


## COMPUTER SCIENCE AND APPLICATIONS <br> Paper - III

1. The following numbers are inserted into an empty binary search tree in the given order: $10,1,3,5,15,12,16$. What is the height of the binary search tree (tree height is the maximum distance of a leaf node from the root) ?
(A) 2
(B) 3
(C) 4
(D) 6
2. What is the time complexity of the following recursive function?
int DoThisThing (int n) \{

$$
\begin{aligned}
& \text { if }(\mathrm{n}<=2) \text { return } 1 \text {; } \\
& \text { else return (DoThisThing } \\
& \qquad(\text { floor }(\operatorname{sqrt}(\mathrm{n})))+\mathrm{n}) ; \text { \} }
\end{aligned}
$$

(A) $\Theta\left(n^{2}\right)$
(B) $\Theta\left(\mathrm{n} \log _{2} \mathrm{n}\right)$
(C) $\Theta\left(\log _{2} n \log _{2} n\right)$
(D) $\Theta\left(\log _{2} n\right)$
3. Let $w$ be the minimum weight among all the edge weights in an undirected connected graph. Let e be a specific edge of weight w. Which of the following is FALSE?
(A) There is a minimum spanning tree containing e
(B) If $e$ is not in a minimum spanning tree T after that in the cycle formed by adding e to T , all edges have the same weight.
(C) Every minimum spanning tree has an edge of weight $w$
(D) e is present in every minimum tree has an edge of weight $w$.
4. Algorithm for $0 / 1$ knapsack Problem of 3 instances can be designed using
(A) Greedy Method
(B) Divide-and-Conquer
(C) Dynamic Programming
(D) All the above
5. Dijkstra algorithm is for finding
(A) Shortest paths from single source to several sinks.
(B) Minimum spanning tree for a graph
(C) Sorted list of nodes in a undirected graph with negative edge weights
(D) All the above
6. The problems 3-SAT and 2-SAT are
(A) both in P
(B) both NP-complete
(C) NP-complete and in P respectively
(D) undecidable and NP-complete respectively
7. Suppose $A$ and $B$ are two sets of strings from $\Sigma^{*}$. Further suppose that $B$ is a subset of $A$. Which of the following statement must always be true for $A$ and $B$ ?
I. If $A$ is finite then $B$ is finite
II. If $A$ is regular then $B$ is regular
III. If $A$ is context free then $B$ is context free
(A) I only
(B) II only
(C) III only
(D) All the above
8. Which of the following languages will be equivalent?
$L_{1}=\left\{0^{n} 1^{n} / n \geq 1\right\}, L_{2}=S \rightarrow 0 S 1\left|01 ; L_{3}=01\right|$ $0^{+} 011^{+}$
(A) $L_{2}$ and $L_{3}$
(B) $\mathrm{L}_{3}$ and $\mathrm{L}_{1}$
(C) $L_{1}$ and $L_{2}$
(D) $L_{1}, L_{2}$ and $L_{3}$
9. Consider a DFA accepting all strings over $\{a, b\}$ such that number of a's and b's are even. What is the minimum number of states such DFA will have?
(A) 2
(B) 4
(C) 6
(D) 8
10. Which one of the following is FALSE?
(A) There is a unique minimal DFA for every regular language.
(B) Every NFA can be converted to an equivalent PDA.
(C) Complement of every context-free language is recursive.
(D) Every non-deterministic PDA can be converted to an equivalent deterministic PDA
11. A shift reduce parser carries out the actions specified within braces immediately after reducing with the corresponding rule of grammar: $S \rightarrow \mathrm{xxW}$ \{print "1"\}, $S \rightarrow Y$ \{print " 2 "\}, $W \rightarrow$ Sz \{print " 3 "\}. What is the translation of xxxxyzz using the syntax directed translation scheme described by the above rules
(A) 11231
(B) 33211
(C) 11233
(D) 23131
12. Let $S$ be an NP-complete problem $Q$ and $R$ be two other problems not known to be in NP. $Q$ is polynomial-time reducible to $S$ and $S$ is polynomial-time reducible to $R$. Which one of the following statements is true?
(A) R is NP-complete
(B) $R$ is NP-hard
(C) Q is NP-complete
(D) Q is NP-hard
13. Degree of Membership of $x$ in Union of fuzzy sets $A$ and $B$ is defined as
(A) $\mu_{A \cup B}(x)=\operatorname{Max}\left\{\mu_{A}(x), \mu_{B}(x)\right\}$
(B) $\mu_{A U B}(x)=\{x / x$ is in $A$ or $x$ is in $B$ or in both $\}$
(C) $\mu_{A \cup B}(x)=\mu_{A}(x) \cdot \mu_{B}(x)$
(D) $\mu_{A U B}(x)=\operatorname{Min}\left\{\mu_{A}(x), \mu_{B}(x)\right\}$
14. The inner product and outer product of two fuzzy vectors $\mathrm{a}=(0.5,0.2,1.0,0.8)$ and $\mathrm{b}=(0.8,0.1,0.9,0.3)$ are respectively
(A) 1.56 and 0.44
(B) 0.5 and 0.5
(C) 0.9 and 0.2
(D) 1.56 and 8.44
15. Logistic sigmoid function is
(A) same as ramp function
(B) $1 /\left(1+e^{-k x}\right)$ with $k$ is the steepness parameter
(C) $-1+2 /\left(1+e^{-k x}\right)$ with $k$ is the steepness parameter
(D) None of the above
16. Given the statements
I. Simple Perceptions are single layer feed-forward networks
II. Simple Perceptions use binary activation functions
III. Simple Perception has output unit which has an activation $1,0,-1$
(A) I and II are correct
(B) I, II, III are correct
(C) II and III are correct
(D) I and III are correct
17. Consider the grammar $E \rightarrow E+n|E \times n| n$. For a sentence $\mathrm{n}+\mathrm{n}$, the handles in the right-sentential form of the reduction are
(A) $n, E+n$ and $E+n x n$
(B) $n, E+n$ and $E+E x n$
(C) $n, n+n$ and $n+n x n$
(D) $\mathrm{n}, \mathrm{E}+\mathrm{n}$ and $\mathrm{E} \times \mathrm{n}$
18. With reference to classes and member functions in C++, identify the FALSE statement among the following:
(A) Only the member functions can have access to private data members and private functions.
(B) Member functions can be defined inside or outside the class.
(C) A static member function can have access to the static members declared in any class.
(D) The keyword const is appended to the function prototype of a member function that does not alter any data in the class.
19. Identify TRUE statement among the following with reference to inheritance concept in C++.
(A) A new class derived from base class using inheritance is known as super class.
(B) The private members of base class can be inherited.
(C) A member declared protected is accessible by any class immediately derived from it.
(D) An abstract class is one that is used to create objects.
20. Constructor in a OOP language
(A) helps us to construct objects of a class
$(B)$ is a member function that initialize the objects of a class
(C) must be declared in a private section
(D) can be a virtual function
21. Which of the following is true?
(A) Optimal solution of Linear Programming Problem can always be identified only in middle of feasible region
(B) Optimal solution of Liner Programming Problem can always be identified with one of the feasible corner points of solution space
(C) Solution space of Linear Programming is always bounded
(D) Solution space of Linear Programming has finite number of solutions
22. The optimal value of $z$ for the following Linear Programming Problem is

Maximize $z=5 x_{1}+6 x_{2}$

Subject to $x_{1}-2 x_{2}>=2$

$$
-2 x_{1}+3 x_{2}>=2
$$

$\mathrm{x}_{1}, \mathrm{x}_{2}$ are unrestricted in sign
(A) -86
(B) 86
(C) unbounded solution
(D) 6
23. The starting solution using least-cost method for the following transportation model

| 1 | 2 | 6 | 7 |
| :--- | :--- | :--- | :--- |
| 0 | 4 | 2 | 12 |
| 3 | 1 | 5 | 11 |
| 10 | 10 | 10 |  |

is
(A) 40
(B) 60
(C) 94
(D) 61
24. Which of the following statements are true?
I. Primal simplex method starts with feasible but not optimal
II. Dual simplex method starts infeasible but optimal
III. Primal simplex method starts with infeasible but optimal
IV. Dual simplex method starts feasible and optimal
(A) II and III only
(B) I ,II and III only
(C) I and II only
(D) I, II, III and IV
25. The method used for in developing necessary Kuhn-Tucker conditions for identifying stationery points of non-linear constrained problem with constraints
(A) Min-Cut
(B) Lagrangean
(C) Vogel
(D) Gomory's Cutting Plane
26. The following four statements were sought to bring out the similarities between the concept of a Table and that of a Relation (in Relational model of data). One of them is incorrect. Identify the INCORRECT choice.
(A) The number of rows in a table is the same as the cardinality of a relation
(B) The number of columns of a table is the same as the degree of a relation
(C) The tenth row of a Table is the $10^{\text {th }}$ Tuple of a Relation
(D) The column headings of a Table is the same as the Attribute names of a Relation
27. For a database relation $R(a, b, c, d)$ where the domain of $a, b, c, d$ include only atomic values. Only the following functional dependencies and those that can be inferred from them hold: $a \rightarrow b, b \rightarrow d$. The relation is
(A) in first normal form but not in second normal form
(B) in second normal form but not in third normal form
(C) in third normal form
(D) None
28. Consider the schedule consisting of sequence of Read ( $r$ ) and Write (w) operations. Subscript of $r$ and $w$ denote two transactions 1 and 2.
$r_{1}(A): w_{1}(A) ; r_{2}(A) ; w_{2}(A) ; r_{1}(B) ; w_{1}(B) ;$
$r_{2}(B) ; w_{2}(B)$
This schedule is of $\qquad$ serializable.
(A) Time stamp
(B) Non-serial
(C) Conflict
(D) Serial
29. Query By Example (QBE) is based on
(A) Tuple Calculus
(B) Domain Calculus
(C) SQL
(D) All of the above
30. A trigger is
(A) a statement that enables to start any DBMS
(B) a statement that is executed by the user when debugging an application program
(C) a condition the system tests for the validity of the user
(D) a statement that is executed automatically by the system as a side effect of modification to the database
31. RAID model is best suited for
(A) Extremely short development cycle
(B) Extremely large development cycle
(C) Suitable for any kind of development
(D) None of the above
32. A level 0 Data Flow Diagram (DFD) is called
(A) Bubble chart
(B) Process chart
(C) ER Diagram
(D) Context diagram
33. Which one of the following is equivalent for quality control in Software?
(A) Defect prevention
(B) Variation control
(C) Defect removal
(D) Cost control
34. Degree of Cohesion of objects can be determined by
(A) Total fan_in of all objects / Total fan_out
(B) Total fan_out of all objects / Total fan_in
(C) Total fan_out of all objects / Total objects
(D) Total fan_in / Total objects
35. Prototyping model is
(A) linear sequential model
(B) an iterative model
(C) an evolutionary model
(D) none
36. Hamming distance of 5 can detect and correct errors in
(A) five bits
(B) three bits
(C) two bits
(D) one bit only
37. Which of the following statements are true for Huffman Code?

Huffman Coding
I. is an entropy encoding algorithm
II. is used for lossless data compression
III. makes use of a variable-length code
(A) II and III only
(B) I and II only
(C) I and III only
(D) All of these
38. Find the statement(s) which is/are NOT applicable to BSC ( Binary Symmetric Channel)
I. it can transmit only one of two symbols (0 and 1)
II. The transmission is assumed to be perfect, with the receiver getting the right bit.
III. Many problems in communication theory can be reduced to a BSC because it is one of the simplest noisy channels to analyze.
(A) III only
(B) II only
(C) I and III only
(D) II and III only
39. The IP delivery service is
(A) reliable, connection-oriented
(B) non-routable
(C) unreliable, connectionless
(D) none of the above
40. What is the best description of switches and hubs from the list below?
(A) Hubs are faster than switches
(B) Switches setup virtual circuits and reduce network bandwidth
(C) More networking devices can be added to a hub
(D) Hubs support spanning trees, switches do not
41. The best data structure to check whether an arithmetic expression has balanced parenthesis is
(A) Queue
(B) Stack
(C) Tree
(D) Graph
42. In Hierarchical routing for 400 router subnet, the optimal number of levels is
(A) 20
(B) 400
(C) 3
(D) 6
43. A device that merges several low-speed asynchronous signals into one highspeed synchronous circuit is called
(A) A de-multiplexer
(B) A concentrator
(C) A buffer
(D) A decoder
44. While using Internet you can secure the communication best by using
(A) encoding
(B) encryption
(C) VOIP
(D) e-FAX
45. Page fault occurs when
(A) there is a mismatch between requested data and available data
(B) OS is finding fault with a page which is already loaded into memory
(C) OS is looking for a page which is not yet defined by the programmer/user
(D) OS is looking for a page which is not loaded into main memory
46. Which of the following is correct with respect to mailbox in Inter-Process Communication?
(A) Only the owner process can send messages to a mailbox
(B) No process other than the owner can send or receive messages to/from a mailbox
(C) Only the owner process can receive messages from a mailbox
(D) Any process can receive messages from a mailbox
47. A critical region is
(A) One which is enclosed by a pair of P and V operation on semaphores
(B) A program segment where shared resources are accessed
(C) A program segment that often causes unexpected system crashes
(D) A program segment that has not been proved bug-free
48. Which of the following is NOT a valid deadlock prevention scheme?
(A) Release all resources before requesting a new resource
(B) Number all resources uniquely and never request a lower numbered resource than the last requested
(C) Never request a resource after releasing the resource
(D) Request and be allocated all required resources before execution
49. Thrashing
(A) reduces page I/O
(B) decreases the degree of multiprogramming
(C) implies excessive I/O
(D) improve the system performance
50. In the relation instance given below, which of the following functional dependencies are satisfied on it.

| A | B | C |
| ---: | ---: | ---: |
| 1 | 4 | 2 |
| 1 | 5 | 3 |
| 1 | 6 | 3 |
| 3 | 2 | 2 |

(A) $\mathrm{AB} \rightarrow \mathrm{C}$ and $\mathrm{C} \rightarrow \mathrm{A}$
(B) $\mathrm{BC} \rightarrow \mathrm{A}$ and $\mathrm{B} \rightarrow \mathrm{C}$
(C) $\mathrm{BC} \rightarrow \mathrm{A}$ and $\mathrm{A} \rightarrow \mathrm{C}$
(D) $\mathrm{AC} \rightarrow \mathrm{B}$ and $\mathrm{B} \rightarrow \mathrm{A}$
51. The minimum time delay between the initiation of two independent memory opertaions is called
(A) access time
(B) cycle time
(C) transfer time
(D) latency time
52. The first operating system used in Microprocessors is
(A) Zenix
(B) DOS
(C) CP/M
(D) Multics
53. A micro-programmed control unit
(A) is faster than a hard-wired control unit
(B) is useful when very small programs are to be run
(C) facilitates easy implementation of new instructions
(D) usually refers to the control unit of a micro-processor
54. The interrupt vector address for TRAP 8085 in 8085 is
(A) 0000h
(B) 0024 h
(C) 0018 h
(D) 002ch
55. Von Neumann architecture is
(A) SISD
(B) SIMD
(C) MIMD
(D) MISD
56. Which of the following devices has a relative origin?
(A) joystick
(B) track ball
(C) mouse
(D) touch screen
57. For a database relation $R(X, Y, Z, P)$, where the domains of $X, Y, Z$, and $P$ include only atomic values, and only the following functional dependencies and those that can be inferred from them hold: $\quad X \rightarrow Z$, $Y \rightarrow P$.

The relation is
(A) in first normal form but not in second normal form
(B) in second normal form but not in third normal form
(C) in third normal form
(D) none of the above
58. Author-ware is a software for
(A) Software for book writing
(B) Creating multimedia documents
(C) Graphics creating
(D) Author's Database
59. Raster Systems display a picture from a definition in a
(A) Display file program
(B) Frame grabber
(C) Frame buffer
(D) Display buffer
60. The best suited hidden surface algorithm to deal with non-polygonal, non-planar surface patches is
(A) Painter's algorithm
(B) z-buffer algorithm
(C) Ray tracing
(D) Scan-line algorithm
61. One of the most noticeable factors that limit processor chip's speed is
(A) Heat built on chip
(B) Large size of monitor
(C) Infrequent use of the Computer System
(D) Size of hard disk
62. Any given Boolean expression can be implemented by using
(A) NAND and NOR gates only
(B) NAND gates only
(C) NOR gates only
(D) OR gates only
63. The main disadvantage of DRAM over SPAM is
(A) High package density
(B) Costly
(C) External memory refresh logic is required
(D) High power consumption
64. A micro-processor with a clock frequency of 100 MHz will have a clock period of
(A) 1 ns
(B) 10 ns
(C) 10000 ns
(D) 1000 ns
65. The ALE line of an 8085 microprocessor is used to
(A) latch the output of an I/O instruction into an external latch.
(B) latch the 8 bits of address line AD7-ADO into external latch
(C) deactivate the chip-select signal from memory devices
(D) find the interrupt enable status of the TRAP interrupt
66. The surface of the drum on which toner stucks is
(A) photogenic
(B) photoconductive
(C) photosensitive
(D) photonic
67. In clipping algorithm of Cohen \& Sutherland using region codes, a line is already clipped if the
(A) logical OR of the end point code is 0000
(B) logical OR of the end point code is not 0000
(C) logical AND of the end point code is 0000
(D) logical AND of the end point code is not 0000
68. The refresh rate below which picture flickers is
(A) 20
(B) 25
(C) 30
(D) 35
69. Plasma panels are based on
(A) Liquit Crystal display
(B) Non-emissive display
(C) Gas discharge display
(D) Absorbing display
70. Which of the following point lies on the same side of the origin, with reference to the line $3 x+7 y=2$ ?
(A) $(3,0)$
(B) $(1,0)$
(C) $(0.5,0.5)$
(D) $(0.5,0)$
71. Which of the following class allows creation of only one object?
(A) Virtual class
(B) Abstract class
(C) Singleton class
(D) Friend class
72. Which of the following concept is appropriate in determining what method to invoke at run time?
(A) dynamic typing
(B) dynamic binding
(C) dynamic loading
(D) data hiding
73. A horn clause with exactly one positive literal is called
(A) A definite clause
(B) A goal clause
(C) A fact
(D) A twist horn
74. BNF is a meta language for
(A) specifying the semantics of a language
(B) specifying the context free grammar
(C) describing how a program works
(D) shell programming
75. As the number of entries in the Hash table increases, the number of collisions
(A) decreases
(B) remains same
(C) increases
(D) randomly changes

## Space for Rough Work

