Signature and Name of Invigilator

1. (Signature) ____________________

   (Name) ____________________

2. (Signature) ____________________

   (Name) ____________________

OMR Sheet No. : ....

(To be filled by the Candidate)

Roll No. | | | | | | | | |

(In figures as per admission card)

Roll No. ____________________

(In words)

J 0 8 7 1 8

PAPER - II

COMPUTER SCIENCE AND APPLICATIONS

Time : 2 hours] **[Maximum Marks : 200**

Number of Pages in this Booklet : **24**

Number of Questions in this Booklet : **100**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of hundred multiple-choice type of questions.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy 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 Test Booklet Number should be entered on the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (1), (2), (3) and (4). You have to darken the circle as indicated below on the correct response against each item.

   Example : ① ② ● ④ where (3) is the correct response.
5. Your responses to the items are to be indicated in the **OMR Sheet given inside the Booklet only.** If you mark your response at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. 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.
9. You have to return the original OMR Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet on conclusion of examination.
10. **Use only Blue/Black Ball point pen.**
11. **Use of any calculator or log table etc., is prohibited.**
12. **There are no negative marks for incorrect answers.**

परीक्षार्थियों के लिए निर्देश

1. इस पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए।
2. इस प्रश्न-पत्र में सौ बहुविकल्पीय प्रश्न हैं।
3. परीक्षा प्रारम्भ होने पर, प्रश्न-पुस्तिका आपको दे दी जायेगी। पहले पाँच मिनट आपको प्रश्न-पुस्तिका खोलने तथा उसकी निम्नलिखित जाँच के लिए दिये जायेंगे, जिसकी जाँच आपको अवश्य करनी है :
   (i) प्रश्न-पुस्तिका खोलने के लिए पुस्तिका पर लगी कागज की सील को फाड़ लें। खुली हुई या बिना स्टीकर-सील की पुस्तिका स्वीकार न करें।
   (ii) **कवर पृष्ठ पर छपे निर्देशानुसार प्रश्न-पुस्तिका के पृष्ठ तथा प्रश्नों की संख्या को अच्छी तरह चैक कर लें कि ये पूरे हैं। दोषपूर्ण पुस्तिका जिनमें पृष्ठ/प्रश्न कम हों या दुबारा आ गये हों या सीरियल में न हों अर्थात् किसी भी प्रकार की त्रुटिपूर्ण पुस्तिका स्वीकार न करें तथा उसी समय उसे लौटाकर उसके स्थान पर दूसरी सही प्रश्न-पुस्तिका ले लें। इसके लिए आपको पाँच मिनट दिये जायेंगे। उसके बाद न तो आपकी प्रश्न-पुस्तिका वापस ली जायेगी और न ही आपको अतिरिक्त समय दिया जायेगा।**
   (iii) इस जाँच के बाद प्रश्न-पुस्तिका का नंबर OMR पत्रक पर अंकित करें और OMR पत्रक का नंबर इस प्रश्न-पुस्तिका पर अंकित कर दें।
4. प्रत्येक प्रश्न के लिए चार उत्तर विकल्प (1), (2), (3) तथा (4) दिये गये हैं। आपको सही उत्तर के वृत्त को पेन से भरकर काला करना है जैसा कि नीचे दिखाया गया है।

   उदाहरण : ① ② ● ④ जबकि (3) सही उत्तर है।
5. प्रश्नों के उत्तर **केवल प्रश्न पुस्तिका के अन्दर दिये गये OMR पत्रक पर ही** अंकित करने हैं। यदि आप OMR पत्रक पर दिये गये वृत्त के अलावा किसी अन्य स्थान पर उत्तर चिह्नांकित करते हैं, तो उसका मूल्यांकन नहीं होगा।
6. अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें।
7. कच्चा काम (Rough Work) इस पुस्तिका के अन्तिम पृष्ठ पर करें।
8. यदि आप OMR पत्रक पर नियत स्थान के अलावा अपना नाम, रोल नम्बर, फोन नम्बर या कोई भी ऐसा चिह्न जिससे आपकी पहचान हो सके, अंकित करते हैं अथवा अभद्र भाषा का प्रयोग करते हैं, या कोई अन्य अनुचित साधन का प्रयोग करते हैं, जैसे कि अंकित किये गये उत्तर को मिटाना या सफेद स्याही से बदलना तो परीक्षा के लिये अयोग्य घोषित किये जा सकते हैं।
9. आपको परीक्षा समाप्त होने पर मूल OMR पत्रक निरीक्षक महोदय को लौटाना आवश्यक है और परीक्षा समाप्ति के बाद उसे अपने साथ परीक्षा भवन से बाहर न लेकर जायें। हालांकि आप परीक्षा समाप्ति पर मूल प्रश्न-पुस्तिका अपने साथ ले जा सकते हैं।
10. **केवल नीले/काले बाल प्वाईंट पेन का ही प्रयोग करें।**
11. **किसी भी प्रकार का संगणक (कैलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है।**
12. **गलत उत्तरों के लिए कोई नकारात्मक अंक नहीं हैं।**

COMPUTER SCIENCE AND APPLICATIONS

PAPER - II

Note : This paper contains **hundred (100)** objective type questions of **two (2)** marks each. **All** questions are **compulsory**.

1. The definitions in an XML document are said to be _____ when the tagging system and definitions in the DTD are all in compliance.

(1) well-formed (2) reasonable

(3) valid (4) logical

2. Consider the JavaScript Code :

```
var y= ''12";

function f( ) {

    var y=''6";

    alert (this.y);

    function g( ) {alert (y); }

    g( );

}

f( );
```

If M is the number of alert dialog boxes generated by this JavaScript code and D1, D2, ..., D_M represents the content displayed in each of the M dialog boxes, then :

(1) M=3; D1 displays "12"; D2 displays "6"; D3 displays "12".

(2) M=3; D1 displays "6"; D2 displays "12"; D3 displays "6".

(3) M=2; D1 displays "6"; D2 displays "12".

(4) M=2; D1 displays "12"; D2 displays "6".

3. What is the output of the following JAVA program ?

```
class simple
{
        public static void main(String[ ] args)
        {
                simple obj = new simple( );
                obj.start( );
        }
        void start( )
        {
                long [ ] P= {3, 4, 5};
                long [ ] Q= method (P);
                System.out.print (P[0] + P[1] + P[2]+":");
                System.out.print (Q[0] + Q[1] + Q[2]);
        }
        long [ ] method (long [ ] R)
        {
                R [1]=7;
                return R;
        }
} //end of class
```

(1) 12 : 15 (2) 15 : 12 (3) 12 : 12 (4) 15 : 15

4. What is the output of the following 'C' program ? (Assuming little - endian representation of multi-byte data in which Least Significant Byte (LSB) is stored at the lowest memory address.)

```
#include <stdio.h>
#include <stdlib.h>
/* Assume short int occupies two bytes of storage */
int main ( )
{
        union saving
        {
                short int one;
                char two[2];
        };
        union saving m;
        m.two [0] = 5;
        m.two [1] = 2;
        printf(''%d, %d, %d\n", m.two [0], m.two [1], m.one);
}/* end of main */
```

(1) 5, 2, 1282 (2) 5, 2, 52 (3) 5, 2, 25 (4) 5, 2, 517

5. Given below are three implementations of the swap( ) function in C++ :

(a)	(b)	(c)

void swap (int a, int b)
{
int temp;
temp = a;
a = b;
b = temp;
}
int main( )
{
int p = 0, q = 1;
swap (p, q);
}
	void swap (int &a, int &b)
	{
	int temp;
	temp = a;
	a = b;
	b = temp;
	}
	int main( )
	{
	int p = 0, q = 1;
	swap (p, q);
	}
		void swap (int *a, int *b)
		{
		int *temp;
		temp = a;
		a = b;
		b = temp;
		}
		int main( )
		{
		int p = 0, q = 1;
		swap (&p, &q);
		}

Which of these would actually swap the contents of the two integer variables p and q ?

(1) (a) only (2) (b) only (3) (c) only (4) (b) and (c) only

6. In Java, which of the following statements is/are **True** ?

S1 : The 'final' keyword applied to a class definition prevents the class from being extended through derivation.

S2 : A class can only inherit one class but can implement multiple interfaces.

S3 : Java permits a class to replace the implementation of a method that it has inherited. It is called method overloading.

Code :

(1) S1 and S2 only (2) S1 and S3 only

(3) S2 and S3 only (4) All of S1, S2 and S3

7. Which of the following statements is/are **True** ?

P : C programming language has a weak type system with static types.

Q : Java programming language has a strong type system with static types.

Code :

(1) P only (2) Q only

(3) Both P and Q (4) Neither P nor Q

8. A graphic display system has a frame buffer that is 640 pixels wide, 480 pixels high and 1 bit of color depth. If the access time for each pixel on the average is 200 nanoseconds, then the refresh rate of this frame buffer is approximately :

(1) 16 frames per second (2) 19 frames per second

(3) 21 frames per second (4) 23 frames per second

9. Which of the following statements is/are **True** regarding the solution to the visibility problem in 3D graphics ?

S1 : The Painter's algorithm sorts polygons by depth and then paints (scan - converts) each Polygon on to the screen starting with the most nearest polygon.

S2 : Backface Culling refers to eliminating geometry with backfacing normals.

Code :

(1) S1 only (2) S2 only

(3) Both S1 and S2 (4) Neither S1 nor S2

10. Consider the matrix $M = \begin{bmatrix} 2 & 0 & 2 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ representing a set of planar (2D) geometric transformations in homogeneous coordinates. Which of the following statements about the matrix M is **True** ?

(1) M represents first, a scaling of vector (2, 1) followed by translation of vector (1, 1)
(2) M represents first, a translation of vector (1, 1) followed by scaling of vector (2, 1)
(3) M represents first, a scaling of vector (3, 1) followed by shearing of parameters (−1, 1)
(4) M represents first, a shearing of parameters (−1, 1) followed by scaling of vector (3, 1)

11. Assume the following regarding the development of a software system P :

- Estimated lines of code of P : 33, 480 LOC
- Average productivity for P : 620 LOC per person-month
- Number of software developers : 6
- Average salary of a software developer : ₹ 50,000 per month

If E, D and C are the estimated development effort (in person-months), estimated development time (in months), and estimated development cost (in ₹ Lac) respectively, then (E, D, C) =_____.

(1) (48, 8, 24) (2) (54, 9, 27) (3) (60, 10, 30) (4) (42, 7, 21)

12. Match the following in Software Engineering :

	List - I		List - II
(a)	Product Complexity	(i)	Software Requirements Definition
(b)	Structured System Analysis	(ii)	Software Design
(c)	Coupling and Cohesion	(iii)	Validation Technique
(d)	Symbolic Execution	(iv)	Software Cost Estimation

Code :

	(a)	(b)	(c)	(d)
(1)	(ii)	(iii)	(iv)	(i)
(2)	(iii)	(i)	(iv)	(ii)
(3)	(iv)	(i)	(ii)	(iii)
(4)	(iii)	(iv)	(i)	(ii)

13. Which one of the following is **not** typically provided by Source Code Management Software ?

(1) Synchronisation
(2) Versioning and Revision history
(3) Syntax highlighting
(4) Project forking

14. A software system crashed 20 times in the year 2017 and for each crash, it took 2 minutes to restart. Approximately, what was the software availability in that year ?

(1) 96.9924%
(2) 97.9924%
(3) 98.9924%
(4) 99.9924%

15. Match the 5 CMM Maturity levels/CMMI staged representations in **List- I** with their characterizations in **List-II** :

	List - I		List - II
(a)	Initial	(i)	Processes are improved quantitatively and continually.
(b)	Repeatable	(ii)	The plan for a project comes from a template for plans.
(c)	Defined	(iii)	The plan uses processes that can be measured quantitatively.
(d)	Managed	(iv)	There may not exist a plan or it may be abandoned.
(e)	Optimizing	(v)	There's a plan and people stick to it.

Code :

	(a)	(b)	(c)	(d)	(e)
(1)	(iv)	(v)	(i)	(iii)	(ii)
(2)	(i)	(ii)	(iv)	(v)	(iii)
(3)	(v)	(iv)	(ii)	(iii)	(i)
(4)	(iv)	(v)	(ii)	(iii)	(i)

16. Coupling is a measure of the strength of the interconnections between software modules. Which of the following are correct statements with respect to module coupling ?

P : Common coupling occurs when one module controls the flow of another module by passing it information on what to do.

Q : In data coupling, the complete data structure is passed from one module to another through parameters.

R : Stamp coupling occurs when modules share a composite data structure and use only parts of it.

Code :

(1) P and Q only (2) P and R only

(3) Q and R only (4) All of P, Q and R

17. A software design pattern often used to restrict access to an object is :

(1) adapter (2) decorator (3) delegation (4) proxy

18. Reasons to re-engineer a software include :

P : Allow legacy software to quickly adapt to the changing requirements

Q : Upgrade to newer technologies/platforms/paradigm (for example, object-oriented)

R : Improve software maintainability

S : Allow change in the functionality and architecture of the software

Code :

(1) P, R and S only (2) P and R only

(3) P, Q and S only (4) P, Q and R only

19. Which of the following is not a key strategy followed by the clean room approach to software development ?

(1) Formal specification (2) Dynamic verification

(3) Incremental development (4) Statistical testing of the system

20. Which of the following statements is/are **True** ?

P : Refactoring is the process of changing a software system in such a way that it does not alter the external behavior of the code yet improves the internal architecture.

Q : An example of refactoring is adding new features to satisfy a customer requirement discovered after a project is shipped.

Code :

(1) P only (2) Q only

(3) Both P and Q (4) Neither P nor Q

21. The solution of the recurrence relation

$T(m) = T(3m/4) + 1$ is :

(1) θ (lg m) (2) θ (m)

(3) θ (mlg m) (4) θ (lglg m)

22. Consider the array A=<4, 1, 3, 2, 16, 9, 10, 14, 8, 7>. After building heap from the array A, the depth of the heap and the right child of max-heap are _____ and _____ respectively. (Root is at level 0).

(1) 3, 14 (2) 3, 10 (3) 4, 14 (4) 4, 10

23. A hash function h defined h(key)=key mod 7, with linear probing, is used to insert the keys 44, 45, 79, 55, 91, 18, 63 into a table indexed from 0 to 6. What will be the location of key 18 ?

(1) 3 (2) 4 (3) 5 (4) 6

24. Which of the following algorithms solves the single-source shortest paths ?

(1) Prim's algorithm

(2) Floyd - Warshall algorithm

(3) Johnson's algorithm

(4) Dijkstra's algorithm

25. A text is made up of the characters A, B, C, D, E each occurring with the probability 0.08, 0.40, 0.25, 0.15 and 0.12 respectively. The optimal coding technique will have the average length of :

(1) 2.4 (2) 1.87 (3) 3.0 (4) 2.15

26. A binary search tree in which every non-leaf node has non-empty left and right subtrees is called a strictly binary tree. Such a tree with 19 leaves :

(1) cannot have more than 37 nodes

(2) has exactly 37 nodes

(3) has exactly 35 nodes

(4) cannot have more than 35 nodes

27. Match the following with respect to algorithm paradigms :

List - I		List - II	
(a)	The 8-Queen's problem	(i)	Dynamic programming
(b)	Single-Source shortest paths	(ii)	Divide and conquer
(c)	STRASSEN's Matrix multiplication	(iii)	Greedy approach
(d)	Optimal binary search trees	(iv)	Backtracking

Code :

	(a)	**(b)**	**(c)**	**(d)**
(1)	(iv)	(i)	(iii)	(ii)
(2)	(iv)	(iii)	(i)	(ii)
(3)	(iii)	(iv)	(ii)	(i)
(4)	(iv)	(iii)	(ii)	(i)

28. The maximum number of comparisons needed to sort 9 items using radix sort is (assume each item is 5 digit octal number) :

(1) 45 (2) 72 (3) 360 (4) 450

29. A 5-ary tree is tree in which every internal node has exactly 5 children. The number of left nodes in such a tree with 8 internal nodes will be :

(1) 30 (2) 33 (3) 45 (4) 125

30. Consider a Boolean function of 'n' variables. The order of an algorithm that determines whether the Boolean function produces a output 1 is :

(1) Logarithmic (2) Linear

(3) Quadratic (4) Exponential

31. Two finite state machines are said to be equivalent if they :

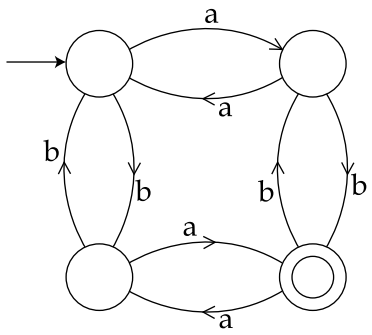
(1) Have the same number of edges

(2) Have the same number of states

(3) Recognize the same set of tokens

(4) Have the same number of states and edges

32. The finite state machine given in figure below recognizes :



(1) any string of odd number of a's
(2) any string of odd number of b's
(3) any string of even number of a's and odd number of b's
(4) any string of odd number of a's and odd number of b's

33. A pushdown automata behaves like a Turing machine when the number of auxiliary memory is :

(1) 0 (2) 1 (3) 1 or more (4) 2 or more

34. Pushdown automata can recognize language generated by_____.

(1) Only context free grammar
(2) Only regular grammar
(3) Context free grammar or regular grammar
(4) Only context sensitive grammar

35. To obtain a string of n Terminals from a given Chomsky normal form grammar, the number of productions to be used is :

(1) $2n-1$ (2) $2n$ (3) $n+1$ (4) n^2

36. Consider the following two Grammars :

G_1 : $S \rightarrow SbS \mid a$

G_2 : $S \rightarrow aB \mid ab$, $A \rightarrow GAB \mid a$, $B \rightarrow ABb \mid b$

Which of the following option is **correct** ?

(1) Only G_1 is ambiguous
(2) Only G_2 is ambiguous
(3) Both G_1 and G_2 are ambiguous
(4) Both G_1 and G_2 are not ambiguous

37. Context sensitive language can be recognized by a :

(1) Finite state machine

(2) Deterministic finite automata

(3) Non-deterministic finite automata

(4) Linear bounded automata

38. The set $A = \{ 0^n 1^n 2^n \mid n = 1, 2, 3, \ldots\ldots \}$ is an example of a grammar that is :

(1) Context sensitive (2) Context free

(3) Regular (4) None of the above

39. A bottom-up parser generates :

(1) Left-most derivation in reverse

(2) Right-most derivation in reverse

(3) Left-most derivation

(4) Right-most derivation

40. Consider the following statements( ) :

S_1 : There exists no algorithm for deciding if any two Turing machines M_1 and M_2 accept the same language.

S_2 : The problem of determining whether a Turing machine halts on any input is undecidable.

Which of the following options is **correct** ?

(1) Both S_1 and S_2 are correct

(2) Both S_1 and S_2 are not correct

(3) Only S_1 is correct

(4) Only S_2 is correct

41. A slotted ALOHA network transmits 200-bit frames using a shared channel with a 200 Kbps bandwidth. Find the throughput of the system, if the system (all stations put together) produces 250 frames per second :

(1) 49 (2) 368 (3) 149 (4) 151

42. The period of a signal is 100 ms. Its frequency is _____.

(1) 100^3 Hertz (2) 10^{-2} KHz (3) 10^{-3} KHz (4) 10^5 Hertz

43. The dotted-decimal notation of the following IPV4 address in binary notation is _____.

10000001 00001011 00001011 11101111

(1) 111.56.45.239 (2) 129.11.10.238

(3) 129.11.11.239 (4) 111.56.11.239

44. Which of the following statements are **true** ?

(a) Advanced Mobile Phone System (AMPS) is a second generation cellular phone system.

(b) IS - 95 is a second generation cellular phone system based on CDMA and DSSS.

(c) The Third generation cellular phone system will provide universal personnel communication.

Code :

(1) (a) and (b) only (2) (b) and (c) only

(3) (a), (b) and (c) (4) (a) and (c) only

45. Match the following symmetric block ciphers with corresponding block and key sizes :

List - I	**List - II**
(a) DES	(i) block size 64 and key size ranges between 32 and 448
(b) IDEA	(ii) block size 64 and key size 64
(c) BLOW FISH	(iii) block size 128 and key sizes 128, 192, 256
(d) AES	(iv) block size 64 and key size 128

Code :

	(a)	**(b)**	**(c)**	**(d)**
(1)	(iv)	(ii)	(i)	(iii)
(2)	(ii)	(iv)	(i)	(iii)
(3)	(ii)	(iv)	(iii)	(i)
(4)	(iv)	(ii)	(iii)	(i)

46. Which of the following statements are **true** ?

(a) Three broad categories of Networks are

(i) Circuit Switched Networks

(ii) Packet Switched Networks

(iii) Message Switched Networks

(b) Circuit Switched Network resources need not be reserved during the set up phase.

(c) In packet switching there is no resource allocation for packets.

Code :

(1) (a) and (b) only (2) (b) and (c) only

(3) (a) and (c) only (4) (a), (b) and (c)

47. In Challenge-Response authentication the claimant _____.

(1) Proves that she knows the secret without revealing it

(2) Proves that she doesn't know the secret

(3) Reveals the secret

(4) Gives a challenge

48. Decrypt the message "WTAAD" using the Caesar Cipher with key = 15.

(1) LIPPS (2) HELLO (3) OLLEH (4) DAATW

49. To guarantee correction of upto t errors, the minimum Hamming distance d_{min} in a block code must be _____.

(1) $t+1$ (2) $t-2$ (3) $2t-1$ (4) $2t+1$

50. Encrypt the Message "HELLO MY DEARZ" using Transposition Cipher with

Key { Plain Text 2 4 1 3 / Cipher Text 1 2 3 4

(1) HLLEO YM AEDRZ (2) EHOLL ZYM RAED

(3) ELHL MDOY AZER (4) ELHL DOMY ZAER

51. At a particular time of computation, the value of a counting semaphore is 10. Then 12 P operations and "x" V operations were performed on this semaphore. If the final value of semaphore is 7, x will be :

(1) 8 (2) 9 (3) 10 (4) 11

52. In a paged memory, the page hit ratio is 0.40. The time required to access a page in secondary memory is equal to 120 ns. The time required to access a page in primary memory is 15 ns. The average time required to access a page is _____.

(1) 105 (2) 68 (3) 75 (4) 78

53. In a multi-user operating system, 30 requests are made to use a particular resource per hour, on an average. The probability that no requests are made in 40 minutes, when arrival pattern is a poisson distribution, is _____.

(1) e^{-15} (2) $1-e^{-15}$ (3) $1-e^{-20}$ (4) e^{-20}

54. Normally user programs are prevented from handling I/O directly by I/O instructions in them. For CPUs having explicit I/O instructions, such I/O protection is ensured by having the I/O instructions privileged. In a CPU with memory mapped I/O, there is no explicit I/O instruction. Which one of the following is true for a CPU with memory mapped I/O ?

(1) I/O protection is ensured by operating system routines.

(2) I/O protection is ensured by a hardware trap.

(3) I/O protection is ensured during system configuration.

(4) I/O protection is not possible.

55. Which UNIX/Linux command is used to make all files and sub-directories in the directory "progs" executable by all users ?

(1) chmod − R a + *x* progs (2) chmod −R 222 progs

(3) chmod −X a + *x* progs (4) chmod −X 222 progs

56. Which of the following statements are **true** ?

(a) External Fragmentation exists when there is enough total memory space to satisfy a request but the available space is contiguous.

(b) Memory Fragmentation can be internal as well as external.

(c) One solution to external Fragmentation is compaction.

Code :

(1) (a) and (b) only (2) (a) and (c) only

(3) (b) and (c) only (4) (a), (b) and (c)

57. Page information in memory is also called as Page Table. The essential contents in each entry of a page table is/are _____.

(1) Page Access information

(2) Virtual Page number

(3) Page Frame number

(4) Both virtual page number and Page Frame Number

58. Consider a virtual page reference string 1, 2, 3, 2, 4, 2, 5, 2, 3, 4. Suppose LRU page replacement algorithm is implemented with 3 page frames in main memory. Then the number of page faults are_____.

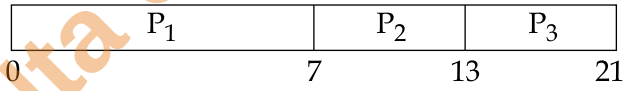
(1) 5 (2) 7 (3) 9 (4) 10

59. Consider the following three processes with the arrival time and CPU burst time given in milliseconds :

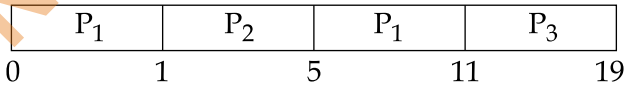
Process	Arrival Time	Burst Time
P_1	0	7
P_2	1	4
P_3	2	8

The Gantt Chart for preemptive SJF scheduling algorithm is _____.

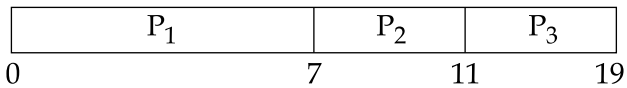
(1)



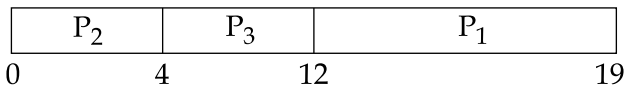
(2)



(3)



(4)



60. In which of the following scheduling criteria, context switching will never take place ?

(1) ROUND ROBIN (2) Preemptive SJF

(3) Non-preemptive SJF (4) Preemptive priority

61. In RDBMS, which type of Join returns all rows that satisfy the join condition ?

(1) Inner Join (2) Outer Join

(3) Semi Join (4) Anti Join

62. Consider a relation book (title, price) which contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL query list ?

```
Select title
from book as B
where (select count (*)
        from book as T
        where T.price > B.price) < 7
```

(1) Titles of the six most expensive books.

(2) Title of the sixth most expensive books.

(3) Titles of the seven most expensive books.

(4) Title of the seventh most expensive books.

63. In a Hierachical database, a hashing function is used to locate the _____.

(1) Collision (2) Root

(3) Foreign Key (4) Records

64. Relations produced from E - R Model will always be in _____.

(1) 1 NF (2) 2 NF (3) 3 NF (4) 4 NF

65. Consider the following schedules involving two transactions.

$S_1 : r_1(X) ; r_1(Y) ; r_2(X) ; r_2(Y) ; w_2(Y) ; w_1(X)$

$S_2 : r_1(X) ; r_2(X) ; r_2(Y) ; w_2(Y) ; r_1(Y) ; w_1(X)$

Which one of the following statements is correct with respect to above ?

(1) Both S_1 and S_2 are conflict serializable.

(2) Both S_1 and S_2 are not conflict serializable.

(3) S_1 is conflict serializable and S_2 is not conflict serializable.

(4) S_1 is not conflict serializable and S_2 is conflict serializable.

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

$a \rightarrow c$

$b \rightarrow d$

The relation is in _____.

(1) First normal form but not in second normal form

(2) Second normal form but not in third normal form

(3) Third normal form

(4) BCNF

67. A many-to-one relationship exists between entity sets r_1 and r_2. How will it be represented using functional depedencies if Pk(r) denotes the primary key attribute of relation r ?

(1) $Pk(r_1) \rightarrow Pk(r_2)$

(2) $Pk(r_2) \rightarrow Pk(r_1)$

(3) $Pk(r_2) \rightarrow Pk(r_1)$ and $Pk(r_1) \rightarrow Pk(r_2)$

(4) $Pk(r_2) \rightarrow Pk(r_1)$ or $Pk(r_1) \rightarrow Pk(r_2)$

68. Database systems that store each relation in a separate operating system file may use the operating system's authorization scheme, instead of defining a special scheme themselves. In this case, which of the following is **false** ?

(1) The administrator enjoys more control on the grant option.

(2) It is difficult to differentiate among the update, delete and insert authorizations.

(3) Cannot store more than one relation in a file.

(4) Operations on the database are speeded up as the authorization procedure is carried out at the operating system level.

69. Let $R_1(a, b, c)$ and $R_2(x, y, z)$ be two relations in which a is the foreign key of R_1 that refers to the primary key of R_2. Consider following four options.

(a) Insert into R_1 (b) Insert into R_2

(c) Delete from R_1 (d) Delete from R_2

Which of the following is correct about the referential integrity constraint with respect to above ?

(1) Operations (a) and (b) will cause violation.

(2) Operations (b) and (c) will cause violation.

(3) Operations (c) and (d) will cause violation.

(4) Operations (d) and (a) will cause violation.

70. Consider a hash table of size seven, with starting index zero, and a hash function $(7x+3)$ mod 4. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence 1, 3, 8, 10 is inserted into the table using closed hashing ? Here "__" denotes an empty location in the table.

(1) 3, 10, 1, 8, __ , __ , __

(2) 1, 3, 8, 10, __ , __ , __

(3) 1, __ , 3, __ , 8, __ , 10

(4) 3, 10, __ , __ , 8, __ , __

71. In Artificial Intelligence (AI), an environment is uncertain if it is _____.

(1) Not fully observable and not deterministic

(2) Not fully observable or not deterministic

(3) Fully observable but not deterministic

(4) Not fully observable but deterministic

72. In Artificial Intelligence (AI), a simple reflex agent selects actions on the basis of_____.

(1) current percept, completely ignoring rest of the percept history.

(2) rest of the percept history, completely ignoring current percept.

(3) both current percept and complete percept history.

(4) both current percept and just previous percept.

73. In heuristic search algorithms in Artificial Intelligence (AI), if a collection of admissible heuristics $h_1.....h_m$ is available for a problem and none of them dominates any of the others, which should we choose ?

(1) $h(n) = \max\{h_1(n),....,h_m(n)\}$

(2) $h(n) = \min\{h_1(n),....,h_m(n)\}$

(3) $h(n) = \text{avg}\{h_1(n),....,h_m(n)\}$

(4) $h(n) = \text{sum}\{h_1(n),....,h_m(n)\}$

74. Consider following sentences regarding A*, an informed search strategy in Artificial Intelligence (AI).

(a) A* expands all nodes with $f(n) < C^*$.

(b) A* expands no nodes with $f(n) \geq C^*$.

(c) Pruning is integral to A*.

Here, C^* is the cost of the optimal solution path.

Which of the following is correct with respect to the above statements ?

(1) Both statement (a) and statement (b) are true.

(2) Both statement (a) and statement (c) are true.

(3) Both statement (b) and statement (c) are true.

(4) All the statements (a), (b) and (c) are true.

75. Consider a vocabulary with only four propositions A, B, C and D. How many models are there for the following sentence ?

$B \vee C$

(1) 10 (2) 12 (3) 15 (4) 16

76. Consider the following statements :

(a) False $\models$ True

(b) If $\alpha \models (\beta \wedge \gamma)$ then $\alpha \models \beta$ and $\alpha \models \gamma$.

Which of the following is correct with respect to the above statements ?

(1) Both statement (a) and statement (b) are false.

(2) Statement (a) is true but statement (b) is false.

(3) Statement (a) is false but statement (b) is true.

(4) Both statement (a) and statement (b) are true.

77. Consider the following English sentence :

"Agra and Gwalior are both in India".

A student has written a logical sentence for the above English sentence in First-Order Logic using predicate In(x, y), which means x is in y, as follows :

In(Agra, India) $\vee$ In(Gwalior, India)

Which one of the following is correct with respect to the above logical sentence ?

(1) It is syntactically valid but does not express the meaning of the English sentence.

(2) It is syntactically valid and expresses the meaning of the English sentence also.

(3) It is syntactically invalid but expresses the meaning of the English sentence.

(4) It is syntactically invalid and does not express the meaning of the English sentence.

78. Consider the following two sentences :

(a) The planning graph data structure can be used to give a better heuristic for a planning problem.

(b) Dropping negative effects from every action schema in a planning problem results in a relaxed problem.

Which of the following is correct with respect to the above sentences ?

(1) Both sentence (a) and sentence (b) are false.

(2) Both sentence (a) and sentence (b) are true.

(3) Sentence (a) is true but sentence (b) is false.

(4) Sentence (a) is false but sentence (b) is true.

79. A knowledge base contains just one sentence, $\exists x$ AsHighAs (x, Everest). Consider the following two sentences obtained after applying existential instantiation.

(a) AsHighAs (Everest, Everest)

(b) AsHighAs (Kilimanjaro, Everest)

Which of the following is correct with respect to the above sentences ?

(1) Both sentence (a) and sentence (b) are sound conclusions.

(2) Both sentence (a) and sentence (b) are unsound conclusions.

(3) Sentence (a) is sound but sentence (b) is unsound.

(4) Sentence (a) is unsound but sentence (b) is sound.

80. Consider the set of all possible five-card poker hands dealt fairly from a standard deck of fifty-two cards. How many atomic events are there in the joint probability distribution ?

(1) 2, 598, 960 (2) 3, 468, 960 (3) 3, 958, 590 (4) 2, 645, 590

81. E is the number of edges in the graph and f is maximum flow in the graph. When the capacities are integers, the runtime of Ford-Fulberson algorithm is bounded by :

(1) O (E*f) (2) O (E^2*f)

(3) O (E*f^2) (4) O (E^2*f^2)

82. Which of the following statements is false about convex minimization problem ?

(1) If a local minimum exists, then it is a global minimum

(2) The set of all global minima is convex set

(3) The set of all global minima is concave set

(4) For each strictly convex function, if the function has a minimum, then the minimum is unique

83. The following LPP

Maximize $z = 100x_1 + 2x_2 + 5x_3$

Subject to

$14x_1 + x_2 - 6x_3 + 3x_4 = 7$

$32x_1 + x_2 - 12x_3 \leq 10$

$3x_1 - x_2 - x_3 \leq 0$

$x_1, x_2, x_3, x_4 \geq 0$

has

(1) Solution : $x_1 = 100, x_2 = 0, x_3 = 0$ (2) Unbounded solution

(3) No solution (4) Solution : $x_1 = 50, x_2 = 70, x_3 = 60$

84. Digital data received from a sensor can fill up 0 to 32 buffers. Let the sample space be $S = \{0, 1, 2, ..., 32\}$ where the sample j denote that j of the buffers are full and $p(i) = \frac{1}{561}(33-i)$. Let A denote the event that the even number of buffers are full. Then p(A) is :

(1) 0.515 (2) 0.785 (3) 0.758 (4) 0.485

85. The equivalence of

$\neg \exists x\, Q(x)$ is :

(1) $\exists x \neg Q(x)$ (2) $\forall x \neg Q(x)$ (3) $\neg \exists x \neg Q(x)$ (4) $\forall x\, Q(x)$

86. If $A_i = \{-i, \ldots -2, -1, 0, 1, 2, \ldots . i\}$

then $\bigcup_{i=1}^{\infty} A_i$ is :

(1) Z (2) Q (3) R (4) C

87. Match the following in **List - I** and **List - II**, for a function f :

	List - I		**List - II**
(a)	$\forall x \forall y (f(x) = f(y) \rightarrow x = y)$	(i)	Constant
(b)	$\forall y \exists x (f(x) = y)$	(ii)	Injective
(c)	$\forall x\, f(x) = k$	(iii)	Surjective

Code :

	(a)	**(b)**	**(c)**
(1)	(i)	(ii)	(iii)
(2)	(iii)	(ii)	(i)
(3)	(ii)	(i)	(iii)
(4)	(ii)	(iii)	(i)

88. Which of the relations on {0, 1, 2, 3} is an equivalence relation ?

(1) { (0, 0) (0, 2) (2, 0) (2, 2) (2, 3) (3, 2) (3, 3) }

(2) { (0, 0) (1, 1) (2, 2) (3, 3) }

(3) { (0, 0) (0, 1) (0, 2) (1, 0) (1, 1) (1, 2) (2, 0) }

(4) { (0, 0) (0, 2) (2, 3) (1, 1) (2, 2) }

89. Which of the following is an equivalence relation on the set of all functions from Z to Z ?

(1) $\{ (f, g) \mid f(x) - g(x) = 1 \ \forall \ x \in Z \}$

(2) $\{ (f, g) \mid f(0) = g(0)$ or $f(1) = g(1) \}$

(3) $\{ (f, g) \mid f(0) = g(1)$ and $f(1) = g(0) \}$

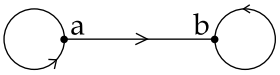
(4) $\{ (f, g) \mid f(x) - g(x) = k$ for some $k \in Z \}$

90. Which of the following statements is **true** ?

(1) $(Z, \leq)$ is not totally ordered

(2) The set inclusion relation $\subseteq$ is a partial ordering on the power set of a set S

(3) $(Z, \neq)$ is a poset

(4) The directed graph 

is not a partial order

91. CMOS is a Computer Chip on the motherboard, which is :

(1) RAM (2) ROM

(3) EPROM (4) Auxillary storage

92. In RS flip-flop, the output of the flip-flop at time $(t+1)$ is same as the output at time t, after the occurance of a clock pulse if :

(1) $S = R = 1$ (2) $S = 0, R = 1$

(3) $S = 1, R = 0$ (4) $S = R = 0$

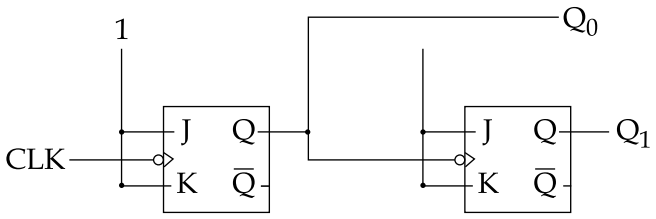
93. Match the terms in **List - I** with the options given in **List - II** :

	List - I		**List - II**
(a)	Decoder	(i)	1 line to 2^n lines
(b)	Multiplexer	(ii)	n lines to 2^n lines
(c)	De multiplexer	(iii)	2^n lines to 1 line
		(iv)	2^n lines to 2^{n-1} lines

Code :

	(a)	**(b)**	**(c)**
(1)	(ii)	(i)	(iii)
(2)	(ii)	(iii)	(i)
(3)	(ii)	(i)	(iv)
(4)	(iv)	(ii)	(i)

94. What does the following logic diagram represent ?



(1) Synchronous Counter (2) Ripple Counter

(3) Combinational Circuit (4) Mod 2 Counter

95. The hexadecimal equivalent of the binary integer number 110101101 is :

(1) D24 (2) 1 B D (3) 1 A E (4) 1 A D

96. Perform the following operation for the binary equivalent of the decimal numbers $(-14)_{10} + (-15)_{10}$

The solution in 8 bit representation is :

(1) 11100011 (2) 00011101

(3) 10011101 (4) 11110011

97. Match the items in **List - I** and **List - II** :

	List - I		**List - II**
(a)	Interrupts which can be delayed when a much highest priority interrupt has occurred	(i)	Normal
(b)	Unplanned interrupts which occur while executing a program	(ii)	Synchronous
(c)	Source of interrupt is in phase with the system clock	(iii)	Maskable
		(iv)	Exception

Code :

	(a)	**(b)**	**(c)**
(1)	(ii)	(i)	(iv)
(2)	(ii)	(iv)	(iii)
(3)	(iii)	(i)	(ii)
(4)	(iii)	(iv)	(ii)

98. Which of the following mapping is not used for mapping process in cache memory ?

(1) Associative mapping (2) Direct mapping

(3) Set-Associative mapping (4) Segmented - page mapping

99. Simplify the following using K-map :

$F(A, B, C, D) = \Sigma (0, 1, 2, 8, 9, 12, 13)$

$d(A, B, C, D) = \Sigma (10, 11, 14, 15)$

d stands for don't care condition.

(1) $A + \overline{B}\,\overline{D} + BC$ (2) $A + \overline{B}\,\overline{D} + \overline{B}\,\overline{C}$

(3) $\overline{A} + \overline{B}\,\overline{C}$ (4) $\overline{A} + \overline{B}\,\overline{C} + \overline{B}\,\overline{D}$

100. In 8085 microprocessor, what is the output of following program ?

```
LDA 8000H
MVI B, 30H
ADD B
STA 8001H
```

(1) Read a number from input port and store it in memory

(2) Read a number from input device with address 8000H and store it in memory at location 8001H

(3) Read a number from memory at location 8000H and store it in memory location 8001H

(4) Load A with data from input device with address 8000H and display it on the output device with address 8001H

- o 0 o -

Space For Rough Work