Y - 63

ENTRANCE EXAMINATION – 2020

Ph.D. Computer Science

Time : 2 Hours | Max. Marks : 70

Hall Ticket No. [ ]

INSTRUCTIONS

1. Write your Hall Ticket Number in the above box and on the OMR Answer Sheet.
2. This test is for **2 hours duration** carrying **70** marks.
3. This test is of objective type and has two parts : Part A contains 35 questions on Research Methodology, and Part B contains 35 questions on Computer Science. Please make sure that all the questions are clearly printed in your paper.
4. Every correct answer gets **1 (one) mark. There is negative marking of 0.33 marks for every wrong answer.**
5. All answers should be marked clearly in the OMR answer sheet only.
6. Do not use any other paper, envelope etc. for writing or doing rough work. All the rough work should be done in your question paper or on the sheets provided with the question paper at the end.
7. During the examination, anyone found indulging in copying or have any discussions will be asked to leave the examination hall.
8. **No calculators and log tables are allowed.**
9. Use of mobile phone is strictly prohibited inside the hall.
10. Handover the OMR Answer Sheet to the Invigilator before leaving the examination hall.

Y-63

Part A – Research Methodology

1. What does ACM stand for, for computer scientists?

   A. Access Control Mechanism.
   B. Algorithmic Computing Method.
   C. Association for Computing Machinery.
   D. American Computing Machines Company.

2. IEEE Xplore, ACM DL, DBLP and Scopus are examples of

   A. Computer Science technical publications.
   B. Technical publication databases.
   C. Computer Science technical publication databases.
   D. Computer Science Institutes ranking agencies.

3. The mean weight of 150 students in a certain class is 60 kilograms. The mean weight of boys in the class is 70 Kg and that of the girls is 55 Kg. The number of boys and the number of girls in the class is

   A. Boys 100, Girls 50
   B. Boys 75, Girls 75
   C. Boys 50, Girls 100
   D. Boys 90, Girls 60

4. The experimental study mainly involves

   A. Conceptualizing the parameters
   B. Replication of research
   C. The manipulation of variables
   D. Literature Survey

5. A systematic literature review of a topic is

   A. Concerned with the literature style of the paper
   B. About new research directions for the topic
   C. A comprehensive summary of the research conducted on the topic
   D. None of the above

6. Which of the following standard probability density functions is applicable to discrete random variables?

   A. Gaussian Distribution
   B. Rayleigh Distribution
   C. Exponential Distribution
   D. Poisson Distribution

Questions 7–10 are based on the text below. Read it carefully and answer them.

> "There is no principle of science that prevents us from making intelligent computers that are infinitely smarter than ourselves ...They may take away some of our (nuclear) toys, they will solve weighty problems that we ourselves have been unable to solve. They will talk to us only to amuse themselves and so, in some sense, keep us as pets."

Prof. Edward Fredkin, Manager, MIT AI Lab, made this statement during an interview aired on BBC in 1983. Although, Fredkin himself seemed to view such a prospect with equanimity, if not relish, his words could have hardly failed to arouse suspicion and apprehension in the minds of a lay audience. People have come to see scientific research and technological advance as processes that are as likely to lead to evil as to good. They have come to suspect that the scientists themselves are irresponsible, recklessly pursuing what they believe to be 'the interests of science' without worrying about the interests of humankind.

In the case of Computer Science in general and Artificial Intelligence in particular, such suspicions fall on fertile ground, well prepared by novelists and film-makers who have presented us with many grim, futuristic versions of the world dominated by machines. Thus, when an authoritative figure such as Prof. Fredkin, makes such statements as above, most people are likely to conclude that something very nasty is indeed stirring in the AI laboratories of the world.

It should, therefore, be stated that a large majority of those working in the field of AI would regard Fredkin's pronouncement as outrageous or damaging nonsense.

7. Why, according to Prof. Fredkin, will computers keep us as pets?

   A. We are very loyal.

   B. We are suspicious and amusing.

   C. They can solve weighty problems.

   D. They are very much smarter than us.

8. What suspicions do people have on scientific research?

   A. Scientists are irresponsible.

   B. Scientists do not worry about human interests.

   C. Scientific research can be used for evil purposes.

   D. All of the above.

9. What does *fertile ground* refer to?

   A. People suspicious of technological advances.

   B. Fields of Computer Science and Artificial Intelligence.

   C. Prof. Fredkin's speech.

   D. Futuristic vision of our world.

10. Who have already provided support for Prof. Fredkin's statements on computers dominating humans?

    A. Suspicious people.

    B. Hollywood movie makers.

    C. Majority of researchers in the field of AI.

    D. BBC interviewing team.

11. Assume you have a green and black identical wallets. The green wallet contains six 10-rupee and four 100-rupee notes. The black wallet contains eight 10-rupee notes and two 100-rupee notes. If you are blind-folded, what is the probability of picking the green wallet if you pulled a 100-rupee note followed by two 10-rupee notes from it?

    A. $\frac{10}{29}$
    B. $\frac{1}{2}$
    C. $\frac{15}{29}$
    D. $\frac{2}{3}$

12. A researcher uses a regression equation to predict home heating bills (dollar cost), based on home size (square feet). The correlation between predicted bills and home size is 0.70. What is the correct interpretation of this finding?

    A. 70% of the variability in home heating bills can be explained by home size.
    B. 49% of the variability in home heating bills can be explained by home size.
    C. For each added square foot of home size, heating bills increased by 70 cents.
    D. For each added square foot of home size, heating bills increased by 49 cents

13. Scatter diagrams are mainly used to detect

    A. Experimental Error
    B. Correlation
    C. Interaction
    D. Interference

14. Let a relation R be defined on the set of all real numbers by aRb if and only if $1 + ab > 0$ then R is

    A. Reflexive. Transitive but not Symmetric
    B. Reflexive. Symmetric but not Transitive
    C. Symmetric, Transitive but not Reflexive
    D. An equivalence relation

15. A furniture store buys its furniture from a wholesaler. For a particular style of chair, the store usually sells a chair for 75% more than the cost of the chair from the wholesaler. During a sale, the store sells the chair for 25% more than the cost from the wholesaler. If he sold the chair in the sale for Rs. 300 then what is the usual price of the chair

    A. 240
    B. 300
    C. 360
    D. 420

16. The number of 6 digit positive integers, whose sum of the digits is at least 52, is

    A. 21
    B. 22
    C. 27
    D. 28

17. Paraphrasing means

A. Change a few words to make it your own and cite it

B. Put quotation marks around the text and cite it

C. Use only the idea without citing it

D. Summarize the text in your own words and cite it

18. For an individual class assignment, Karan and Jugal decide to collaborate. Karan compiles research notes, Jugal identifies the main findings and both write their own original research papers. Is this:

A. Unethical collaboration

B. Plagiarism

C. Both unethical collaboration and plagiarism

D. Acceptable collaboration

19. A test is conducted annually. The test has a mean score of 127 and a standard deviation of 19. If Susheel's Z-score is 2, what is his score in the test?

A. 165

B. 89

C. 273

D. 292

20. Which of the following packages is developed by the computer scientist, Donald E. Knuth?

A. MS Word

B. Wordstar

C. Firefox

D. TEX

21. The number of one-to-one functions from a set with m elements to a set with n elements where $n \geq m$, is

A. $n(n-1)(n-2)\ldots(n-m+1)$

B. n^m

C. m^n

D. $n!m!$

22. If my experimental hypothesis were " Eating cheese before bed affects the number of nightmares you have", what would the null hypothesis be?

A. Eating cheese before bed gives you more nightmares.

B. Eating cheese before bed gives you fewer nightmares.

C. Eating cheese is linearly related to the number of nightmares you have.

D. The number of nightmares you have is not affected by eating cheese before bed

23. The mean and standard deviation of the first N natural numbers are

A. Mean = (N+1)/2, Standard deviation = $\sqrt{\frac{(N+1)(N-1)}{12}}$

B. Mean = (N+1)/2, Standard deviation = $\sqrt{\frac{(N+1)(2N+1)}{6}}$

C. Mean = N(N+1)/2, Standard deviation = $\sqrt{\frac{(N+1)(N-1)}{12}}$

D. mean = N(N+1)/2, Standard deviation = $\sqrt{\frac{(N+1)(2N+1)}{6}}$

24. What does *et al* mean in the sentence "Davis et al. propose a measure called MRLP for multi relational networks." ?

A. et cetera

B. and other co-authors

C. and two other authors

D. None of these

25. What happens to confidence interval when some outliers are introduced in the data?

A. Confidence interval is robust to outliers

B. Confidence interval will increase with the introduction of outliers

C. Confidence interval will decrease with the introduction of outliers

D. We cannot determine the confidence interval in this case

26. The number of possible solutions of the equation $x_1 + x_2 + x_3 = 11$, where x_1, x_2, and x_3 are non-negative integers is

A. $13C_2$

B. $11C_3$

C. $11C_2$

D. $14C_3$

27. A quantitative variable has the object values [80, 20, 40, 60, 65, 15, 90]. What are the split points if equal width discretization is applied for forming five bins?

A. 15, 35, 55, 75, 90

B. 15, 30, 45, 60, 75

C. 30, 45, 60, 75

D. 15, 30, 45, 60

28. One of the conclusions in a technical paper states that, "The results demonstrated that our method is superior to the state-of-the-art in the false-positive rates." What the authors mean is that

A. Their false positive rates are higher than the other methods.

B. Their false positive rates are lower than the other methods.

C. Their answers are more positive than the other methods.

D. Their answers are less positive than the other methods.

29. When a research problem is related to heterogeneous population, the most suitable sampling method is

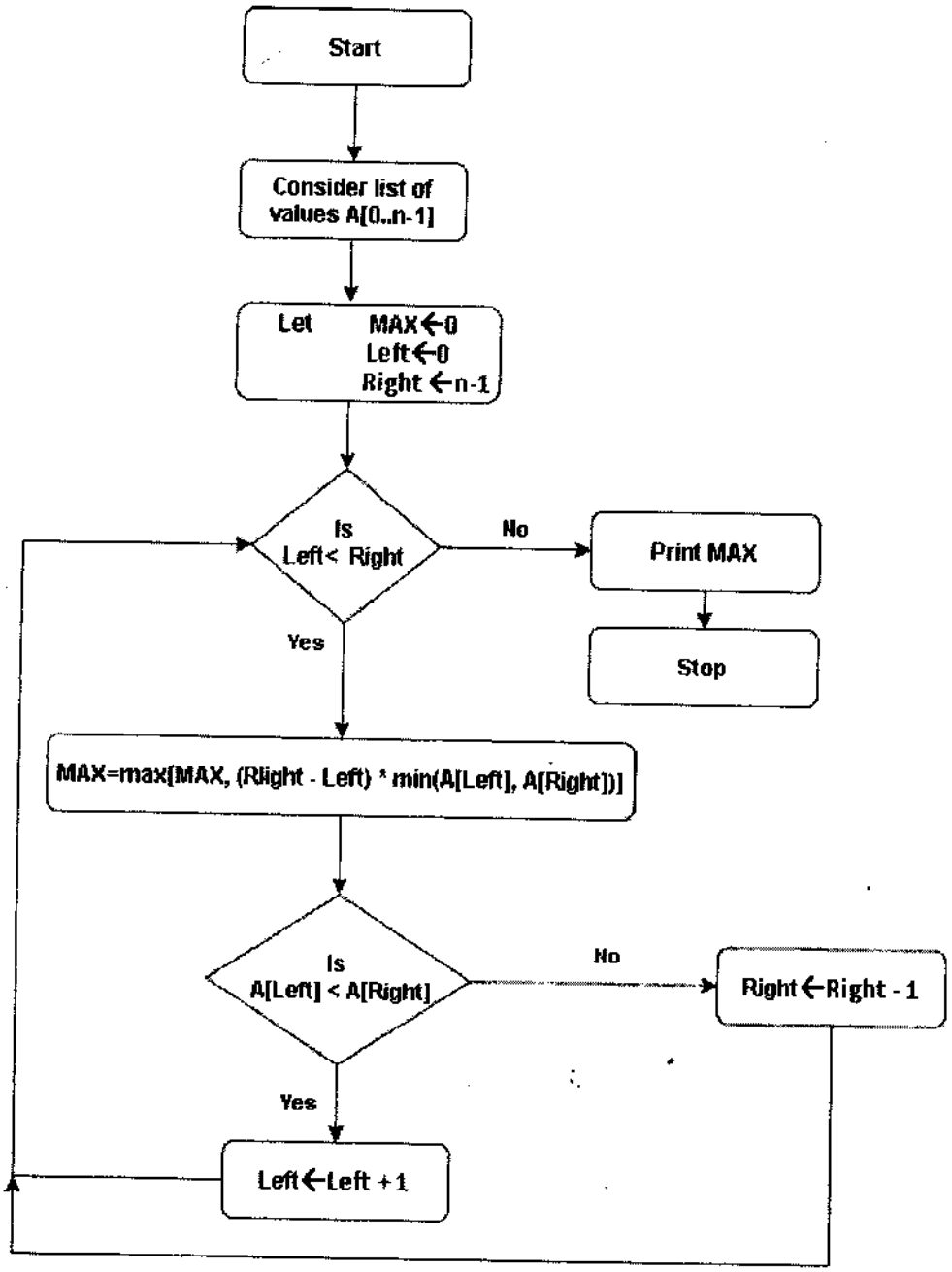
A. Cluster Sampling

B. Stratified Sampling

C. Convenient sampling

D. Lottery method

Questions 30–32 are based on the flowchart given below.
Consider a list of values A[0...n-1]. **max** and **min** are mathematical functions which will find the maximum and minimum of the given arguments.



30. If the list $A = [2, 3, 4, 2, 8, 5, 7, 6]$, find the values of MAX, Left and Right?

A. 18,4,5

B. 14,4,7

C. 20,2,7

D. 20,4,4

31. How many times is the outer loop executed?

A. 9

B. 7

C. 8

D. None of the above

32. If the initial values of Left and Right are chosen as 2 and 5 respectively and another set of Left and Right are chosen as 3 and 7, what is the change in MAX value?

A. 4

B. 6

C. -2

D. None of the above

33. The area lying in the first quadrant and bounded by the circle $x^2 + y^2 = 4$ and lines $x = 0$ and $x = 1$ is given by

A. $\frac{\pi}{3} + \frac{\sqrt{3}}{2}$

B. $\frac{\pi}{6} + \frac{\sqrt{3}}{4}$

C. $\frac{\pi}{3} - \frac{\sqrt{3}}{2}$

D. $\frac{\pi}{6} + \frac{\sqrt{3}}{2}$

34. Rekha and Fathima have a certain number of red and black marbles with them. The ratio of red marbles to black marbles with them is 7 : 1 and 9 : 1 respectively. If the total number of marbles with the two persons is 90, what can be the number of red marbles with Fathima?

A. Either 9 or 45

B. Either 10 or 50

C. Either 36 or 72

D. Either 18 or 36

35. On a test to obtain a securities license there are 20 questions with possible answers A, B, C, D, and E. Obtaining a score of 70% (or 14 out of 20 correct) is necessary to pass. A student is certain he knows the correct answers for 10 questions, but must guess answers for the other 10. What is the probability of getting at least 4 correct if he picked up random answers for the other 10?

A. 0.0328

B. 0.8791

C. 0.1209

D. 0.9672

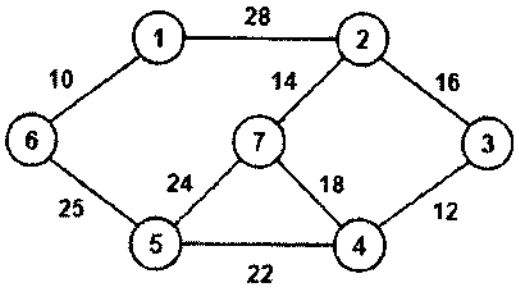
TURN THE PAGE FOR PART B ⟶

Part B – Computer Science

36. Consider a 7-bit normalized representation: $(-1)^s * (.ffff) * (2^{ee})$ of floating-point numbers, where s is the sign bit, $ffff$ is unsigned and ee is two's complement. What is the smallest positive value that can be represented?

A. 0.5
B. 0.25
C. 0.125
D. 0.28125

37. Suppose we are using Kruskal's algorithm to obtain the Minimum spanning tree of the Graph given below. Which of the sets of edges DO NOT contribute to the final solution?



A. (1,2), (2,3), (4,7), (5,7)
B. (1,2), (4,7), (5,7), (5,6)
C. (1,2), (5,7), (5,6), (4,5)
D. None of the above

38. The relation scheme Student Performance(name, courseNo, rollNo, grade) has the following functional dependencies:
name, courseNo → grade
rollNo, courseNo → grade
name → rollNo
rollNo → name
The highest normal form of this relation scheme is

A. 2NF
B. 3NF
C. BCF
D. 4NF

39. What is the length of the shortest string NOT in the language over alphabet $\{a, b\}$ for regular expression given below: $b^*.(a.a^*.b)^*.b^*$

A. one
B. two
C. three
D. four

40. The message 11001001 is to be transmitted using the CRC polynomial $x^3 + 1$ to protect it from errors. The message that should be transmitted is :

A. 110010011001

B. 11001001

C. 110010011001001

D. 11001001011

41. "Copy-on-write" finds its main use in sharing the virtual memory of operating system processes, in the implementation of which of these system calls ?

A. File Opening

B. Forking of a new process

C. File Closing

D. None of the above

42. In IPV 4, the IP address 200.200.200.200 belongs to

A. Class A

B. Class B

C. Class C

D. Class D

43. If the binary heap H = {40, 10, 20, 9, 6, 19, 15}, then what will the heap be after performing the two operations: *EXTRACT-MAX()* followed by *HEAP-INSERT(25)*?

A. 25, 10, 20, 9, 6, 15, 19

B. 25, 20, 10, 9, 6, 15, 19

C. 25, 10, 20, 9, 6, 19, 15

D. 25, 20, 19, 15, 10, 9, 6

44. The intersection of a context-free language and a regular language is

A. Always context-free

B. Always regular

C. May or may not be context free

D. None of the above

45. Does there exist a simple undirected graph with FIVE vertices with degree sequences given in (a) and (b)?
(a) 3, 3, 3, 3, 2 (b) 1, 2, 3, 4, 5

A. No for (a) and Yes for (b)

B. Yes for (a) and Yes for (b)

C. Yes for (a) and No for (b)

D. No for (a) and No for (b)

46. Which of the following represents a vertex visiting sequence of a depth-first spanning tree with the given non-tree edges of a graph?

A. 1,2,3,4,3,2,1,5,1 and (1,4), (4,5)

B. 1,2,1,3,1,4,5,4,1 and (1,5), (2,3)

C. 1,2,3,2,4,5,4,2,1 and (1,3), (2,5)

D. 1,2,1,3,4,3,1,5,1 and (2,5), (1,4)

47. Consider the following two commands C1 and C2 on the relation R from an SQL database:
C1 : drop table R
C2 : delete from R
Which of the following statements is TRUE ?
I. Both C1 and C2 delete the schema for R.
II. C2 retains relation R, but deletes all tuples in R.
III. C1 deletes not only all tuples of R, but also the schema for R.

A. I only

B. I and II only

C. II and III only

D. I, II and III

48. Which of the following statements is NOT true in general.

I Heap Sort algorithm is exactly the same as Selection Sort algorithm but uses a heap data structure while finding the minimum.

II Greedy strategy always finds an optimal solution.

III Dynamic Programming strategy can be applied if the problem satisfies optimality principle.

IV The Branch and Bound strategy neither adopts BFS nor DFS completely for finding an optimal solution.

A. I only

B. I and II

C. II only

D. III and IV

49. Match the following :

List – I	List – II
a. Application layer	1. TCP
b. Transport layer	2. HDLC
c. Network layer	3. HTTP
d. Data link layer	4. IPX

The layers given in a b c d of List-I respectively match to

A. 2 1 4 3

B. 3 4 1 2

C. 3 1 4 2

D. 2 4 1 3

50. The following production rules are defined for a language
$S \rightarrow aS_1a$
$S \rightarrow bS_2b$
$S_1 \rightarrow S \mid b$
$S_2 \rightarrow S \mid a$

The language generated by the above grammar over the alphabet $\{a, b\}$ is the set of

A. All palindromes

B. Strings with alternate 'a' and 'b'

C. All even length palindromes

D. All odd length palindromes

51. Consider the following decision system dataset with "A" being the quantitative variable and "D" denoting the class decision variable.

A	D
30	P
70	Q
80	Q
35	P
?	P
50	Q
20	P

Here "?" represents a missing value. What are the imputed values of the missing value by following "Mean Imputation" and "Mean Imputation restricted to a class" respectively?

A. 40.71, 21.25

B. 40.71, 28.33

C. 47.5, 21.25

D. 47.5, 28.33

52. A relative mode branch type of instruction is stored in memory at an address equivalent to ABC7(Hex). The address field of the instruction contains 139(Hex). What is the effective address after execution of the instruction(in Hex)

A. AD01

B. AD67

C. AD07

D. AD61

Questions from 53–54 are based on the Table given here regarding the cumulative statistics of COVID19 infections in 4 countries A, B, C and D on a certain date. The table gives the total population (in Crores) along with the number of infected and the virus-related deaths that occurred in each country.

Country	Total Population in Crores	Infected	Deaths
A	33	3100	17
B	20	2215	10
C	139	12300	62
D	138	12200	60

53. Which country has the least percentage of infected people?

A. A

B. B

C. C
D. D

54. Which country has the least rate of deaths among the infected?

A. A
B. B
C. C
D. D

55. Find the product of the non-zero eigenvalues of the matrix below.

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

A. 6
B. 8
C. 10
D. 12

56. Which of the following methods of accessing a device has the lowest possible latency?

A. Polling
B. Interrupt
C. I/O instructions
D. DMA

57. Operating Systems use these protected variables (I) for abstract data types to lock a resource being used. The value of the variable (II) is also used to indicate the status of a common resource, or its instances available. Here I and II actually are referring to which of the following? (Choose the most appropriate pair.)

A. Binary and Counting Semaphores
B. Mutual Exclusion and Deadlock
C. Mutual Exclusion and Bankers Algorithm
D. None of these

58. What would be the output of the following 'C' program assuming that the array begins at location 2001?

```
main()
{
int a[2][3][4] =
{   {1, 2, 3, 4,
5, 6, 7, 8,9, 10, 11, 12 },
{13, 1, 2, 3,
6, 7, 8, 9,0, 0, 0, 0 }
};
printf("%u %u %u %d", a, *a, **a, ***a);
}
```

A. 2001 2001 2001 1

B. 2001 1 13 0

C. 2001 2001 2003 3

D. 2002 1 13 4

59. Let X be random variable that follows the normal distribution with mean 5 and variance 25. Then the mean of the random variable $Y = ((X - 5)/5)^3$ is

A. -5

B. 0

C. 25

D. 125

60. Consider a direct-mapped cache of size 32KB with cache line size of one word. Assume that a main memory access takes 100 cycles and accessing a cache takes 1 cycle. What would the performance difference be for this program on a machine with a Write-back vs. Write-through cache?

```
for ( i=0; i<4000; i++) {
a[i] = a[i] + a[i+1];
}
```

A. Same performance

B. Write-back cache is 1.5 times slower

C. Write-back cache is 2 times slower

D. Write-back cache is 3 times slower

61. 30 buses are used to transport 2000 passengers from Hyderabad to Warangal. Each bus has 80 seats and each passenger will occupy exactly one seat. Consider the following statement:

At least X buses will carry at least 67 passengers and at least Y buses will have at least 14 vacant seats.

Assuming that this statement is always true irrespective of the way passengers are assigned to buses, the maximum possible values of X and Y are

A. $X = 1, Y = 10$

B. $X = 2, Y = 10$

C. $X = 2, Y = 1$

D. None of the above

62. Belady's anomaly proves that it is possible to have more page faults on increasing the number of page frames, while using which one of the following algorithms?

A. FIFO

B. LRU

C. Optimal Page Replacement

D. SJF

63. The Longest Common Subsequence (LCS) of two strings "ABAZDC" and "BACBAD" that can be obtained using dynamic programming is:

A. ABAD

B. ACAD

C. BAC

D. None of the above

64. What are the time complexities of an optimal algorithm that computes the maximum degree of a connected graph ($G = (V, E), |V| = n$ and $|E| = m$) using Adjacency Matrix and Adjacency List representations respectively?

A. $\theta(m)$ and $\theta(m)$

B. $\theta(n^2)$ and $\theta(m)$

C. $\theta(n^2)$ and $\theta(n^2)$

D. $\theta(n^2)$ and $\theta(n)$

65. Consider the effect in a network of using slow start on a line with a 10 msec round-trip time and no congestion. The receive window is 24KB and the maximum segment size is 2KB. How long does it take before the first full window can be sent?

A. 10 msec

B. 20 msec

C. 24 msec

D. 40 msec

66. If $T(n) = T(n/2) + T(n/4) + T(n/8) + 100n$, then T(n)=?

A. $\theta(nlogn)$

B. $\theta(n)$

C. $\theta(n^2)$

D. $\theta(nloglogn)$

67. What would be the output of the following 'C' program assuming that sizeof(int) = 32 bits?

```
#include<stdio.h>

int main()
{
    int i=1;
    while(i > 0)
    {
        i++;
    }
    printf("%d, %d", i, i-1);
}
```

A. 0, -1

B. $-2^{31}, 2^{31} - 1$

C. Program goes into infinite loop

D. $-2^{31} - 1, 2^{31} - 1$

68. Suppose that you have made a request for a web page through your web browser to a web server. Initially, the browser cache is empty. Further, the browser is configured to send HTTP requests in non-persistent mode. The web page contains text and seven very small images. What is the minimum number of TCP connections required to display the web page completely in your browser?

A. 1

B. 2

C. 7

D. 8

69. Prashanth has been asked to show that a certain problem A is NP-complete. He derives a polynomial time reduction from 3-SAT to A. Which of the following can be inferred from this reduction?

A. A is NP, but is not NP-complete

B. A is NP-hard but may not be NP-complete

C. A is NP-Complete

D. It cannot be inferred if A is NP-hard, or NP

70. Consider the following log sequence of two transactions on a bank account, with initial balance 12000, that transfer 2000 to a mortgage payment and then apply a 5% interest.

1. T1 start
2. T1 B old=12000 new=10000
3. T1 M old=0 new=2000
4. T1 commit
5. T2 start
6. T2 B old=10000 new=10500
7. T2 commit

Suppose the database system crashes just before log record 7 is written. When the system is restarted, which one statement is true of the recovery procedure?

A. We must redo log record 6 to set B to 10500

B. We need not redo log records 2 and 3 because transaction T1 has committed

C. We can apply redo and undo operations in arbitrary order because they are idempotent

D. We must undo log record 6 to set B to 10000 and then redo log records 2 and 3

THE END

University of Hyderabad
Entrance Examinations - 2020

School/Department/Centre : SCHOOL OF COMPUTER AND INFORMATION SCIENCES
Course/Subject : ~~CSIT~~ PhD (COMPUTER SCIENCE) Y-63

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	C	26	A	51	D	76	
2	B	27	C	52	A	77	
3	C	28	B	53	D	78	
4	C	29	B	54	D	79	
5	C	30	D	55	A	80	
6	D	31	B	56	A	81	
7	D	32	B	57	A	82	
8	D	33	A	58	A	83	
9	A	34	A	59	B	84	
10	B	35	C	60	C	85	
11	C	36	B	61	C	86	
12	B	37	D	62	A	87	
13	B	38	B	63	A	88	
14	B	39	A	64	B	89	
15	D	40	D	65	D	90	
16	D	41	B	66	B	91	
17	D	42	C	67	B	92	
18	C	43	A	68	D	93	
19	A	44	A	69	B	94	
20	D	45	C	70	D	95	
21	A	46	C	71		96	
22	D	47	C	72		97	
23	A	48	C	73		98	
24	B	49	C	74		99	
25	B	50	D	75		100	

Note/Remarks : There are only 70 Q in the paper

Signature
School/Department/Centre
SCIS 1/10/2020