

Signature and Name of Invigilator

1. (Signature) _____

(Name) _____

2. (Signature) _____

(Name) _____

OMR Sheet No. :
(To be filled by the Candidate)

Roll No.

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(In figures as per admission card)

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PAPER - III
COMPUTER SCIENCE AND
APPLICATIONS

Roll No. _____
(In words)

Time : 2½ hours]

[Maximum Marks : 150

Number of Pages in this Booklet : 20

Number of Questions in this Booklet : 75

Instructions for the Candidates

- Write your roll number in the space provided on the top of this page.
- This paper consists of seventy five multiple-choice type of questions.
- 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 :
 - 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.
 - 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.
 - 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.
- 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.
- 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.
- Read instructions given inside carefully.
- Rough Work is to be done in the end of this booklet.
- 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.
- 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 and duplicate copy of OMR Sheet on conclusion of examination.
- Use only Blue/Black Ball point pen.
- Use of any calculator or log table etc., is prohibited.
- There are no negative marks for incorrect answers.

परीक्षार्थियों के लिए निर्देश

- इस पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए।
- इस प्रश्न-पत्र में पचहत्तर बहुविकल्पीय प्रश्न हैं।
- 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 :
 - 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।
 - 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।
 - 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।
- 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।
- 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 चिह्नित करते हैं, तो उसका मूल्यांकन नहीं होगा।
- अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें।
- कच्चा काम (Rough Work) इस पुस्तिका के अन्तिम पृष्ठ पर करें।
- 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।
- 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 तथा OMR पत्रक की डुप्लीकेट प्रति अपने साथ ले जा सकते हैं।
- केवल नीले/काले बाल प्वाइंट पेन का ही प्रयोग करें।
- किसी भी प्रकार का संगणक (कैलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है।
- गलत उत्तरों के लिए कोई नकारात्मक अंक नहीं हैं।



COMPUTER SCIENCE AND APPLICATIONS

PAPER - III

Note : This paper contains **seventy five (75)** objective type questions of **two (2)** marks each. **All** questions are **compulsory**.

1. In 8085 microprocessor which of the following flag(s) is (are) affected by an arithmetic operation ?
(1) AC flag Only (2) CY flag Only (3) Z flag Only (4) AC, CY, Z flags
2. In 8085 microprocessor the address bus is of _____ bits.
(1) 4 (2) 8 (3) 16 (4) 32
3. In the architecture of 8085 microprocessor match the following :
(a) Processing unit (i) Interrupt
(b) Instruction unit (ii) General purpose Register
(c) Storage and Interface unit (iii) ALU
(iv) Timing and Control

Code :

- | | | | |
|-----|-------|-------|------|
| (a) | (b) | (c) | |
| (1) | (iv) | (i) | (ii) |
| (2) | (iii) | (iv) | (ii) |
| (3) | (ii) | (iii) | (i) |
| (4) | (i) | (ii) | (iv) |
-
4. Which of the following addressing mode is best suited to access elements of an array of contiguous memory locations ?
(1) Indexed addressing mode (2) Base Register addressing mode
(3) Relative address mode (4) Displacement mode



5. Which of the following is **correct** statement ?
- (1) In memory - mapped I/O, the CPU can manipulate I/O data residing in interface registers that are not used to manipulate memory words.
 - (2) The isolated I/O method isolates memory and I/O addresses so that memory address range is not affected by interface address assignment.
 - (3) In asynchronous serial transfer of data the two units share a common clock.
 - (4) In synchronous serial transmission of data the two units have different clocks.
6. A micro-instruction format has micro-ops field which is divided into three subfields F1, F2, F3 each having seven distinct micro-operations, condition field CD for four status bits, branch field BR having four options used in conjunction with address field ADF. The address space is of 128 memory locations. The size of micro-instruction is :
- (1) 17 bits
 - (2) 20 bits
 - (3) 24 bits
 - (4) 32 bits
7. Consider the following four schedules due to three transactions (indicated by the subscript) using read and write on a data item X, denoted by $r(X)$ and $w(X)$ respectively. Which one of them is conflict serializable ?
- $S_1 : r_1(X); r_2(X); w_1(X); r_3(X); w_2(X)$
 $S_2 : r_2(X); r_1(X); w_2(X); r_3(X); w_1(X)$
 $S_3 : r_3(X); r_2(X); r_1(X); w_2(X); w_1(X)$
 $S_4 : r_2(X); w_2(X); r_3(X); r_1(X); w_1(X)$
- (1) S_1
 - (2) S_2
 - (3) S_3
 - (4) S_4
8. Suppose a database schedule S involves transactions T_1, T_2, \dots, T_n . Consider the precedence graph of S with vertices representing the transactions and edges representing the conflicts. If S is serializable, which one of the following orderings of the vertices of the precedence graph is guaranteed to yield a serial schedule ?
- (1) Topological order
 - (2) Depth - first order
 - (3) Breadth - first order
 - (4) Ascending order of transaction indices
9. If every non-key attribute is functionally dependent on the primary key, then the relation is in _____ .
- (1) First normal form
 - (2) Second normal form
 - (3) Third normal form
 - (4) Fourth normal form



10. Consider a relation R (A, B, C, D, E, F, G, H), where each attribute is atomic, and following functional dependencies exist.

$CH \rightarrow G$

$A \rightarrow BC$

$B \rightarrow CFH$

$E \rightarrow A$

$F \rightarrow EG$

The relation R is _____ .

- (1) in 1NF but not in 2NF (2) in 2NF but not in 3NF
(3) in 3NF but not in BCNF (4) in BCNF
11. Given two relations $R_1(A, B)$ and $R_2(C, D)$, the result of following query

Select distinct A, B

from R_1, R_2

is guaranteed to be same as R_1 provided one of the following condition is satisfied.

- (1) R_1 has no duplicates and R_2 is empty.
(2) R_1 has no duplicates and R_2 is non - empty.
(3) Both R_1 and R_2 have no duplicates.
(4) R_2 has no duplicates and R_1 is non - empty.
12. Consider a schema R(A, B, C, D) and following functional dependencies.

$A \rightarrow B$

$B \rightarrow C$

$C \rightarrow D$

$D \rightarrow B$

Then decomposition of R into $R_1(A, B)$, $R_2(B, C)$ and $R_3(B, D)$ is _____ .

- (1) Dependency preserving and lossless join.
(2) Lossless join but not dependency preserving.
(3) Dependency preserving but not lossless join.
(4) Not dependency preserving and not lossless join.



13. Which of the following is **not** a component of Memory tube display ?

- (1) Flooding gun (2) Collector (3) Ground (4) Liquid Crystal

14. Which of the following is **not** true in case of Oblique Projections ?

- (1) Parallel projection rays are not perpendicular to the viewing plane.
 (2) Parallel lines in space appear parallel on the final projected image.
 (3) Used exclusively for pictorial purposes rather than formal working drawings.
 (4) Projectors are always perpendicular to the plane of projection.

15. With respect to CRT, the horizontal retrace is defined as :

- (1) The path an electron beam takes when returning to the left side of the CRT.
 (2) The path an electron beam takes when returning to the right side of the CRT.
 (3) The technique of turning the electron beam off while retracing.
 (4) The technique of turning the electron beam on/off while retracing.

16. Find the equation of the circle $x^2 + y^2 = 1$ in terms of $x'y'$ coordinates, assuming that the xy coordinate system results from a scaling of 3 units in the x' direction and 4 units in the y' direction.

- (1) $3(x')^2 + 4(y')^2 = 1$ (2) $\left(\frac{x'}{3}\right)^2 + \left(\frac{y'}{4}\right)^2 = 1$
 (3) $(3x')^2 + (4y')^2 = 1$ (4) $\frac{1}{3}(x')^2 + \frac{1}{4}(y')^2 = 1$

17. Find the normalization transformation that maps a window whose lower left corner is at (1, 1) and upper right corner is at (3, 5) onto a viewport that is the entire normalized device screen.

- (1) $\begin{pmatrix} \frac{1}{2} & 0 & \frac{-1}{2} \\ 0 & \frac{1}{4} & \frac{-1}{4} \\ 0 & 0 & 1 \end{pmatrix}$ (2) $\begin{pmatrix} \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & \frac{-1}{4} & \frac{1}{4} \\ 1 & 1 & 1 \end{pmatrix}$ (3) $\begin{pmatrix} \frac{1}{2} & 0 & \frac{-1}{2} \\ 0 & \frac{1}{4} & \frac{1}{4} \\ 1 & 0 & 0 \end{pmatrix}$ (4) $\begin{pmatrix} \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & \frac{1}{4} & \frac{-1}{4} \\ 1 & 0 & 0 \end{pmatrix}$

18. The three aspects of Quantization, programmers generally concerned with are :
- (1) Coding error, Sampling rate and Amplification
 - (2) Sampling rate, Coding error and Conditioning
 - (3) Sampling rate, Aperture time and Coding error
 - (4) Aperture time, Coding error and Strobing
19. The logic of pumping lemma is an example of _____ .
- (1) iteration
 - (2) recursion
 - (3) the divide and conquer principle
 - (4) the pigeon - hole principle
20. Heap allocation is required for languages that :
- (1) use dynamic scope rules
 - (2) support dynamic data structures
 - (3) support recursion
 - (4) support recursion and dynamic data structures
21. Pumping lemma for regular language is generally used for proving :
- (1) whether two given regular expressions are equivalent
 - (2) a given grammar is ambiguous
 - (3) a given grammar is regular
 - (4) a given grammar is not regular
22. Which of the following problems is undecidable ?
- (1) To determine if two finite automata are equivalent
 - (2) Membership problem for context free grammar
 - (3) Finiteness problem for finite automata
 - (4) Ambiguity problem for context free grammar



23. Finite state machine can recognize language generated by _____.
- (1) Only context free grammar (2) Only context sensitive grammar
(3) Only regular grammar (4) any unambiguous grammar
24. The language $L = \{a^i b c^i \mid i \geq 0\}$ over the alphabet $\{a, b, c\}$ is :
- (1) a regular language.
(2) not a deterministic context free language but a context free language.
(3) recursive and is a deterministic context free language.
(4) not recursive.
25. Suppose we want to download text documents at the rate of 100 pages per second. Assume that a page consists of an average of 24 lines with 80 characters in each line. What is the required bit rate of the channel ?
- (1) 192 kbps (2) 512 kbps
(3) 1.248 Mbps (4) 1.536 Mbps
26. Quadrature Amplitude Modulation means changing both :
- (1) Frequency and phase of the carrier.
(2) Frequency and Amplitude of the carrier.
(3) Amplitude and phase of the carrier.
(4) Amplitude and Wavelength of the carrier.
27. If a file consisting of 50,000 characters takes 40 seconds to send, then the data rate is _____.
- (1) 1 kbps (2) 1.25 kbps
(3) 2 kbps (4) 10 kbps



28. Match the following :

List - I

- (a) Data link layer
- (b) Network layer
- (c) Transport layer
- (d) Presentation layer

List - II

- (i) Encryption
- (ii) Connection control
- (iii) Routing
- (iv) Framing

Code :

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

29. The address of a class B host is to be split into subnets with a 6 - bit subnet number. What is the maximum number of subnets and maximum number of hosts in each subnet ?

- (1) 62 subnets and 1022 hosts
- (2) 64 subnets and 1024 hosts
- (3) 62 subnets and 254 hosts
- (4) 64 subnets and 256 hosts

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

- (a) The fragmentation fields in the base header section of IPv4 have moved to the fragmentation extension header in IPv6.
- (b) The authentication extension header is new in IPv6.
- (c) The record route option is not implemented in IPv6.

Code :

- (1) (a) and (b) Only
- (2) (b) and (c) Only
- (3) (a) and (c) Only
- (4) (a), (b) and (c)

31. Consider a full binary tree with n internal nodes, internal path length i , and external path length e . The internal path length of a full binary tree is the sum, taken over all nodes of the tree, of the depth of each node. Similarly, the external path length is the sum, taken over all leaves of the tree, of the depth of each leaf.

Which of the following is **correct** for the full binary tree?

- (1) $e = i + n$
- (2) $e = i + 2n$
- (3) $e = 2i + n$
- (4) $e = 2^n + i$



32. You are given a sequence of n elements to sort. The input sequence consists of $\frac{n}{k}$ subsequences, each containing k elements. The elements in a given subsequence are all smaller than the elements in the succeeding subsequence and larger than the elements in the preceding subsequence. Thus, all that is needed to sort the whole sequence of length n is to sort the k elements in each of the $\frac{n}{k}$ subsequences.

The lower bound on the number of comparisons needed to solve this variant of the sorting problem is :

- (1) $\Omega(n)$ (2) $\Omega\left(\frac{n}{k}\right)$ (3) $\Omega(n \lg k)$ (4) $\Omega\left(\frac{n}{k} \lg \frac{n}{k}\right)$

33. Consider the recurrence relation :

$$T(n) = 8T\left(\frac{n}{2}\right) + Cn, \text{ if } n > 1$$

$$= b, \text{ if } n = 1$$

Where b and c are constants.

The order of the algorithm corresponding to above recurrence relation is :

- (1) n (2) n^2 (3) $n \lg n$ (4) n^3

34. Consider the following two sequences :

$X = \langle B, C, D, C, A, B, C \rangle$

and $Y = \langle C, A, D, B, C, B \rangle$

The length of longest common subsequence of X and Y is :

- (1) 5 (2) 3 (3) 4 (4) 2

35. A text is made up of the characters a, b, c, d, e each occurring with the probability 0.11, 0.40, 0.16, 0.09 and 0.24 respectively. The optimal Huffman coding technique will have the average length of :

- (1) 2.40 (2) 2.16 (3) 2.26 (4) 2.15

36. An undirected graph $G(V, E)$ contains n ($n > 2$) nodes named v_1, v_2, \dots, v_n . Two nodes v_i and v_j are connected if and only if $0 < |i - j| \leq 2$. Each edge (v_i, v_j) is assigned a weight $i + j$.

The cost of the minimum spanning tree of such a graph with 10 nodes is :

- (1) 88 (2) 91 (3) 49 (4) 21



40. Which of the following statements is/are TRUE ?

- (a) In HTML, character entities are used to incorporate external content into a web page, such as images.
- (b) Once a web server returns a cookie to a browser, the cookie will be included in all future requests from the browser to the same server.

Code :

- (1) Only (a) is TRUE.
- (2) Only (b) is TRUE.
- (3) Both (a) and (b) are TRUE.
- (4) Neither (a) nor (b) is TRUE.

41. Which of the following statements is/are TRUE regarding JAVA ?

- (a) Constants that cannot be changed are declared using the 'static' keyword.
- (b) A class can only inherit one class but can implement multiple interfaces.

Code :

- (1) Only (a) is TRUE.
- (2) Only (b) is TRUE.
- (3) Both (a) and (b) are TRUE.
- (4) Neither (a) nor (b) is TRUE.

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

```
Class Test
{
    public static void main (String [ ] args)
    {
        Test obj = new Test ( );
        obj.start ( );
    }
    void start ( )
    {
        String stra="do";
        String strb = method (stra);
        System.out.print(":" + stra + strb);
    }
    String method (String stra)
    {
        stra=stra+"good";
        System.out.print (stra);
        return "good";
    }
}
```

- (1) dogood : dogoodgood
- (2) dogood : gooddogood
- (3) dogood : dodogood
- (4) dogood : dogood



43. Statistical software quality assurance in software engineering involves _____ .
- (1) using sampling in place of exhaustive testing of software.
 - (2) surveying customers to find out their opinions about product quality.
 - (3) tracing each defect to its underlying cause, isolating the vital few causes, and moving to correct them.
 - (4) tracing each defect to its underlying causes, and using the Pareto principle to correct each problem found.
44. Which of the following statements is/are FALSE with respect to software testing ?
- S1 : White-box tests are based on specifications; better at telling whether program meets specification, better at finding errors of omission.
- S2 : Black-box tests are based on code; better for finding crashes, out of bounds errors, file not closed errors.
- S3 : Alpha testing is conducted at the developer's site by a team of highly skilled testers for software that is developed as a product to be used by many customers.
- (1) Only S1 and S2 are FALSE.
 - (2) Only S1 and S3 are FALSE.
 - (3) Only S2 and S3 are FALSE.
 - (4) All of S1, S2, and S3 are FALSE.
45. A signal processor software is expected to operate for 91.25 days after repair, and the mean software repair time is expected to be 5 minutes. Then, the availability of the software is :
- (1) 96.9862%
 - (2) 97.9862%
 - (3) 98.9962%
 - (4) 99.9962%
46. Consider the method mcq () :
- ```

int mcq (boolean a, boolean b, boolean c, boolean d)
{
 int ans=1;
 if (a) {ans = 2;}
 else if (b) {ans = 3;}
 else if (c) {
 if (d) {ans=4;}
 }
 return ans ;
}

```
- If
- M1 = Number of tests to exhaustively test mcq ( );
- M2 = Minimum number of tests to achieve full statement coverage for mcq ( ); and
- M3 = Minimum number of tests to achieve full branch coverage for mcq ( );
- then (M1, M2, M3) = \_\_\_\_\_.
- (1) (16, 3, 5)
  - (2) (8, 5, 3)
  - (3) (8, 3, 5)
  - (4) (16, 4, 4)



47. A simple stand - alone software utility is to be developed in 'C' programming by a team of software experts for a computer running Linux and the overall size of this software is estimated to be 20,000 lines of code. Considering  $(a, b) = (2.4, 1.05)$  as multiplicative and exponention factor for the basic COCOMO effort estimation equation and  $(c, d) = (2.5, 0.38)$  as multiplicative and exponention factor for the basic COCOMO development time estimation equation, approximately how long does the software project take to complete ?
- (1) 10.52 months    (2) 11.52 months    (3) 12.52 months    (4) 14.52 months

48. In Software Configuration Management (SCM), which of the following is a use-case supported by standard version control systems ?
- (a) Managing several versions or releases of a software  
 (b) Filing bug reports and tracking their progress  
 (c) Allowing team members to work in parallel  
 (d) Identifying when and where a regression occurred

Code :

- (1) Only (a), (c), and (d)    (2) Only (a), (b), and (c)  
 (3) Only (a), (b), and (d)    (4) Only (b), (c), and (d)
49. Consider the following four processes with the arrival time and length of CPU burst given in milliseconds :

| Process        | Arrival Time | Burst Time |
|----------------|--------------|------------|
| P <sub>1</sub> | 0            | 8          |
| P <sub>2</sub> | 1            | 4          |
| P <sub>3</sub> | 2            | 9          |
| P <sub>4</sub> | 3            | 5          |

The average waiting time for preemptive SJF scheduling algorithm is \_\_\_\_\_ .

- (1) 6.5 ms    (2) 7.5 ms    (3) 6.75 ms    (4) 7.75 ms
50. Consider a virtual page reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. Suppose a demand paged virtual memory system running on a computer system such that the main memory has 3 page frames. Then \_\_\_\_\_ page replacement algorithm has minimum number of page faults.
- (1) FIFO    (2) LIFO    (3) LRU    (4) Optimal



51. User level threads are threads that are visible to the programmer and are unknown to the kernel. The operating system kernel supports and manages kernel level threads. Three different types of models relate user and kernel level threads.

Which of the following statements is/are true ?

- (a) (i) The Many - to - one model maps many user threads to one kernel thread  
(ii) The one - to - one model maps one user thread to one kernel thread  
(iii) The many - to - many model maps many user threads to smaller or equal kernel threads
- (b) (i) Many - to - one model maps many kernel threads to one user thread  
(ii) One - to - one model maps one kernel thread to one user thread  
(iii) Many - to - many model maps many kernel threads to smaller or equal user threads

Code :

- (1) (a) is true; (b) is false                      (2) (a) is false; (b) is true  
(3) Both (a) and (b) are true                      (4) Both (a) and (b) are false

52. Consider a system with five processes  $P_0$  through  $P_4$  and three resource types A, B and C. Resource type A has seven instances, resource type B has two instances and resource type C has six instances suppose at time  $T_0$  we have the following allocation.

| Process | Allocation |   |   | Request |   |   | Available |   |   |
|---------|------------|---|---|---------|---|---|-----------|---|---|
|         | A          | B | C | A       | B | C | A         | B | C |
| $P_0$   | 0          | 1 | 0 | 0       | 0 | 0 | 0         | 0 | 0 |
| $P_1$   | 2          | 0 | 0 | 2       | 0 | 2 |           |   |   |
| $P_2$   | 3          | 0 | 3 | 0       | 0 | 0 |           |   |   |
| $P_3$   | 2          | 1 | 1 | 1       | 0 | 0 |           |   |   |
| $P_4$   | 0          | 2 | 2 | 0       | 0 | 2 |           |   |   |

If we implement Deadlock detection algorithm we claim that system is \_\_\_\_\_.

- (1) Semaphore                                              (2) Deadlock state  
(3) Circular wait                                              (4) Not in deadlock state

53. Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 37, 122, 14, 124, 65, 67. Suppose SSTF disk scheduling algorithm implemented to meet the requests then the total number of head movements are \_\_\_\_\_ if the disk head is initially at 53.

- (1) 224                                              (2) 248                                              (3) 236                                              (4) 240

54. The Bounded buffer problem is also known as \_\_\_\_\_.
- (1) Producer - consumer problem      (2) Reader - writer problem  
 (3) Dining Philosophers problem      (4) Both (2) and (3)
55. In Artificial Intelligence (AI), which agent deals with happy and unhappy state ?
- (1) Simple reflex agent                      (2) Model based agent  
 (3) Learning agent                              (4) Utility based agent
56. If  $b$  is the branching factor and  $m$  is the maximum depth of the search tree, what is the space complexity of greedy search ?
- (1)  $O(b+m)$       (2)  $O(bm)$               (3)  $O(b^m)$               (4)  $O(m^b)$
57. Let  $P, Q, R$  and  $S$  be Propositions. Assume that the equivalences  $P \Leftrightarrow (Q \vee \neg Q)$  and  $Q \Leftrightarrow R$  hold. Then the truth value of the formula  $(P \wedge Q) \Rightarrow ((P \wedge R) \vee S)$  is always :
- (1) True                                              (2) False  
 (3) Same as truth table of  $Q$               (4) Same as truth table of  $S$
58. "If  $X$ , then  $Y$  unless  $Z$ " is represented by which of the following formulae in propositional logic ?
- (1)  $(X \wedge Y) \rightarrow \neg Z$       (2)  $(X \wedge \neg Z) \rightarrow Y$       (3)  $X \rightarrow (Y \wedge \neg Z)$       (4)  $Y \rightarrow (X \wedge \neg Z)$
59. Consider the following two well-formed formulas in propositional logic.
- F1 :  $P \Rightarrow \neg P$   
 F2 :  $(P \Rightarrow \neg P) \vee (\neg P \Rightarrow P)$
- Which of the following statements is correct ?
- (1) F1 is Satisfiable, F2 is valid              (2) F1 is unsatisfiable, F2 is Satisfiable  
 (3) F1 is unsatisfiable, F2 is valid              (4) F1 and F2 both are Satisfiable
60. Standard planning algorithms assume environment to be \_\_\_\_\_.
- (1) Both deterministic and fully observable  
 (2) Neither deterministic nor fully observable  
 (3) Deterministic but not fully observable  
 (4) Not deterministic but fully observable



61. Which of the following statements is **not** correct ?
- (1) Every recursive language is recursively enumerable.
  - (2)  $L = \{0^n 1^n 0^n \mid n=1, 2, 3, \dots\}$  is recursively enumerable.
  - (3) Recursive languages are closed under intersection.
  - (4) Recursive languages are not closed under intersection.
62. Context free grammar is not closed under :
- (1) Concatenation
  - (2) Complementation
  - (3) Kleene Star
  - (4) Union

63. Consider the following languages :

$$L_1 = \{a^m b^n \mid m \neq n\}$$

$$L_2 = \{a^m b^n \mid m = 2n + 1\}$$

$$L_3 = \{a^m b^n \mid m \neq 2n\}$$

Which one of the following statement is correct ?

- (1) Only  $L_1$  and  $L_2$  are context free languages
  - (2) Only  $L_1$  and  $L_3$  are context free languages
  - (3) Only  $L_2$  and  $L_3$  are context free languages
  - (4)  $L_1, L_2$  and  $L_3$  are context free languages
64. A  $4 \times 4$  DFT matrix is given by :

$$\frac{1}{2} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & x & -1 & y \\ 1 & -1 & 1 & -1 \\ 1 & -j & -1 & j \end{bmatrix}$$

$$(j^2 = -1)$$

Where values of  $x$  and  $y$  are \_\_\_\_\_, \_\_\_\_\_ respectively.

- (1) 1, -1
  - (2) -1, 1
  - (3) -j, j
  - (4) j, -j
65. Entropy of a discrete random variable with possible values  $\{x_1, x_2, \dots, x_n\}$  and probability density function  $P(X)$  is :

$$H(X) = - \sum_{i=1}^n P(x_i) \log_b P(x_i)$$

The value of  $b$  gives the units of entropy. The unit for  $b=10$  is :

- (1) bits
- (2) bann
- (3) nats
- (4) deca





66. For any binary  $(n, h)$  linear code with minimum distance  $(2t+1)$  or greater

$$n - h \geq \log_2 \left[ \sum_{i=0}^{\alpha} \binom{n}{i} \right] \text{ where } \alpha \text{ is :}$$

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

67. Which of the following is a valid reason for causing degeneracy in a transportation problem ? Here  $m$  is no. of rows and  $n$  is no. of columns in transportation table.

- (1) When the number of allocations is  $m+n-1$ .  
 (2) When two or more occupied cells become unoccupied simultaneously.  
 (3) When the number of allocations is less than  $m+n-1$ .  
 (4) When a loop cannot be drawn without using unoccupied cells, except the starting cell of the loop.

68. Consider the following LPP :

$$\text{Max } Z = 15x_1 + 10x_2$$

Subject to the constraints

$$4x_1 + 6x_2 \leq 360$$

$$3x_1 + 0x_2 \leq 180$$

$$0x_1 + 5x_2 \leq 200$$

$$x_1, x_2 \geq 0$$

The solution of the LPP using Graphical solution technique is :

- (1)  $x_1 = 60, x_2 = 0$  and  $Z = 900$                       (2)  $x_1 = 60, x_2 = 20$  and  $Z = 1100$   
 (3)  $x_1 = 60, x_2 = 30$  and  $Z = 1200$                       (4)  $x_1 = 50, x_2 = 40$  and  $Z = 1150$

69. Consider the following LPP :

$$\text{Min } Z = 2x_1 + x_2 + 3x_3$$

Subject to :

$$x_1 - 2x_2 + x_3 \geq 4$$

$$2x_1 + x_2 + x_3 \leq 8$$

$$x_1 - x_3 \geq 0$$

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

The solution of this LPP using Dual Simplex Method is :

- (1)  $x_1 = 0, x_2 = 0, x_3 = 3$  and  $Z = 9$                       (2)  $x_1 = 0, x_2 = 6, x_3 = 0$  and  $Z = 6$   
 (3)  $x_1 = 4, x_2 = 0, x_3 = 0$  and  $Z = 8$                       (4)  $x_1 = 2, x_2 = 0, x_3 = 2$  and  $Z = 10$

70. Consider a Takagi - Sugeno - Kang (TSK) Model consisting of rules of the form :

If  $x_1$  is  $A_{i1}$  and ... and  $x_r$  is  $A_{ir}$

THEN  $y = f_i(x_1, x_2, \dots, x_r) = b_{i0} + b_{i1}x_1 + \dots + b_{ir}x_r$

assume,  $\alpha_i$  is the matching degree of rule  $i$ , then the total output of the model is given by :

$$(1) \quad y = \sum_{i=1}^L \alpha_i f_i(x_1, x_2, \dots, x_r)$$

$$(2) \quad y = \frac{\sum_{i=1}^L \alpha_i f_i(x_1, x_2, \dots, x_r)}{\sum_{i=1}^L \alpha_i}$$

$$(3) \quad y = \frac{\sum_{i=1}^L f_i(x_1, x_2, \dots, x_r)}{\sum_{i=1}^L \alpha_i}$$

$$(4) \quad y = \max_i [\alpha_i f_i(x_1, x_2, \dots, x_r)]$$

71. Consider a single perceptron with sign activation function. The perceptron is represented by weight vector  $[0.4 \ -0.3 \ 0.1]^t$  and a bias  $\theta=0$ . If the input vector to the perceptron is  $X=[0.2 \ 0.6 \ 0.5]$  then the output of the perceptron is :

- (1) 1                                      (2) 0                                      (3) -0.05                                      (4) -1

72. The Sigmoid activation function  $f(t)$  is defined as :

(1)  $\frac{1}{\exp(t) + \exp(-t)}$                                       (2)  $t \exp(-t)$

(3)  $\frac{1}{1 + \exp(t)}$                                       (4)  $\frac{1}{1 + \exp(-t)}$



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