

Test Booklet Series



Test Booklet
(Computer Engineering)

Test Booklet No.

Name of Applicant

Answer Sheet No.

Applicant ID/Roll No. :

Signature of Applicant :

Date of Examination :

Signature of the Invigilator(s)

Time of Examination :

1.

2.

Duration : 2 Hour]

[Maximum Marks : 100

IMPORTANT INSTRUCTIONS

- (i) The question paper is in the form of Test-Booklet containing **100 (Hundred)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct. Choose the correct option or the most appropriate option.
- (ii) On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **100** questions. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.
- (iii) A separate Answer-Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are **100** rows containing four circles each. One row pertains to one question.
- (iv) The candidate should write his/her Application ID/Roll number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and **NOWHERE ELSE**.
- (v) No second Test-Booklet/Question Paper and Answer-Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.
- (vi) For every correct answer of the question **One (1) mark will be awarded**.
- (vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.
- (viii) To mark the answer on the Answer-Sheet, candidate should darken the appropriate circle in the row of each question with Blue or Black pen.
- (ix) For each question only **one** circle should be **darkened** as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the answer will be treated as incorrect.
- (x) The candidates should not remove any paper from the Test-Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.
- (xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.
- (xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*
- (xiii) No candidate shall be permitted to leave the examination hall before the expiry of the time.

DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO.

PART-A
(Research Methodology)

1. The main objective of fundamental/basic research is:
(A) To solve an immediate practical problem
(B) To discover new facts and develop theories
(C) To evaluate existing social programs
(D) To study historical events

2. The scientific method of research is characterized by:
(A) Subjectivity and intuition
(B) Empiricism, objectivity, and replicability
(C) Relying solely on authority
(D) Lack of logical reasoning

3. While selecting a research topic, which of the following is the LEAST important consideration?
(A) Feasibility of the study
(B) Researcher's interest
(C) Availability of funds and time
(D) Personal biases of the researcher

4. The ethical principle of "Informed Consent" implies that:
(A) Participants must be forced to participate for the greater good
(B) Participants must be fully aware of the research procedures and agree voluntarily
(C) Researchers can hide the true purpose of the study to avoid bias
(D) Data can be shared publicly without participant knowledge

5. Fabrication, falsification, and plagiarism in research are collectively known as:
(A) Research misconduct
(B) Sampling error
(C) Ethical compliance
(D) Research methodology

6. Which research design is primarily concerned with describing the characteristics of a population or phenomenon?
(A) Exploratory research design
(B) Descriptive research design
(C) Experimental research design
(D) Diagnostic research design

7. In an experimental research design, the variable that is intentionally manipulated by the researcher is the:
(A) Dependent variable
(B) Extraneous variable
(C) Independent variable
(D) Control variable

8. Research conducted to find out the causes of an event that has already happened, without manipulating variables, is known as:
- (A) Action research (B) Ex-post facto research
(C) Applied research (D) Pure research
9. The "Control Group" in an experimental design is used to:
- (A) Introduce the experimental treatment
(B) Serve as a baseline for comparison with the experimental group
(C) Eliminate the dependent variable
(D) Increase the sample size
10. Deductive reasoning in the scientific method moves from:
- (A) Specific observations to general theories
(B) General theories to specific hypotheses
(C) Empirical data to conceptualization
(D) Null hypothesis to alternative hypothesis
11. Internal validity in an experimental design refers to:
- (A) The generalizability of the findings to the real world
(B) The certainty that the independent variable caused the changes in the dependent variable
(C) The consistency of the measuring instrument
(D) The representativeness of the sample
12. If every member of the population has an equal and independent chance of being selected, the sampling technique is called:
- (A) Purposive sampling (B) Convenience sampling
(C) Simple random sampling (D) Quota sampling
13. When the population is heterogeneous with distinct subgroups (strata), the most appropriate probability sampling technique is:
- (A) Simple random sampling (B) Stratified random sampling
(C) Cluster sampling (D) Snowball sampling

14. In cluster sampling, the sampling units selected are:
- (A) Individual elements
 - (B) Natural groupings or categories (e.g., districts, schools)
 - (C) Homogeneous subgroups
 - (D) Volunteers
15. Snowball sampling is specifically used when:
- (A) The population size is very large
 - (B) The sampling frame is readily available
 - (C) The population is hidden, rare, or difficult to access
 - (D) The researcher needs a perfectly representative sample
16. The difference between a sample statistic and the true population parameter is termed as:
- (A) Systematic error
 - (B) Sampling error
 - (C) Measurement error
 - (D) Non-sampling error
17. Which measurement scale classifies data into mutually exclusive categories without any order or ranking?
- (A) Ordinal scale
 - (B) Interval scale
 - (C) Nominal scale
 - (D) Ratio scale
18. A Likert scale (Strongly Disagree to Strongly Agree) is technically an example of:
- (A) Nominal scale
 - (B) Ordinal scale
 - (C) Interval scale
 - (D) Ratio scale
19. Which scaling technique asks respondents to rate an object on a series of bipolar adjectives (e.g., Good-Bad, Fast-Slow)?
- (A) Likert scale
 - (B) Guttman scale
 - (C) Semantic Differential scale
 - (D) Thurstone scale

- 20.** The key difference between a questionnaire and a schedule is:
- (A) A questionnaire is filled by the enumerator, a schedule is filled by the respondent
 - (B) A questionnaire is filled by the respondent, a schedule is filled by the enumerator/ interviewer
 - (C) A schedule is mailed, a questionnaire is given face-to-face
 - (D) There is no difference between them
- 21.** Data collected by the researcher themselves for the specific purpose of the current study is called:
- (A) Secondary data
 - (B) Primary data
 - (C) Official data
 - (D) Documentary data
- 22.** The process of checking the raw data to ensure completeness, accuracy, and consistency before analysis is called:
- (A) Coding
 - (B) Editing
 - (C) Tabulation
 - (D) Classification
- 23.** Assigning numerical values or symbols to the responses for computational purposes is known as:
- (A) Editing
 - (B) Coding
 - (C) Transcription
 - (D) Tabulation
- 24.** A histogram is used to graphically represent the distribution of:
- (A) Discrete/categorical data
 - (B) Continuous data grouped into class intervals
 - (C) Qualitative characteristics
 - (D) Proportions of a whole
- 25.** A pie chart is most effective for representing:
- (A) Trends over time
 - (B) The relationship between two continuous variables
 - (C) The percentage breakdown of a whole
 - (D) Frequency distribution of continuous data

26. A hypothesis that states there is no significant difference or relationship is called:
- (A) Directional hypothesis
 - (B) Non-directional hypothesis
 - (C) Null hypothesis
 - (D) Alternative hypothesis
27. "Students who study using method A will score significantly higher than those who study using method B." This is an example of:
- (A) Null hypothesis
 - (B) Directional alternative hypothesis
 - (C) Non-directional alternative hypothesis
 - (D) Ex-post facto hypothesis
28. A Type I error in hypothesis testing occurs when:
- (A) We fail to reject a true null hypothesis
 - (B) We reject a true null hypothesis
 - (C) We fail to reject a false null hypothesis
 - (D) We reject a false null hypothesis
29. The probability of committing a Type I error is denoted by:
- (A) Beta (β)
 - (B) Alpha (α)
 - (C) P-value
 - (D) Standard error
30. A statistical test that makes assumptions about the population parameters (like normal distribution, homogeneity of variance) is called:
- (A) Non-parametric test
 - (B) Parametric test
 - (C) Chi-square test
 - (D) Distribution-free test
31. The Chi-square (χ^2) test is primarily used to test:
- (A) The difference between means of two groups
 - (B) The association between two categorical variables
 - (C) The significance of regression coefficients
 - (D) The variance within a single group

32. In a Chi-square test of independence, if the calculated value of χ^2 is greater than the critical/ table value at the 0.05 level, we:
- (A) Accept the null hypothesis
 - (B) Reject the null hypothesis
 - (C) Conclude the variables are independent
 - (D) Conclude the sample is biased
33. The formula for calculating expected frequency (E) in a Chi-square contingency table cell is:
- (A) (Row Total $\times$ Column Total) / Grand Total
 - (B) (Row Total + Column Total) / Grand Total
 - (C) Grand Total / (Row Total $\times$ Column Total)
 - (D) Row Total / Column Total
34. Analysis of Variance (ANOVA) is used instead of multiple t-tests to compare the means of three or more groups because:
- (A) ANOVA is easier to calculate
 - (B) Multiple t-tests increase the risk of Type I error
 - (C) ANOVA does not require normal distribution
 - (D) ANOVA uses nominal data
35. In a one-way ANOVA, the "one way" refers to:
- (A) One dependent variable and one independent variable with multiple levels
 - (B) One independent variable and multiple dependent variables
 - (C) Only one sample being tested
 - (D) One-tailed test of significance
36. The F-ratio in One-way ANOVA is calculated as:
- (A) Within-group variance / Between-group variance
 - (B) Between-group variance / Within-group variance
 - (C) Total variance / Residual variance
 - (D) Mean square error / Mean square total
37. The degrees of freedom for "Between Groups" in a One-Way ANOVA with 'k' groups is:
- (A) $N - 1$
 - (B) $N - k$
 - (C) $k - 1$
 - (D) $(N - 1) - (k - 1)$

38. Which of the following is a non-parametric alternative to One-way ANOVA?
(A) Kruskal-Wallis test (B) Mann-Whitney U test
(C) Wilcoxon signed-rank test (D) Chi-square goodness of fit
39. A multivariate statistical technique used to reduce a large number of interrelated variables to a smaller set of unobservable factors is:
(A) Cluster Analysis (B) Factor Analysis
(C) Discriminant Analysis (D) Conjoint Analysis
40. In Factor Analysis, the proportion of variance in a specific variable explained by the common factors is called:
(A) Communality (B) Eigenvalue
(C) Factor loading (D) Uniqueness
41. Which concept in Factor Analysis represents the total variance explained by a specific factor across all variables?
(A) Communality (B) Eigenvalue
(C) Factor score (D) Rotation
42. Multiple Regression is used to:
(A) Classify objects into groups
(B) Predict the value of a dependent variable based on two or more independent variables
(C) Reduce the number of variables
(D) Determine the association between two categorical variables
43. In Multiple Regression, the coefficient of multiple determination (R^2) represents:
(A) The correlation between two independent variables
(B) The proportion of variance in the dependent variable explained by all independent variables
(C) The regression coefficient of the strongest predictor
(D) The standard error of the estimate
44. Pearson's correlation coefficient (r) measures:
(A) The causal relationship between two variables
(B) The linear association between two continuous variables
(C) The association between two categorical variables
(D) The variance of a single variable

- 45.** If the Pearson correlation coefficient between X and Y is -0.85 , it indicates:
- (A) A weak positive relationship (B) A strong positive relationship
(C) A strong negative relationship (D) No relationship
- 46.** Which multivariate technique is used to group objects or individuals so that objects in the same group are highly similar to each other but different from objects in other groups?
- (A) Discriminant Analysis (B) Factor Analysis
(C) Cluster Analysis (D) Conjoint Analysis
- 47.** The main difference between Cluster Analysis and Discriminant Analysis is that:
- (A) Cluster analysis requires predefined groups, discriminant analysis does not
(B) Discriminant analysis requires predefined groups, cluster analysis does not
(C) Cluster analysis uses metric data, discriminant analysis uses non-metric
(D) Discriminant analysis is for data reduction, cluster analysis is for prediction
- 48.** Conjoint Analysis is primarily used in marketing research to:
- (A) Determine the optimal number of clusters
(B) Measure how consumers value different features of a product by analyzing trade-offs
(C) Reduce the dimensions of product features
(D) Classify customers into predefined demographic groups
- 49.** The standard format for writing a quantitative research report is generally known by the acronym:
- (A) IMRAD (Introduction, Method, Results, And Discussion)
(B) PEST (Political, Economic, Social, Technological)
(C) SWOT (Strengths, Weaknesses, Opportunities, Threats)
(D) APA (American Psychological Association)
- 50.** Which section of the research report contains a brief summary of the entire study, including the problem, methodology, major findings, and conclusions?
- (A) Introduction (B) Abstract/Executive Summary
(C) Literature Review (D) Discussion

PART-B

(Computer Engineering)

51. Which of the following is an advantage of adjacency list representation over adjacency matrix representation of a graph?
- (A) In adjacency list representation, space is saved for sparse graphs.
 - (B) DFS and BFS can be done in $O(V + E)$ time for adjacency list representation. These operations take $O(V^2)$ time in adjacency matrix representation. Here V and E are number of vertices and edges respectively.
 - (C) Adding a vertex in adjacency list representation is easier than adjacency matrix representation.
 - (D) All the above
52. LU decomposition expresses a matrix as
- (A) $L + U$
 - (B) LU
 - (C) UL
 - (D) $L - U$
53. A Half Adder has
- (A) 2 inputs and 1 output
 - (B) 2 inputs and 2 outputs
 - (C) 3 inputs and 2 outputs
 - (D) 3 outputs
54. The recurrence relation is $a_n = a_{n-1} + 4$, $a_0 = 3$, The value of a_4 is:
- (A) 15
 - (B) 16
 - (C) 19
 - (D) 20
55. Machine A produces 40% of bulbs with 2% defective. Machine B produces 60% of bulbs with 5% defective. A defective bulb is selected. The probability it came from Machine A is
- (A) 0.21
 - (B) 0.40
 - (C) 0.32
 - (D) 0.18

56. What is the simplified Boolean expression for $(A + A'B(A + B))$?
- (A) (A) (B) $(A + B)$
 (C) $(A + B')$ (D) $(A'B)$
57. How many distinct Min-terms can be formed for a 3-variable Boolean function $F(A, B, C)$?
- (A) 2 (B) 4
 (C) 8 (D) 16
58. A function is continuous at $x = a$ if
- (A) Left limit = Right limit = $f(a)$ (B) Only left limit exists
 (C) Only right limit exists (D) None
59. The 2's complement of 101100 is
- (A) 101011 (B) 010011
 (C) 010101 (D) 010100
60. A 3-bit ripple counter initially stores '101', After one clock pulse, state becomes
- (A) 110 (B) 100
 (C) 111 (D) 000
61. Suppose the sender window size is 8 and the sequence number field is 4 bits. The maximum receiver window size for Selective Repeat protocol is
- (A) 4 (B) 8
 (C) 15 (D) 16
62. A processor uses 16-bit instructions. The opcode field is 5 bits, and the remaining bits represent the memory address. What is the maximum directly addressable memory?
- (A) 512 locations (B) 1024 locations
 (C) 2048 locations (D) 4096 locations

63. Consider the instructions:

I1: ADD R1, R2, R3

I2: SUB R4, R1, R5

Which hazard occurs?

- | | |
|----------------|-------------|
| (A) Structural | (B) Control |
| (C) WAR | (D) RAW |

64. A cache has

- Hit ratio = 0.92
- Hit time = 3 ns
- Miss penalty = 40 ns

Calculated average memory access time is

- | | |
|------------|------------|
| (A) 5.8 ns | (B) 6.2 ns |
| (C) 7.0 ns | (D) 8.2 ns |

65. Which addressing mode is most suitable for array processing?

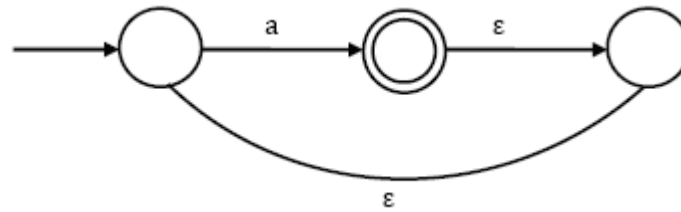
- | | |
|---------------|-------------|
| (A) Immediate | (B) Indexed |
| (C) Direct | (D) Implied |

66. Given the language $L = \{ab, aa, baa\}$, which of the following strings are in L^* ?

1. abaabaaabaa
2. aaaabaaaa
3. baaaaabaaaab
4. baaaaabaa

- | | |
|----------------|----------------|
| (A) 1, 2 and 3 | (B) 2, 3 and 4 |
| (C) 1, 2 and 4 | (D) 1, 3 and 4 |

67. What is the complement of the language accepted by the NFA shown below? Assume $\Sigma = \{a\}$ and ε is the empty string



- (A) Φ (B) ε
 (C) a (D) $\{a, \varepsilon\}$
68. Let P be a regular language and Q be context-free language such that $Q \subseteq P$. (For example, let P be the language represented by the regular expression p^*q^* and Q be $\{p^nq^n | n \in \mathbb{N}\}$). Then which of the following is ALWAYS regular?
- (A) $P \cap Q$ (B) $P - Q$
 (C) $\Sigma^* - Q$ (D) $\Sigma^* - P$
69. $S \rightarrow aSa \mid bSb \mid a \mid b$; The language generated by the above grammar over the alphabet $\{a, b\}$ is the set of
- (A) All palindromes
 (B) All odd length palindromes
 (C) Strings that begin and end with the same symbol
 (D) All even length palindromes.
70. Let L_1 be a recursive language. Let L_2 and L_3 be languages that are recursively enumerable but not recursive. Which of the following statements is not necessarily true?
- (A) $L_1 - L_3$ is recursively enumerable
 (B) $L_2 - L_1$ is recursively enumerable
 (C) $L_2 \cap L_1$ is recursively enumerable
 (D) $L_2 \cup L_1$ is recursively enumerable

71. Which of the following suffices to convert an arbitrary CFG to an LL(1) grammar?
- (A) Removing left recursion alone
 - (B) Factoring the grammar alone
 - (C) Removing left recursion and factoring the grammar
 - (D) None of the above
72. Assume that the SLR parser for a grammar G has n_1 states and the LALR parser for G has n_2 states. The relationship between n_1 and n_2 is
- (A) n_1 is necessarily less than n_2
 - (B) n_1 is necessarily equal to n_2
 - (C) n_1 is necessarily greater than n_2
 - (D) None of the above
73. Which condition is NOT required in the pumping lemma for context-free languages?
- (A) $|vx| > 0$
 - (B) $|vwx| \leq p$
 - (C) $uv^iwx^iy \in L$ for all $i \geq 0$
 - (D) $|uvw| = p$
74. Which of the following is NOT a valid deadlock prevention scheme?
- (A) Release all resources before requesting a new resource
 - (B) Number the resources uniquely and never request a lower numbered resource than the last one requested
 - (C) Never request a resource after releasing any resource
 - (D) Request that all required resources be allocated before execution
75. Suppose the time to service a page fault is on average 10 milliseconds, while a memory access takes 1 microsecond. Then a 99.99% hit ratio results in an average memory access time of
- (A) 1.9999 milliseconds
 - (B) 1 millisecond
 - (C) 9.999 microseconds
 - (D) 1.9999 microseconds

76. The minimum number of page frames that must be allocated to a running process in a virtual memory environment is determined by
- (A) the instruction set architecture
 - (B) page size
 - (C) physical memory size
 - (D) number of processes in memory
77. Consider the virtual page reference string 1, 2, 3, 2, 4, 1, 3, 2, 4, 1. On a demand paged virtual memory system running on a computer system that 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) $\text{OPTIMAL} < \text{LRU} < \text{FIFO}$
 - (B) $\text{OPTIMAL} < \text{FIFO} < \text{LRU}$
 - (C) $\text{OPTIMAL} = \text{LRU}$
 - (D) $\text{OPTIMAL} = \text{FIFO}$
78. A process executes the code
- ```
fork ();
fork ();
fork ();
```
- The total number of child processes created is
- (A) 3
  - (B) 4
  - (C) 7
  - (D) 8
79. Let the time taken to switch between user and kernel modes of execution be  $t_1$  while the time taken to switch between two processes be  $t_2$ . Which of the following is TRUE?
- (A)  $t_1 > t_2$
  - (B)  $t_1 = t_2$
  - (C)  $t_1 < t_2$
  - (D) Nothing can be said about the relation between  $t_1$  and  $t_2$



80. In which one of the following page replacement policies, Belady's anomaly may occur?
- (A) FIFO (B) OPTIMAL  
(C) LRU (D) MRU
81. The negation of " $P \rightarrow Q$ " is:
- (A)  $\neg P \rightarrow \neg Q$  (B)  $P \wedge \neg Q$   
(C)  $\neg P \vee Q$  (D)  $P \vee \neg Q$
82. G is an undirected graph with n vertices and 25 edges such that each vertex of G has degree at least 3. Then the maximum possible value of n is \_\_\_\_\_.
- (A) 15 (B) 16  
(C) 17 (D) 18
83. What is the minimum number of comparisons required to find both the minimum and maximum element in a 1-D array of size n?
- (A) n (B) 2n  
(C)  $3n/2 - 2$  (D)  $n_2$
84. A binary search tree is generated by inserting in order the following integers:  
50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24  
The number of nodes in the left subtree and right subtree of the root respectively is
- (A) (4, 7) (B) (7, 4)  
(C) (8, 3) (D) (3, 8)
85. A circular queue implemented using an array of size 20 reserves one location to distinguish full and empty conditions. What is the maximum number of elements that can be stored?
- (A) 20 (B) 19  
(C) 18 (D) 21

86. Consider the following recurrence relation:

$$T(n) = 2T(n - 1) + n2^n \text{ for } n > 0, T(0) = 1.$$

Which ONE of the following options is CORRECT?

- (A)  $T(n) = \Theta(n^2 2^n)$  (B)  $T(n) = \Theta(n 2^n)$   
 (C)  $T(n) = \Theta((\log n)^2 2^n)$  (D)  $T(n) = \Theta(4^n)$

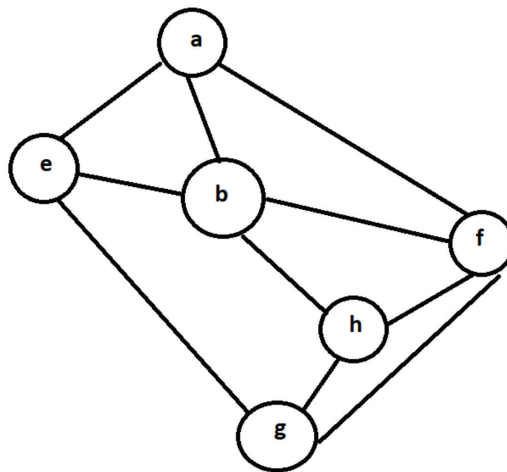
87. In a depth-first traversal of a graph G with n vertices, k edges are marked as tree edges. The number of connected components in G is

- (A) k (B) k + 1  
 (C) n - k - 1 (D) n - k

88. Consider the following graph,

Among the following sequences:

- I. a b e g h f  
 II. a b f e h g  
 III. a b f h g e  
 IV. a f g h b e



Which is the depth-first traversals of the above graph?

- (A) I, II, and IV only (B) I and IV only  
 (C) II, III, and IV only (D) I, III, and IV only

89. Consider a complete binary tree with 7 nodes. Let A denote the set of first 3 elements obtained by performing Breadth-First Search (BFS) starting from the root. Let B denote the set of first 3 elements obtained by performing Depth-First Search (DFS) starting from the root. The value of  $|A-B|$  is \_\_\_\_\_ .

- (A) 1 (B) 2  
(C) 3 (D) 4

90. Consider the following program:

```
int f(int *p, int n)
{
 if (n <= 1) return 0;
 else return max(f(p+1,n-1),p[0]-p[1]);
}

int main()
{
 int a[] = {3,5,2,6,4};
 printf("%d", f(a,5));
}
```

**Note :** max(x, y) returns the maximum of x and y. The value printed by this program is

- (A) 2 (B) 3  
(C) 4 (D) 5

91. A processor has a 6-stage pipeline and executes 50 instructions. Ignoring hazards, the total number of clock cycles required is

- (A) 50 (B) 55  
(C) 56 (D) 300

92. Identify the ONE CORRECT matching between the OSI layers and their corresponding functionalities as shown.

| OSI Layers                       | Functionalities                  |
|----------------------------------|----------------------------------|
| (a) Network layer                | (I) Packet routing               |
| (b) Transport layer              | (II) Framing and error handling  |
| (c) Datalink layer               | (III) Host to host communication |
| (A) (a)-(I), (b)-(II), (c)-(III) | (B) (a)-(I), (b)-(III), (c)-(II) |
| (C) (a)-(II), (b)-(I), (c)-(III) | (D) (a)-(III), (b)-(II), (c)-(I) |

93. Consider the 3-way handshaking protocol for TCP connection establishment. Let the three packets exchanged during the connection establishment be denoted as P1, P2, and P3, in order. Which of the following option(s) is/are TRUE with respect to TCP header flags that are set in the packets?

- (A) P3: SYN = 1, ACK = 1                      (B) P2: SYN = 1, ACK = 1  
(C) P2: SYN = 0, ACK = 1                      (D) P1: SYN = 0

94. Consider a network that uses Ethernet and IPv4. Assume that IPv4 headers do not use any options field. Each Ethernet frame can carry a maximum of 1500 bytes in its data field. A UDP segment is transmitted. The payload (data) in the UDP segment is 7488 bytes. Which ONE of the following choices has the CORRECT total number of fragments transmitted and the size of the last fragment including IPv4 header?

- (A) 5 fragments, 1488 bytes                      (B) 6 fragments, 88 bytes  
(C) 6 fragments, 108 bytes                      (D) 6 fragments, 116 bytes

95. The Address Resolution Protocol (ARP) is used for:

- (A) Finding the IP address from the DNS  
(B) Finding the IP address of the default gateway  
(C) Finding the IP address that corresponds to a MAC address  
(D) Finding the MAC address that corresponds to an IP address

96. A schedule of three database transactions T1, T2, and T3 is shown.

$R_1(X) W_1(Y) R_2(X) R_2(Y) R_3(Y) \text{ABORT}(T_1)$

$R_i(A)$  and  $W_i(A)$  denote read and write of data item A by transaction  $T_i$ ,  $i = 1, 2, 3$ . The transaction T1 aborts at the end. Which other transaction(s) will be required to be rolled back?

- (A) Only T2                                              (B) Only T3  
(C) Both T2 and T3                                      (D) Neither T2 nor T3

97. Consider a relational schema  $team(name, city, owner)$ , with functional dependencies  $\{name \rightarrow city, name \rightarrow owner\}$ . The relation  $team$  is decomposed into two relations,  $t1(name, city)$  and  $t2(name, owner)$ . Which of the following statement(s) is/are TRUE?
- (A) The relation  $team$  is NOT in BCNF.  
 (B) The relations  $t1$  and  $t2$  are in BCNF.  
 (C) The decomposition constitutes a loss 'Y' join.  
 (D) The relation  $team$  is NOT in 3NF.
98. Consider the following relational schema along with all the functional dependencies that hold on them.  $R1(A, B, C, D, E) : \{D \rightarrow E, EA \rightarrow B, EB \rightarrow C\}$   $R2(A, B, C, D) : \{A \rightarrow D, A \rightarrow B, C \rightarrow A\}$ . Which of the following statement(s) is/are TRUE?
- (A) Only  $R1$  is in 3NF. (B) Only  $R2$  is in 3NF.  
 (C) Both  $R1$  and  $R2$  are in 3NF. (D) Neither  $R1$  nor  $R2$  is in 3NF.

99. Consider the following Relations:

| Roll_No | Student_Name |
|---------|--------------|
| 1       | Raj          |
| 2       | Rohit        |
| 3       | Raj          |

| Roll_No | Course  | Marks |
|---------|---------|-------|
| 1       | Math    | 80    |
| 1       | English | 70    |
| 2       | Math    | 75    |
| 3       | English | 80    |
| 2       | Physics | 65    |
| 3       | Math    | 80    |

SELECT S. Student\_Name, sum(P.Marks)

FROM Student S, Performance P

WHERE S.Roll\_No = P.Roll\_No

GROUP BY S.Student\_Name

The number of rows that will be returned by the SQL query is \_\_\_\_\_.

- (A) 0 (B) 1  
 (C) 2 (D) 3

**100.** Consider a simple checkpointing protocol and the following set of operations in the log.

(start, T4);

(write, T4, y, 2, 3);

(start, T1);

(commit, T4);

(write, T1, z, 5, 7);

(checkpoint);

(start, T2);

(write, T2, x, 1, 9);

(commit, T2);

(start, T3);

(write, T3, z, 7, 2);

If a crash happens now and the system tries to recover using both undo and redo operations, what are the contents of the undo list and the redo list?

(A) Undo: T3, T1; Redo: T2

(B) Undo: T3, T1; Redo: T2, T4

(C) Undo: none; Redo: T2, T4, T3; T1

(D) Undo: T3, T1, T4; Redo: T2

## ROUGH WORK

## ROUGH WORK