Roll No. | | | | | | | |

(Write Roll Number from left side exactly as in the Admit Card)

Signature of Invigilators

1. _____

2. _____

2215

Question Booklet Series **A**

PAPER–III

Question Booklet No.

Subject Code : 22

OMR Sheet No. .....

COMPUTER SCIENCE AND APPLICATIONS

Time : 2 Hours 30 Minutes *Maximum Marks: 150*

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page as well as on the OMR Sheet provided.
2. At the commencement of the examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and verify it:
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page.
   (ii) Faulty booklet, if detected, should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   (iii) After this verification is over, the Question Booklet Series and Question Booklet Number should be entered on the OMR Sheet and the OMR Sheet Number should be entered on this Question Booklet.
3. This paper consists of seventy-five (75) multiple-choice type questions. All the questions are compulsory. Each question carries *two* marks.
4. Each Question has four alternative responses marked: (A) (B) (C) (D). You have to darken the circle as indicated below on the correct response against each question.

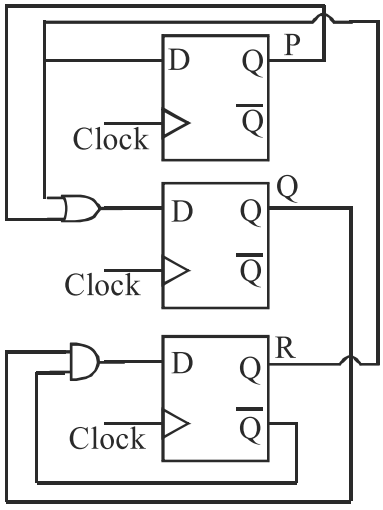
   Example: (A) (B) ● (D), where (C) is the correct response.
5. Your responses to the questions are to be indicated correctly in the OMR Sheet. If you mark your response at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Rough work is to be done at the end of this booklet.
7. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
8. Do not tamper or fold the OMR Sheet in any way. If you do so, your OMR Sheet will not be evaluated.
9. You have to return the Original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry question booklet and duplicate copy of OMR Sheet after completion of examination.
10. **Use only Blue/Black Ball point pen.**
11. **Use of any calculator or log table or mobile phone etc. is strictly prohibited.**
12. **There are no negative marks for incorrect answers.**

[Please Turn Over]

Computer Science and Applications

PAPER—III

1. Consider the following circuit with D flip-flops. Suppose P = 0, Q = 1, and R = 0. What shall be P, Q, R after the clock edge?



(A) 000
(B) 001
(C) 010
(D) 011

2. Consider the languages:

$L_1 = \{a^m b^n : m \geq n\}$
$L_2 = \{a^m b^p c^n d^q : m + n = p + q\}$
$L_3 = \{a^m b^n : m = 2n\}$

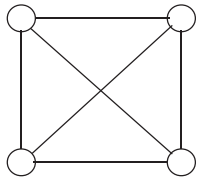
Which of the following is true?

(A) L_1 is context-free, L_2 is context-free, L_3 is context-free.
(B) L_1 is context-free, L_2 is not context-free, L_3 is context-free.
(C) L_1 is context-sensitive, L_2 is context-free, L_3 is context-free.
(D) L_1 is context-free, L_2 is context-free, L_3 is context-sensitive.

3. L_1 : Context-free Language
L_2 : Regular Language
L_3 : Context-free Language
L_4 : Regular Language
$L_5 = L_1 \cap L_2$, $L_6 = L_1 \cup L_3$, $L_7 = L_1 \cup L_4$
Which of the following is correct?

(A) L_5 Regular, L_6 Regular, L_7 Regular
(B) L_5 is context-free, L_6 context-free, L_7 Regular
(C) L_5 context-free, L_6 context-free, L_7 context-free
(D) L_5 Regular, L_6 context-free, L_7 Regular

4. Consider the graph and its search tree



for generation of all cliques by back-tracking. How many nodes are generated for this problem?

(A) 15
(B) 10
(C) 14
(D) 9

5. Consider the time complexities (T) of the following problems.

P_1 : Fourier transform
P_2 : Fast Fourier transform
P_3 : Floyd's algorithm for all pair shortest paths
P_4 : Dijkstra's shortest paths algorithm
Which of the following is true?

(A) $T(P_1) = T(P_2)$, $T(P_3) = T(P_4)$
(B) $T(P_1) < T(P_2)$, $T(P_3) < T(P_4)$
(C) $T(P_2) > T(P_1)$, $T(P_3) < T(P_4)$
(D) $T(P_2) < T(P_1)$, $T(P_4) < T(P_3)$

6. Consider the classes of problems P, NP-Complete, NP-Hard and the problems 2-SAT, 3-SAT, Tower of Hanoi.

Which one of the following is correct?

(A) 2-SAT is in NP-complete, Tower of Hanoi is in NP-complete

(B) 3-SAT is in P, Tower of Hanoi is in NP-Hard

(C) 2-SAT and 3-SAT are in P, Tower of Hanoi is in NP-complete

(D) 2-SAT is in P, Tower of Hanoi is in NP-Hard

7. The height (h) of the Huffman tree for seven distinct symbols having relative frequencies of occurrence 4, 2, 12, 8, 6, 16, 10 respectively. Which one of the following is correct?

(A) h=3

(B) h=5

(C) h=7

(D) h=4

8. Pumping lemma is used for deciding whether a language is of type K. Which one is true of the following options?

(A) K=3 only

(B) K=3, K=2

(C) K=3, K=2, K=1

(D) K=3, K=0

9. Consider the following:

(X) baa $\in$ a* b* a* b*

(Y) b* a* $\cap$ a* b* = a* $\cup$ b*

(Z) a* b* $\cap$ b* c* = ϕ

(W) abcd $\in$ (a(cd)* b)*

Which of the following is correct?

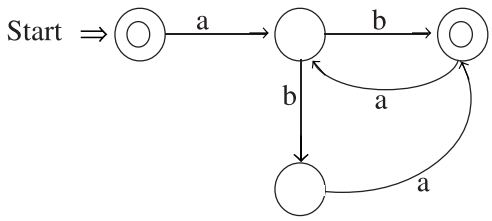
(A) X, W, Z are correct.

(B) Y, W, Z are correct.

(C) X, Y, W are correct.

(D) Z, W are correct.

10. Consider the following non-deterministic finite automaton (NDFA)



Which of the following strings (i) ab, (ii) abab, (iii) abaa are accepted by the NDFA?

(A) (i) only

(B) (ii) and (iii) only

(C) (i) and (iii) only

(D) (i) and (ii) only

11. A string X $\in \Sigma^*$ is square-free if it cannot be written as X= uvvw for some u, v, w$\in \Sigma^*$, v $\neq \in$. Harry is not square-free. Suppose $|\Sigma|>1$ and L= set of all square-free strings in Σ^*. Which of the following is wrong?

(A) L is regular.

(B) L is context-free.

(C) L is context-sensitive.

(D) L is recursively enumerative.

12. Consider the push down automation

M = (K, Σ,τ, Δ, s, F) where

K = {*s*,*f*}

F = {*f*}

Σ = {*a*,*b*}

τ = {*a*}

Δ = {((*s*,*a*,*e*), (*s*,*a*)),((*s*,*b*,*e*),(*s*,*a*)), ((*s*,*a*,*e*),(*f*,*e*)), ((*f*,*a*,*a*), (*f*,*e*)), ((*f*,*b*,*a*), (*f*,*e*))}

Which one of the following is correct?

(A) $aa \in L$, $bab \notin L$

(B) $baaaa \in L$

(C) $aba \in L$, $baa \notin L$

(D) $abb \notin L$, $baa \in L$

13. The time complexity of Banker's algorithm is _____, where P is the number of active processes and r is the number of resources

(A) rP^2

(B) r^2P

(C) rP

(D) r^2P^2

14. A scheduling algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority zero (the lowest priority). The scheduler re-evaluates the process priorities every T time units and decides the next process to schedule. Which among the following is time if the processes have no I/O operations and all arrive at time zero?

The algorithm is equivalent to

(A) First Come First Serve

(B) Shortest Job First

(C) Round-robin scheduling

(D) Shortest Remaining Time First

15. In the index allocation scheme of blocks to a file, the maximum possible size of the file depends on

(A) the size of the blocks and the size of the address of the blocks.

(B) the number of blocks used for the index and the size of the blocks.

(C) the size of the blocks, the number of blocks used for the index and the size of the address of the blocks.

(D) None of the above.

16. The subcategories of orthographic projection are

(A) Cavalier, cabinet, isometric

(B) Cavalier, cabinet

(C) Isometric, dimetric, trimetric

(D) Isometric, cavalier, trimetric

17. Assuming that one allows 256 depth value levels to be used, how much memory would a 512×512 display require to store the Z- buffer?

(A) 512 KB

(B) 256 KB

(C) 1024 KB

(D) 128 KB

18. A bilinear transformation can be simulated by the transformations

(A) Translation, rotation and stretching

(B) Translation and rotation

(C) Rotation, stretching and inversion

(D) Rotation, stretching, inversion and translation

19. With the line Y=X as the reflection axis, the reflection matrix is

(A) $\begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}$

(B) $\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

(C) $\begin{pmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$

(D) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

20. Hue of a color is related to its

(A) Luminance

(B) Saturation

(C) Incandescence

(D) Wavelength

21. Increase in the size of a page in memory management would result in

(A) more internal fragmentation always
(B) more external fragmentation always
(C) both (A) and (B)
(D) cannot be specified for sure

22. In round-robin scheduling, the relation between the time slot and context switching will be

(A) direct
(B) inverse
(C) cannot be specified
(D) conditionaly inverse

23. The dispatcher involves some/all of the followings:

(i) Switching context
(ii) Switching to user mode
(iii) Jumping to the proper location in the user program to restart that program

The proper option will be—

(A) (i) and (ii)
(B) (i) and (iii)
(C) (i), (ii) and (iii)
(D) (ii) and (iii)

24. Among the following four

(i) Mutual exclusion
(ii) Progress
(iii) Bounded waiting and
(iv) Circular wait

a solution to the critical section problem must satisfy

(A) All the four above
(B) (i), (ii) and (iii)
(C) (ii), (iii) and (iv)
(D) (i), (iii) and (iv)

25. A _____ is a flat area of the search space in which a whole set of neighbouring states have the same value

(A) Ridge
(B) Shoulder
(C) Plateau
(D) Both (B) and (C)

26. Which of the following(s) is/are true?

(A) BFS is more time intensive than DFS.
(B) BFS is less time intensive than DFS.
(C) BFS and DFS have the same time overhead.
(D) Time overhead of BFS and DFS cannot be compared.

27. If $C_{Mean}(I)$ and $C_{Median}(I)$ are the time overhead of mean filtering and median filtering respectively of a digital image I of size m × n then which of the following is true?

(A) $C_{Median}(I) = m \times n \times C_{Mean}(I)$
(B) $C_{Median}(I) = C_{Mean}(I)$
(C) $C_{Median}(I) = \log_2 (m \times n) \times C_{Mean}(I)$
(D) $C_{Mean}(I) = \log_2 (m \times n) \times C_{Median}(I)$

28. The storage requirement of storing a true colour digital image of size m × n is

(A) 3mn bytes
(B) mn bytes
(C) 3mn bits
(D) None of the above

29. JPEG format uses

(A) Lossless compression
(B) Lossy compression
(C) no compression at all
(D) selective compression

30. A single layer perceptron (SLP) is capable of

(A) linear classification only
(B) nonlinear classification only
(C) linear as well as nonlinear classification
(D) no classification at all

31. If A is a fuzzy set on universe of discourse X with membership function $\mu_A(x)$, $x \in X$, then

(A) $A^m \subseteq A^n$ whenever $m \leq n$
(B) $A^m \subseteq A^n$ whenever $m \geq n$
(C) $A^m = A^n$ even if $m > n$
(D) $A^m = A^n$ even if $m < n$

32. If A and B are two fuzzy sets on the same universe of discourse X, then

(A) $\overline{A \cap B} = \overline{A} \cup \overline{B}$

(B) $\overline{A \cup B} = \overline{A} \cap \overline{B}$

(C) Both (A) and (B) are true

(D) $\overline{A \cap B} = \overline{A} \cap \overline{B}$

33. If A is a subnormal fuzzy set on universe of discourse X, then the λ-cut on A, represented as $A\lambda$, $\lambda \in [0, 1]$ satisfies

(A) $A_{1.00} = \phi$

(B) $A_{1.00} = \{1\}$

(C) $A_{1.00} \supseteq \{1\}$

(D) None of the above

34. When a process creates a new process, possibilities are enlisted in terms of address space of the new process are as follows:

(i) The parent continues to be executed concurrently with its children.

(ii) The parent waits until some or all of its children have terminated.

(iii) The child process is a duplicate of the parent process (it has the same program and data as the parent).

(iv) The child process has a new program loaded into it.

Which among below is appropriate?

(A) (i) and (ii)

(B) (iii) and (iv)

(C) (i), (ii), (iii) and (iv)

(D) (i), (ii) and (iii)

35. IEEE 802.3 (Ethernet) features which type of signaling?

(A) Baseband Signaling

(B) Wideband

(C) Broadband

(D) Ultra-Wide Band

36. In case of OFDM, the letter 'O' stands for

(A) Optical

(B) Orthogonal

(C) Opto-Magnetic (Magneto-Optic)

(D) Optimal

37. Which of the following does require (or suffer from) resource monopolization?

(A) Physical Circuit Switching

(B) Virtual Circuit Switching

(C) Packet Switching

(D) Message Switching

38. The TCP/IP Network Architecture has Application Layer directly atop the Transport Layer (TCP/UDP etc.). Does it mean that, unlike the OSI Reference Model, in case of TCP/IP Architecture, the presentation and session related functionalities are completely absent?

(A) Yes, there is no such support in the TCP/IP

(B) It depends upon the configuration settings by the network administrator since he/she could enable/disable these functionalities in a given node or network

(C) No, this is not true, since these functionalities are present in certain form but have been selectively pushed into higher and lower layers so as to allow application-specific requirements to be taken care of

(D) None of the above

39. The original Ethernet Protocol does not support hard real-time behavior because

(A) there is no upper-bound possible to be defined on Frame delivery in view of back-off (exponential back-off included) based re-transmission mechanism.

(B) it is slow in term of rate of data transfer.

(C) it uses a shared medium.

(D) it does support hard real-time traffic needs.

40. 'Count-to-Infinity' issue is associated with which of the following Routing Algorithms?

(A) Link-State Routing Algorithm

(B) Distance Vector Routing Algorithm

(C) Path Vector Routing Algorithm

(D) Flow-based Routing Algorithm

41. If a Wide Area Network has very large number of nodes geographically spread over multiple nations, supports Protocol-Independent Multicast (PIM) Routing, supports IP but has less than 1% of its nodes who would from across nations participate in multi-participant video-conferencing, which of the following would be the most efficient?

(A) PIM-SM (Sparse Mode)
(B) PIM-DM (Dense Mode)
(C) Both PIM-SM and PIM-DM would be equally efficient
(D) None of the above

42. The diagram which depicts the flow of task between various components of a system is

(A) class diagram
(B) activity diagram
(C) use case diagram
(D) sequence diagram

43. Which multivalued dependency is not followed from the following table?

Ename	Pname	Dname
Smith	X	Rama
Smith	Y	Lakshman
Smith	X	Lakshman
Smith	Y	Rama

(A) Ename $\rightarrow$ Pname
(B) Pname $\rightarrow$ Ename
(C) Ename $\rightarrow$ Dname
(D) None of the above

44. Consider the employee relation:
employee (name, sex, supervisor_name) with name as key. What does the following Tuple relational calculus query produce?

$\{e.name | employee\ e \wedge \forall(x)$
$[\neg$ employee e(x) V x. supervisor_name $\neq$ e.name V x. sex = male$]\}$

(A) Name of employees with male supervisor
(B) Name of employees with no immediate female supervisor
(C) Name of employees with no immediate male supervisor
(D) None of the above

45. Which of the following uses overflow pages?

(A) B^+ tree
(B) AVL tree
(C) B tree
(D) None of the above

46. In which phase of the query processing is the query lexically and syntactically analysed using parsers to find out any syntax error?

(A) Semantic Analysis
(B) Analysis
(C) Normalization
(D) None of the above

47. The objective of query simplifier is

(A) transformation of query to a semantically equivalent and more efficient form
(B) detection of redundant quantification
(C) elimination of common sub expression
(D) All of the above

48. In which case is the query executed as a single large task?

(A) centralized processing
(B) parallel processing
(C) sequential processing
(D) None of the above

49. If the shadowing approach is used for flushing a datam back to disk, then the datam is written back to

(A) disk before the transaction commits
(B) disk only after the transaction commits
(C) the same disk location from which it was read
(D) a different location on disk

50. In distributed query processing semi join operation is used to

(A) reduce the size of relation that needs to be transmitted.
(B) reduce the communication cost.
(C) Both (A) and (B)
(D) None of the above

51. In intelligent systems reasoning from facts and rules to conclusion is known as

(A) forwarded chaining inferencing
(B) backward chaining inferencing
(C) knowledge discovery using data mining
(D) None of the above

52. An inferencing rule that says if you know falsity of conclusion you can infer falsity of premise is

(A) Modus ponens
(B) Generalised Modus ponens
(C) Chain rule
(D) None of the above

53. The process of finding a substitution that makes two logical statements look same is known as

(A) Heuristic process
(B) NLP
(C) Unification process
(D) None of the above

54. Which of the following is an informed search technique?

(A) Breadth First Search
(B) Best First Search
(C) Depth First Search
(D) None of the above

55. Local maximum Plateau, Ridge, are the difficulties in which searching algorithm?

(A) Hill climbing
(B) Best First Search
(C) Breadth First Search
(D) None of the above

56. A* algorithm uses .... heuristic function to search any goal

(A) evaluation function
(B) heuristic function
(C) fitness number
(D) None of the above

57. In a rule-based system procedural domain knowledge is in the form of

(A) rule interpreters
(B) production rules
(C) meta rules
(D) control rules

58. The sequence diagram depicts the .... behaviour of the system in 0-0 approach

(A) Statical
(B) Dynamical
(C) Both (A) and (B)
(D) None of the above

59. Temporal Cohesion means

(A) Cohesion with respect to time.
(B) Cohesion between temporary variables.
(C) Cohesion between temporary records.
(D) Coincidental cohesion.

60. One of the aspects of software quality is

(A) conformance to requirements
(B) to test the software as an end product
(C) to check the developer's performance
(D) None of the above

61. Which one of the following is not a category of software maintenance?

(A) Corrective maintenance
(B) Effective maintenance
(C) Adaptive maintenance
(D) Perfective maintenance

62. Minimum cyclomatic complexity of any compliable code can be

(A) –1
(B) 0
(C) 1
(D) 0·1

63. Software reliability is

(A) the probability of failure-free operation of a program for a specified time in a specified environment.

(B) the probability of failure of a program for a specified time in a specified environment.

(C) the probability of success of a program for a specified time in a specified environment.

(D) None of the above.

64. If the inorder and preorder traversal of a binary tree are D, B, F, E, G, H, A, C and A, B, D, E, F, G, H, C respectively, then the postorder traversal of that tree is

(A) D, F, G, A, B, C, H, E

(B) F, H, D, G, E, B, C, A

(C) D, F, H, G, E, B, C, A

(D) C, G, H, F, E, D, B, A

65. If a binary tree is threaded for an inorder traversal order, NULL left link of any node is replaced by the address of its

(A) predecessor

(B) root

(C) successor

(D) last node

66. It is required to access the (n/2)th element of a singly connected linked list for K = 0 to $\log_2 n$ in the given order. If n is assumed to be power of 2, then the number of nodes to be traversed for this purpose is

(A) n

(B) 2n

(C) n+1

(D) None of the above

67. Which of the following data structure may give overflow error, even though the current number of elements, is less than it size?

(A) Stack

(B) A simple quene

(C) Circular queue

(D) None of the above

68. Consider the following grammar.

$E \rightarrow TE'$

$E' \rightarrow + TE'/E$

$T \rightarrow FT'$

$T' \rightarrow *FT'/t$

$F \rightarrow (E)/id$

then FOLLOW (E) is given by

(A) {), $}

(B) {+,), $}

(C) {+, *,), $}

(D) None of the above

69. Type checking is normally done during

(A) lexical analysis

(B) syntax analysis

(C) syntax-directed translation

(D) code optimization

70. A state of an NFA is important if

(A) it has a regular out-transition

(B) it has $\in$-dependent out-transition

(C) it has non-$\in$ out-transition

(D) it has no out-transition

71. In a programming language, an identifier is defined as a letter followed by any number of letters or digits. If A and N denote the sets of letters and digits respectively, then the identifier is represented by

(A) (A. N) *

(B) A. (A. N) *

(C) A ($A \cup N$)

(D) ($A \cup N$) *

72. A grammar is left-recursive if

(A) it has a nonterminal A such that there is a derivation $A \overset{+}{\Rightarrow} A\alpha$ for some string α.

(B) it has a nonterminal A such that there is a derivation $A \overset{*}{\Rightarrow} A\alpha$ for some string α.

(C) it has a nonterminal A such that there is a derivation $A \overset{+}{\Rightarrow} A\alpha$ for some string α.

(D) it has a nonterminal A such that there is a derivation $A \rightarrow A\alpha$ for some string α.

73. Define lcs (x, y) as the longest common subsequence of two strings x and y as a string that is a subsequence of both x and y and is as long as any such subsequence. Also define d (x, y) as the distance between x and y as the minimum number of insertion and deletions required to transform x into y. Then for any two strings x & y, the distance between x & y and length of their longest common subsequence are related by

(A) d (x, y) = |x| + |y| – (2*|lcs (x, y)|)

(B) d (x, y) = |x| + |y| – (| lcs (x, y)|)

(C) d (x, y) = |x| + |y| + (| lcs (x, y)|)

(D) None of the above

74. How many points with integer co-ordinates lie in the feasible region defined by $3x+4y \leq 12$, $x \geq 0$, and $y \geq 1$?

(A) 5
(B) 8
(C) 4
(D) 6

75. The solution of the linear programming problem

Min $Z = 5x_1 - 2x_2$

such that $2x_1 + 3x_2 \geq 1$, $x_1, x_2 \geq 0$ is given by

(A) $x_1 = 0, x_2 = 1$, min $z = -8/3$
(B) $x_1 = 0, x_2 = 1/3$, min $z = -2/3$
(C) $x_1 = 1, x_2 = 1/3$, min $z = -4/3$
(D) None of the above

ROUGH WORK