) 473754.125715
- b) 473754.527464
- c) 116773.125715
- d) 116773.527464

Q14. The simplified form of the following Boolean expression is

$$Z = \bar{A}\bar{B}C + \overline{(A + B + C)} + \bar{A}\bar{B}\bar{C}D$$

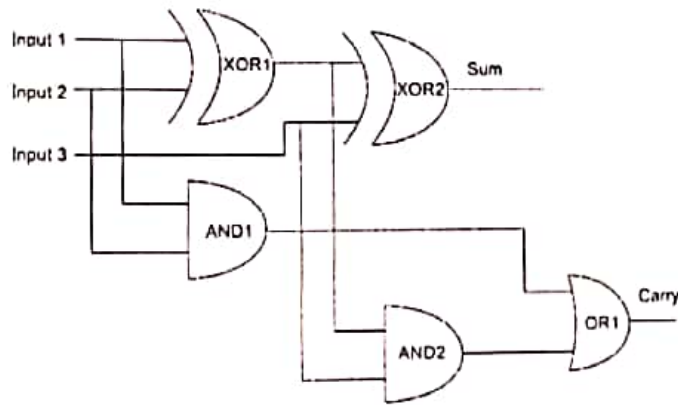
- a) $\bar{A}\bar{B}$
- b) $AB + \overline{(AC)}$
- c) $A\bar{C} + B\bar{D}$
- d) None of the above

Q15. What is the value of Q and O in the following diagram, assuming A=1, B=1 and C=0.



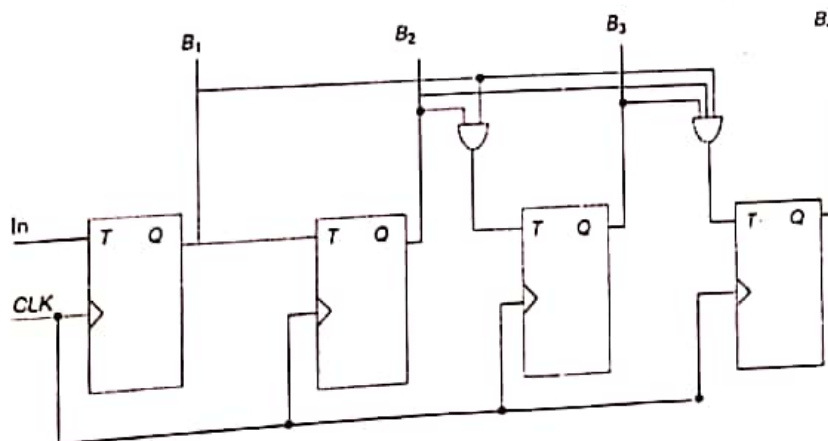
- a) Q=1 and O=1
- b) Q=1 and O=0
- c) Q=0 and O=1
- d) Q=0 and O=0

Q16. The figure below shows the circuit diagram of _____



- a) Full Subtractor
- b) Half Adder
- c) Half Subtractor
- d) Full Adder

Q17. The figure below shows the circuit diagram of _____



- a) Flip-flop
- b) Asynchronous Counter
- c) Synchronous Counter
- d) None of the above

Q18. How many address lines are required to select a 4-bit word in a 2048-bit ROM?

- a) 4 address lines
- b) 2 address lines
- c) 9 address lines
- d) 11 address lines

Q19. The number of IC chips of memory size 1024×4 required to have a $16K \times 8$ memory will be _____

- a) 2
- b) 16
- c) 32
- d) None of the above

Q20. A non-pipeline system takes 80 ns to process a task. The same task can be processed in four segment pipeline with a clock cycle of 20 ns . Determine the speedup ratio of the pipeline for 100 tasks. What is the maximum speedup ratio that can be achieved?

- a) 1
- b) 3
- c) 4
- d) None of the above

Q21. $S \rightarrow Sa \mid b$ Which of the following is True?

- (a) There will be SR conflict during parsing
- (b) There will be RR conflict during Parsing
- (c) There will be both conflict
- (d) There will be no conflict

Q22. An LALR(1) parser for a grammar G can have shift-reduce (S-R) conflicts if and only if

- (a) the SLR(1) parser for G has S-R conflicts
- (b) the LR(1) parser for G has S-R conflicts
- (c) the LR(0) parser for G has S-R conflicts
- (d) the LALR(1) parser for G has reduce-reduce conflicts

Q23. Match all items in Group 1 with correct options from those given in Group 2.

Group 1

Group 2

P. Regular expression

1. Syntax analysis

Q. Pushdown automata

2. Code generation

R. Dataflow analysis

3. Lexical analysis

S. Register allocation

4. Code optimization

- (a) P1, Q3, R4, S2
- (b) P3, Q1, R4, S2
- (c) P3, Q1, R2, S4
- (d) P1, Q3, R2, S4

Q24. Consider the grammar $S \rightarrow (S)a$. Let the number of states in $LALR(1)$, $SLR(1)$, and $LR(1)$ parsers for the grammar be n_1 , n_2 and n_3 respectively. Write down the relationship that holds good between n_1 , n_2 and n_3 .

- (a) $n_1 = n_2 = n_3$
- (b) $n_1 = n_2 < n_3$
- (c) $n_1 = n_3 < n_2$
- (d) $n_2 = n_3 < n_1$

Q25. Given production rule $S \rightarrow ABC$, $ABC \rightarrow aC$, $C \rightarrow b$. What is the type of the given production rules?

- a) Type-3 Grammar
- b) Type-2 Grammar
- c) Type-1 Grammar
- d) Type-0 Grammar

Q26. Consider the grammar $G = \{S \rightarrow bS \mid aA \mid b, A \rightarrow bA \mid aB, B \rightarrow bB \mid aS \mid a\}$. Let $N_a(w)$ and $N_b(w)$ denote the number of a's and b's in a string w , respectively. The language $L(G) \in \{a, b\}^+$ generated by G is

- (A) $\{w \mid N_a(w) > 3N_b(w)\}$
- (B) $\{w \mid N_b(w) > 3N_a(w)\}$
- (C) $\{w \mid N_a(w) = 3k, k \in \{0, 1, 2, \dots\}\}$
- (D) $\{w \mid N_b(w) = 3k, k \in \{0, 1, 2, \dots\}\}$

Q27. Pumping lemma is generally used for proving that

- (A) Given grammar is regular
- (B) Given grammar is not regular
- (C) Whether two given regular expressions are equivalent or not
- (D) None of these

Q28. If $\Sigma = \emptyset$, then Σ^* represents

- (A) Infinite number of strings
- (B) Only ϵ
- (C) Infinite strings excluding ϵ
- (D) None of these

Q29. If a TM halts for each and every word of a language L and rejects other, then L is called

- (A) Context Free Language
- (B) Recursive Language
- (C) Recursive Enumerable Language
- (D) None of the above

Q30. In the ring topology what happens if one of the stations is unplugged?

- a) Will not affect the working of the network.
- b) Will disable the entire network
- c) Such a situation cannot happen in ring topology
- d) None of the above

Q31. Match the following with respect to OSI model

- | | |
|----------------------|--|
| i. Application Layer | a. Reliable process-to-process message delivery |
| ii. Physical Layer | b. Route selection |
| iii. Network Layer | c. Defines frames |
| iv. Data Link Layer | d. Provides user services such as e-mail and file transfer |
| v. Transport Layer | e. Transmission of bit stream across physical medium |

- a) i-a, ii-b, iii-c, iv-d, v-e
- b) i-d, ii-c, iii-b, iv-e, v-a
- c) i-d, ii-e, iii-a, iv-c, v-b
- d) i-d, ii-e, iii-b, iv-c, v-a

Q32. Which of the following is not a property of UDP?

- a) It is connectionless but reliable transport protocol.
- b) It performs very limited error checking
- c) It has minimum of overhead in comparison to TCP
- d) UDP is a suitable transport protocol for multicasting

Q33. Which of the following is not an Application Layer protocol?

- a) SMTP
- b) SNMP
- c) ICMP
- d) TELNET

Q34. In a B+ tree, if the search-key value is 12 bytes long, the block size is 1024 bytes and the block pointer is 6 bytes, then the maximum number of keys that can be accommodated in each non-leaf node of the tree is _____

- a) 57
- b) 54
- c) 58
- d) 56

Q35. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128 page table entries and is 4-way set-associative. The minimum size of the TLB tag is:

- a) 11 bits
- b) 13 bits
- c) 15 bits
- d) 20 bits

Q36. Consider the virtual page reference string 1, 2, 3, 2, 4, 1, 3, 2, 4, 1. On a demand paged virtual memory system with main memory size of 3 pages frames which are initially empty. Let LRU, FIFO and OPTIMAL denote the number of page faults under the corresponding page replacements policy. Then

- a) OPTIMAL < LRU < FIFO
- b) OPTIMAL < FIFO < LRU
- c) OPTIMAL = LRU
- d) OPTIMAL = FIFO

- Q37. Which of the following is NOT true of deadlock prevention and deadlock avoidance schemes?
- a) In deadlock prevention, the request for resources is always granted if the resulting state is safe
 - b) In deadlock avoidance, the request for resources is always granted if the result state is safe
 - c) Deadlock avoidance is less restrictive than deadlock prevention
 - d) Deadlock avoidance requires knowledge of resource requirements a priori
- Q38. A system contains three programs and each requires three tape units for its operation. The minimum number of tape units which the system must have such that deadlocks never arise is ____.
- a) 6
 - b) 7
 - c) 8
 - d) 9
- Q39. Given the basic ER and relational models, which of the following is INCORRECT?
- a) An attribute of an entity can have more than one value
 - b) An attribute of an entity can be composite
 - c) In a row of a relational table, an attribute can have more than one value
 - d) In a row of a relational table, an attribute can have exactly one value or a NULL value
- Q40. Which of the following concurrency control protocols ensure both conflict serializability and freedom from deadlock?
- I. 2-phase locking
 - II. Time-stamp ordering
- a) I only
 - b) II only
 - c) Both I and II
 - d) Neither I nor II

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ANSWER KEY

Question No.	Answer	Question No.	Answer
Q1	C	Q21	D
Q2	D	Q22	B
Q3	B	Q23	B
Q4	A	Q24	B
Q5	D	Q25	D
Q6	A	Q26	C
Q7	D	Q27	B
Q8	D	Q28	B
Q9	A	Q29	B
Q10	D	Q30	B
Q11	C	Q31	D
Q12	B	Q32	A
Q13	D	Q33	C
Q14	A	Q34	D
Q15	A	Q35	C
Q16	D	Q36	B
Q17	C	Q37	A
Q18	C	Q38	B
Q19	C	Q39	C
Q20	D	Q40	B

