

- Q-1. $(G, *)$ is an abelian group. Then
- $x = x^{-1}$, for any x belonging to G
 - $x = x^2$, for any x belonging to G
 - $(x * y)^2 = x^2 * y^2$, for any x, y belonging to G
 - G is of finite order
- Q-2. If $A = \{x, y, z\}$ and $B = \{u, v, w, x\}$, and the universe is $\{s, t, u, v, w, x, y, z\}$. Then $(A \cup B)' \cap (A \cap B)$ is equal to
- $\{u, v, w, x\}$
 - $\{\}$
 - $\{u, v, w, x, y, z\}$
 - None of these
- Q-3. The domain of the function $\log(\log \sin(x))$ is
- $0 < x < \pi$
 - $2n\pi < x < (2n + 1)\pi$, for n in \mathbb{N}
 - Empty set
 - None of the above
- Q-4. The Gauss-Seidal iterative method can be used to solve which of the following sets?
- Linear algebraic equations
 - Linear and non-linear algebraic equations
 - Linear differential equations
 - Linear and non-linear differential equations
- Q-5. A class of 30 students occupy a classroom containing 5 rows of seats, with 8 seats in each row. If the students seat themselves at random, the probability that the sixth seat in the fifth row will be empty is
- $1/5$
 - $1/3$
 - $1/4$
 - $2/5$
- Q-6. The range of integers that can be represented by an n bit 2's complement number system is:
- -2^{n-1} to $2^{n-1} - 1$
 - $-(2^{n-1} - 1)$ to $(2^{n-1} - 1)$
 - -2^{n-1} to 2^{n-1}
 - $-(2^{n-1} + 1)$ to $(2^{n-1} - 1)$
- Q-7. A modulus -12 ring counter requires a minimum of
- 10 flip-flops
 - 12 flip-flops
 - 8 flip-flops
 - 6 flip-flops
- Q-8. How many 32K X 1 RAM chips are needed to provide a memory capacity of 256K-bytes?
- 8
 - 32
 - 64
 - 128
- Q-9. In a 8-bit ripple carry adder using identical full adders, each full adder takes 34 ns for computing sum. If the time taken for 8-bit addition is 90 ns, find time taken by each full adder to find carry.
- 6 ns
 - 7 ns

- C. 10 ns
- D. 8 ns

Q-10. Consider a 32-bit processor which supports 70 instructions. Each instruction is 32 bit long and has 4 fields namely opcode, two register identifiers and an immediate operand of unsigned integer type. Maximum value of the immediate operand that can be supported by the processor is 8191. How many registers the processor has ?

- A. 16
- B. 32
- C. 64
- D. 128

Q-11. Consider the function

```
int fun(x: integer)
{
    If x > 100 then fun = x - 10;
    else
    fun = fun(fun(x + 11));
}
```

For the input x = 95, the function will return

- A. 89
- B. 90
- C. 91
- D. 92

Q-12. What does the following C-statement declare?

```
int (*f) (int*);
```

- A. A function that takes an integer pointer as argument and returns an integer
- B. A function that takes an integer as argument and returns an integer pointer
- C. A pointer to a function that takes an integer pointer as argument and returns an integer
- D. A function that takes an integer pointer as argument and returns a function pointer

Q-13. A language with string manipulation facilities uses the following operations.

head(s) - returns the first character of the string s

tail(s) - returns all but the first character of the string s

concat(s1, s2) - concatenates string s1 with s2.

The output of **concat(head(s), head(tail(tail(s))))**, where s is abcd is

- A. ab
- B. ba
- C. ac
- D. as

Q-14. A stack is implemented with an array of 'A[0...N - 1]' and a variable 'pos'. The push and pop operations are defined by the following code.

```
push (x)
    A[pos] ← x
    pos ← pos + 1
end push
```

```
pop ( )
    pos ← pos - 1
    return A[pos]
end pop
```

Which of the following will initialize an empty stack with capacity N for the above implementation?

- A. $\text{pos} \leftarrow -1$
 - B. $\text{pos} \leftarrow 0$
 - C. $\text{pos} \leftarrow 1$
 - D. $\text{pos} \leftarrow N - 1$
- Q-15. The number of rotations required to insert a sequence of elements 9,6,5,8,7,10 into an empty AVL tree is?
- A. 1
 - B. 2
 - C. 3
 - D. 4
- Q-16. Given two sorted list of size m and n respectively. The number of comparisons needed the worst case by the merge sort algorithm will be
- A. $m \times n$
 - B. maximum of m and n
 - C. minimum of m and n
 - D. $m + n - 1$
- Q-17. Given a binary-max heap. The elements are stored in an arrays as 25, 14, 16, 13, 10, 8, 12. What is the content of the array after two delete operations?
- A. 14,13,8,12,10
 - B. 14,12,13,10,8
 - C. 14,13,12,8,10
 - D. 14,13,12,10,8
- Q-18. Which one of the following in-place sorting algorithms needs the minimum number of swaps?
- A. Insertion Sort
 - B. Quick Sort
 - C. Heap Sort
 - D. Selection Sort
- Q-19. Which one of the following property is correct for a red-black tree?
- A. Every simple path from a node to a descendant leaf contains the same number of black nodes
 - B. If a node is red, then one children is red and another is black
 - C. If a node is red, then both its children are red
 - D. Every leaf node (sentinel node) is red
- Q-20. A priority queue is implemented as a Max-heap. Initially it has 5 elements. The level order traversal of the heap is 10, 8, 5, 3, 2. Two new elements '1' and '7' are inserted into the heap in that order. The level order traversal of the heap after the insertion of the elements is
- A. 10, 8, 7, 5, 3, 2, 1
 - B. 10, 8, 7, 2, 3, 1, 5
 - C. 10, 8, 7, 1, 2, 3, 5
 - D. 10, 8, 7, 3, 2, 1, 5
- Q-21. If a node has K children in Btree, then the node contains exactly _____ keys.
- A. K^2
 - B. $K - 1$
 - C. $K + 1$
 - D. $K^{1/2}$

- Q-22. The Floyd-Warshall algorithm for all-pair shortest paths computation is based on:
- Greedy paradigm.
 - Divide-and-Conquer paradigm.
 - Dynamic Programming paradigm.
 - neither Greedy nor Divide-and-Conquer nor Dynamic Programming paradigm.
- Q-23. Identify the language generated by the following grammar
- $$S \rightarrow AB$$
- $$A \rightarrow aAb/\epsilon$$
- $$B \rightarrow bB/b$$
- $\{a^m b^n \mid n \geq m, m > 0\}$
 - $\{a^m b^n \mid n \geq m, m \geq 0\}$
 - $\{a^m b^n \mid n > m, m > 0\}$
 - $\{a^m b^n \mid n > m, m \geq 0\}$
- Q-24. Suppose that L1 is a regular language and L2 is a context-free language. Which one of the following languages is NOT necessarily context-free?
- $L1 \cap L2$
 - $L1 \cdot L2$
 - $L1 - L2$
 - $L1 \cup L2$
- Q-25. What is the number of steps required to derive the string $((() ()) ())$
- $$S \rightarrow SS$$
- $$S \rightarrow (S)$$
- $$S \rightarrow \epsilon$$
- 10
 - 15
 - 12
 - 16
- Q-26. Which of the following productions eliminate left recursion in the productions given below:
- $$S \rightarrow Aa \mid b, A \rightarrow Ac \mid Sd \mid \epsilon$$
- $S \rightarrow Aa \mid b, A \rightarrow bdA', A' \rightarrow A'c \mid A'ba \mid A \mid \epsilon$
 - $S \rightarrow Aa \mid b, A \rightarrow A' \mid bdA', A' \rightarrow cA' \mid adA' \mid \epsilon$
 - $S \rightarrow Aa \mid b, A \rightarrow A'c \mid A'd, A' \rightarrow bdA' \mid cA \mid \epsilon$
 - $S \rightarrow Aa \mid b, A \rightarrow cA' \mid adA' \mid bdA', A' \rightarrow A \mid \epsilon$
- Q-27. The output of a lexical analyzer is
- A parse tree
 - Intermediate code
 - Machine code
 - A stream of tokens
- Q-28. Which of the following comment about peep-hole optimization is true?
- It is applied to small part of the code and applied repeatedly
 - It can be used to optimize intermediate code
 - It can be applied to a portion of the code that is not contiguous
 - It is applied in symbol table to optimize the memory requirements.
- Q-29. Consider the following table in a relational database

| Last Name | Rank | Room | Shift |
|-----------|-----------|------|-----------|
| Smith | Manager | 234 | Morning |
| Jones | Custodian | 33 | Afternoon |
| Smith | Custodian | 33 | Evening |
| Doe | Clerical | 222 | Morning |

According to the data shown in the table, which of the following could be a candidate key of the table?

- A. {Last Name}
- B. {Room}
- C. {Shift}
- D. {Room, Shift}

Q-30. Consider the following query :

```
SELECT E.eno, COUNT(*)  
FROM Employees E  
GROUP BY E.eno
```

If an index on eno is available, the query can be answered by scanning only the index if

- A. the index is only hash and clustered
- B. the index is only B+tree and clustered
- C. index can be hash or B+ tree and clustered or non-clustered
- D. index can be hash or B+ tree and clustered

Q-31. For a database relation R(a,b,c,d) where the domains of a, b, c and d include only atomic values, only the following functional dependencies and those that can be inferred from them hold

$a \rightarrow c$
 $b \rightarrow d$

The relation is in

- A. First normal form but not in second normal form
- B. Second normal form but not in third normal form
- C. Third normal form
- D. None of the above

Q-32. ACID properties of a transactions are

- A. Atomicity, consistency, isolation, database
- B. Atomicity, consistency, isolation, durability
- C. Atomicity, consistency, integrity, durability
- D. Atomicity, consistency, integrity, database

Q-33. Which of the following is the highest isolation level in transaction management?

- A. Serializable
- B. Repeated Read
- C. Committed Read
- D. Uncommitted Read

Q-34. Suppose a system contains n processes and system uses the round-robin algorithm for CPU scheduling then which data structure is best suited for ready queue of the process

- A. stack
- B. queue
- C. circular queue
- D. tree

Q-35. Increasing the RAM of a computer typically improves performance because:

- A. Virtual Memory increases
- B. Larger RAMs are faster
- C. Fewer page faults occur
- D. Fewer segmentation faults occur

Q-36. Consider the following program.

```
main()  
{
```

```

fork();
fork();
fork();
}

```

How many new processes will be created?

- A. 5
- B. 5
- C. 7
- D. 8

Q-37. Consider the following set of processes, with arrival times and the required CPU-burst times given in milliseconds.

| Process | Arrival Time | Burst Time |
|---------|--------------|------------|
| P1 | 0 | 4 |
| P2 | 2 | 2 |
| P3 | 3 | 1 |

What is the sequence in which the processes are completed? Assume round robin scheduling with a time quantum of 2 milliseconds

- A. P1, P2, P3
- B. P2, P1, P3
- C. P3, P2, P1
- D. P2, P3, P1

Q-38. Determine the number of page faults when references to pages occur in order - 1, 2, 4, 5, 2, 1, 2, 4. Assume that the main memory can accommodate 3 pages and the main memory already has the pages 1 and 2, with page 1 having brought earlier than page 2.(assume LRU algorithm is used)

- A. 3
- B. 4
- C. 5
- D. 6

Q-39. How many check bits are required for 16 bit data word to detect 2 bit errors and single bit correction using hamming code?

- A. 5
- B. 6
- C. 7
- D. 8

Q-40. What is the maximum number of characters (7 bits + parity) that can be transmitted in a second on a 19.2 kbps line. This asynchronous transmission requires 1 start bit and 1 stop bit.

- A. 192
- B. 240
- C. 1920
- D. 1966

Q-41. IPv6 does not support which of the following addressing modes?

- A. unicast addressing
- B. multicast addressing
- C. broadcast addressing
- D. anycast addressing

Q-42. What is IP class and number of sub-networks if the subnet mask is 255.224.0.0?

- A. Class A, 3
- B. Class A, 8

- C. Class B, 3
 - D. Class B, 32
- Q-43. In the IPv4 addressing format, the number of networks allowed under Class C addresses is
- A. 2^{20}
 - B. 2^{24}
 - C. 2^{14}
 - D. 2^{21}
- Q-44. Which of the following protocol is used for transferring electronic mail messages from one machine to another?
- A. TELNET
 - B. FTP
 - C. SNMP
 - D. SMTP
- Q-45. Which media access control protocol is used by IEEE 802.11 wireless LAN?
- A. CDMA
 - B. CSMA/CA
 - C. ALOHA
 - D. None of the above
- Q-46. Pretty Good Privacy (PGP) is used in
- A. Browser security
 - B. FTP security
 - C. Email security
 - D. None of the above
- Q-47. An Ethernet frame that is less than the IEEE 802.3 minimum length of 64 octets is called
- A. Short frame
 - B. Small frame
 - C. Mini frame
 - D. Runt frame
- Q-48. A supernet has a first address of 205.16.32.0 and a supernet mask of 255.255.248.0. A router receives 4 packets with the following destination addresses. Which packet belongs to this supernet?
- A. 205.16.42.56
 - B. 205.17.32.76
 - C. 205.16.31.10
 - D. 205.16.39.44
- Q-49. What is the availability of the software with following reliability figures.
- i. Mean Time Between Failures (MTBF) is 20 days
 - ii. Mean Time to Repair (MTRR) is 20 hours
- A. 90%
 - B. 96%
 - C. 24%
 - D. 50%
- Q-50. Which of the following types of coupling has the weakest coupling?
- A. Pathological coupling
 - B. Control coupling
 - C. Data coupling
 - D. Message coupling

- Q-51. In unit testing of a module, it is found that for a set of test data, at the maximum 90% of the code alone were tested with the probability of success 0.9. The reliability of the module is
- A. Greater than 0.9
 - B. Equal to 0.9
 - C. At most 0.81
 - D. At least 0.81
- Q-52. In software maintenance tackling the changes in the hardware or software environment where the software works, is
- A. Corrective maintenance
 - B. Perfective maintenance
 - C. Adaptive maintenance
 - D. Preventive maintenance
- Q-53. Which of the following is not a life cycle model?
- A. Spiral model
 - B. Prototyping model
 - C. Waterfall model
 - D. Capability maturity model
- Q-54. The lower degree of cohesion is kind of
- A. Logical Cohesion
 - B. Coincidental Cohesion
 - C. Procedural Cohesion
 - D. Communicational Cohesion
- Q-55. The Functions Point (FP) metric is
- A. Calculated from user requirement
 - B. Calculated from lines of code
 - C. Calculated from software complexity assessment
 - D. None of the above
- Q-56. What does the data dictionary identify?
- A. Field names
 - B. Field formats
 - C. Field Types
 - D. All of these
- Q-57. Which of the following UML 2.0 diagrams capture behavioural aspects of a system?
- A. Use Case Diagram, Object Diagram, Activity Diagram, and State Machine Diagram
 - B. Use Case Diagram, Activity Diagram, and State Machine Diagram
 - C. Object Diagram, Communication Diagram, Timing Diagram, and Interaction diagram
 - D. Object Diagram, Composite Structure Diagram, Package Diagram, and Deployment Diagram
- Q-58. Which of the following is not a life cycle model?
- A. Spiral model
 - B. Prototyping model
 - C. Waterfall model
 - D. Capability maturity model
- Q-59. Cloaking is a search engine optimization (SEO) technique. During cloaking
- A. Content presented to search engine spider is different from that presented to user's browser

- B. Content present to search engine spider and browser is same
- C. Contents of user's requested website are changed
- D. None of the above

Q-60. XPath is used to navigate through elements and attributes in

- A. XSL document
- B. XML document
- C. XHTML document
- D. XQuery document

Answer Key ITCA Final

| | | | | | |
|----|---|----|---|----|---|
| 1 | C | 21 | B | 41 | C |
| 2 | D | 22 | C | 42 | B |
| 3 | C | 23 | D | 43 | D |
| 4 | A | 24 | C | 44 | D |
| 5 | C | 25 | A | 45 | B |
| 6 | A | 26 | B | 46 | C |
| 7 | B | 27 | D | 47 | D |
| 8 | C | 28 | A | 48 | D |
| 9 | D | 29 | D | 49 | B |
| 10 | C | 30 | C | 50 | C |
| 11 | C | 31 | A | 51 | C |
| 12 | C | 32 | B | 52 | C |
| 13 | C | 33 | A | 53 | D |
| 14 | D | 34 | C | 54 | B |
| 15 | C | 35 | C | 55 | C |
| 16 | D | 36 | * | 56 | D |
| 17 | C | 37 | B | 57 | B |
| 18 | D | 38 | B | 58 | # |
| 19 | A | 39 | B | 59 | A |
| 20 | D | 40 | C | 60 | B |

* Option A & B are identical for Q. No. 36, hence marks awarded to all candidates for Q. No. 36.

Q. No. 53 & Q. No. 58 are identical, hence Q. No. 58 is dropped. Therefore, the total number of questions will be 59 for the paper.