

09
Optional Paper
Computer Engg.
Paper - I

Time : 3 Hours

Maximum Marks : 200

IMPORTANT NOTES / महत्वपूर्ण निर्देश

- (A) Please fill up the OMR Sheet of this Question Answer Booklet properly before answering. Please also see the directions printed on the obverse before filling it.
प्रश्नोत्तर पुस्तिका में प्रश्न हल करने से पूर्व उसके संलग्न ओ.एम.आर. पत्रक को भली प्रकार भर लें। उसे भरने हेतु उसके पृष्ठ भाग पर मुद्रित निर्देशों का अध्ययन कर लें।
- (B) The question paper has been divided into three Parts - A, B and C. The number of questions to be attempted and their marks are indicated in each part.
प्रश्न-पत्र अ, ब और स तीन भागों में विभाजित है। प्रत्येक भाग में से किये जाने वाले प्रश्नों की संख्या और उनके अंक उस भाग में अंकित किये गये हैं।
- (C) Attempt answers in **English**.
उत्तर अंग्रेजी भाषा में दीजिये।
- (D) Answers to all the questions of each part should be written continuously in the script and should not be mixed with those of other parts. In the event of candidate writing answers to a question in a part different to the one to which the question belongs, the question will not be assessed by the examiner.
उत्तर पुस्तिका में प्रत्येक भाग के समस्त प्रश्नों के उत्तर क्रमवार देने चाहिये तथा एक भाग में दूसरे भाग के उत्तर नहीं मिलाने चाहिये। एक भाग में दूसरे भाग के प्रश्न के उत्तर लिखे जाने पर ऐसे प्रश्न को जाँचा नहीं जा सकता है।
- (E) The candidates should not write the answers beyond the limit of words prescribed in parts A, B and C failing this the marks can be deducted.
अभ्यर्थियों को भाग अ, ब और स में अपने उत्तर निर्धारित शब्दों की सीमा से अधिक नहीं लिखने चाहिये। इसका उल्लंघन करने पर अंक काटे जा सकते हैं।
- (F) **In case the candidate makes any identification mark i.e. Roll No./Name/Telephone No./Mobile No. or any other marking either outside or inside the answer book, it would be treated as resorting to using unfair means. In such a case his candidature shall be rejected for the entire examination by the Commission.**
अभ्यर्थी द्वारा उत्तर पुस्तिका के अंदर अथवा बाहर पहचान चिन्ह यथा - रोल नम्बर / नाम / मोबाईल नम्बर / टेलीफोन नम्बर लिखे जाने या अन्य कोई निशान इत्यादि अंकित किये जाने को अनुचित साधन मान जायेगा। आयोग द्वारा ऐसा पाये जाने पर अभ्यर्थी की सम्पूर्ण परीक्षा में अभ्यर्थिता रद्द कर दी जायेगी।



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Note : Attempt all the **twenty** questions. Each question carries **2** marks. Answer should not exceed **15** words.

1 What is the binary number corresponding to the BCD code 100101100100.001101110101?

2 Simplify $x + x'y$ using Boolean Algebraic Laws.

3 Minimize the function $F(A, B, C, D) = B'D + B'C + ABCD$ with the don't care condition $d = A'BD + AB'C'D'$ using K-map.



4 Find the characteristic equations of an RS flip-flop.

5 What does the following in C mean?

```
#ifndef max_marks  
#define max_marks 100  
#endif
```

6 What is the difference between structures and classes?



7 What are the C++ operators which cannot be overloaded?

8 What is the output of the following JAVA programme?

```
Public class Print Pascals Triangle
{public static void main (String [ ] args)
    {for (int i=0, i < 5; i++)
        {for (int j=0; j< =2; j++)
            system out print (C(i,j) + "\t");
            system out println ();
        }
    }
static long c (int n, int k)
{If (k < = 0 || k > = n) return 1;
    return C (n-1, k) + C (n-1, k-1);
}
}
```



- 9 Which data structure should best be chosen for the situation where only INSERT and MAX operations are to be carried out?

- 10 Let a and b denote positive integers. Suppose a function θ is defined recursively as follows:

$$\theta(a, b) = \begin{cases} 0 & \text{if } a < b \\ \theta((a-b), b) + 1 & \text{if } b \leq a \end{cases}$$

What does this function do? Find $\theta(8869, 17)$

- 11 The pre-order and in-order traversals of a binary tree are ABDGHKCEF and GDHKBAECF respectively. Find the post-order traversal of this tree.



12 Complexity wise, which sorting algorithm is best and why?

13 Find out the number of 512×8 memory chips required to provide a memory capacity of $64k \times 16$.

14 For the instruction POP R4, list the series of micro-operations including their op-code fetch cycles.



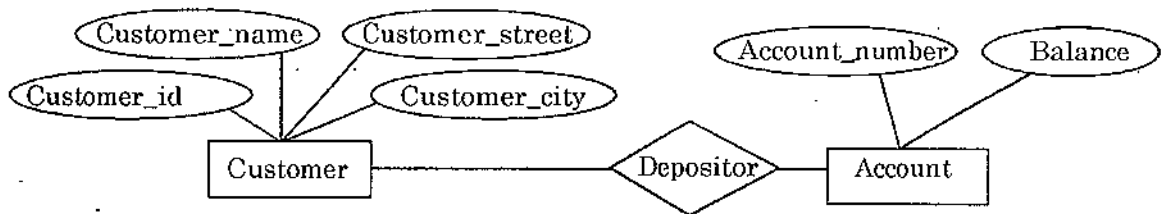
- 15 Given an adder an operand A and compliment of the other operand B, explain the meaning of "subtract with Borrow".

- 16 An 8-bit register A has one input x. The register operation is described symbolically as follows:

$$P : A_8 \leftarrow x, A_i \leftarrow A_{i+1} \forall i = 1, 2, \dots, 7$$

What is the function of this register A, if the cells are numbered from right to left?

- 17 In the sample E-R diagram given below, what do rectangles, ellipses and diamonds portray?





18 Out of the fundamental Relational-Algebra operations, what are the unary operations?

19 In B^+ trees, what is the significance of the logarithm to the base N of the number of records in the relation, where each nonleaf node stores N pointers?

20 List the five built-in Aggregate functions offered by SQL.



Note ÷ Attempt all the **twelve** questions. Each question carries **5** marks. Answer should not exceed **50** words.

- 21 Simplify in Sum of Products form the Boolean function $F(a,b,c,d) = \pi(1,4,7,10,11,12;13,14,15)$ with the don't care conditions being $\Sigma(10,11,12,13,14,15)$. Thereafter, implement this function F in NOR-OR form.

- 22 Consider a full subtractor with three inputs x, y and z denoting the minuend, subtrahend and previous borrow, respectively. The two outputs D and B represent the difference and output borrow, respectively. Realize this full subtractor using a dual 4-line to 1-line multiplexer with x and z connected to selection lines S_0 and S_1 respectively.



23 Consider a JK' flip-flop i.e. a JK flip-flop with an inverter between external input k'' and internal input K. Obtain the flip-flop characteristic table, characteristic equation and excitation table.

24 - What is the difference between C-string and C++ string? Explain.



25 In JAVA, what is the difference between a string Buffer object and a vector object of char values?

26 Suppose A is a sorted array with 200 elements, and suppose a given element X appears with the same probability in any place in A. Find the worst-case running time $f(n)$ and the average-case running time $g(n)$ to find x in A using the binary search algorithm.



- 27 Discuss the advantages, if any, of a two way list over a one-way list for each of the following operations :
- (a) Traversing the list to process each node (b) Deleting a node whose location LOC is given (c) Searching an unsorted list for a given element ITEM (d) Searching a sorted list for a given element ITEM (e) Inserting a node before the node with a given location LOC. (f) Inserting a node after the node with a given location LOC.

- 28 Suppose a table T has 11 memory locations, T[1], T[2],...,T[11], and suppose the file F consists of 8 records A, B, C, D, E, X, Y and Z with the following hash addresses :
- | | | | | | | | | |
|----------|---|---|---|----|---|----|---|---|
| Record : | A | B | C | D | E | X | Y | Z |
| H(k) : | 4 | 8 | 2 | 11 | 4 | 11 | 5 | 1 |
- Suppose the 8 records are entered into the table T in the above order. Find the average number S of probes for a successful search and the average number U of probes for an unsuccessful search. Use linear probing for collision resolution.



29 The Database Transactions are required to have the ACID properties : Atomicity, Consistency, isolation and Durability. Explain each one of them in brief.

30 For the infix expression $\phi : ((A+B)*D) \uparrow (E-F)$, show its conversion to an equivalent postfix expression P in the following form :

Symbol	Stack	Expression P
:	;	1
	-	1



- 31 For a 3-level memory Hierarchy, let H_i be the Hit ratio of the i th level and t_i be the time of memory access at level i . For $H_1 = 0.85$, $H_2=0.92$, $t_1=0.2 \mu s$, $t_2 = 0.5 \mu s$ and $t_3 = 0.9 \mu s$ find out the average memory access time for this memory hierarchy.

- 32 The register transfer statements for registers A and R and the memory in a computer are as follows (the X's are control functions that occur at random) :

$$\bar{X}_3 X_1 : R \leftarrow M(MAR)$$

$$\bar{X}_1 X_2 : R \leftarrow A$$

$$\bar{X}_1 X_3 : M[MAR] \leftarrow R$$

Draw the hardware implementation of R, A and the memory in block diagram form. Show how the control functions X_1 through X_3 select the load control input R, the select inputs of multiplexer(s) that you may include in the diagram, and the read and write inputs of the memory.



Note : Attempt any 5 questions. Each question carries 20 marks. Answer should not exceed 200 words.

- 33 Design a synchronous counter with the following binary sequence : 0, 4, 2, 1, 6 and repeat. Use JK flip flops. Assume that this is a self starting counter in the sense that, if the circuit ever goes to an invalid state, the next count pulse transfers it to one of the valid states, say 0.



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35 In JAVA, implement a Url class for representing Internet Uniform Resource Locator addresses.



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- 36 Discuss the Binary Search and Insertion (BSI) algorithm for merging. Analyze the best case and worst case complexities for BSI and compare it with the conventional technique of merging.

A series of horizontal lines provided for writing the answer to question 36.





- 38 Design a combinational circuit that generates the 1's complement of a BCD digit. Use this combinational circuit along with other MSI function blocks to design a decimal arithmetic unit with two selection variables V_1 and V_0 and two BCD digits, A and B. The unit should have four arithmetic operations which depend on the values of the selection variables as shown below :

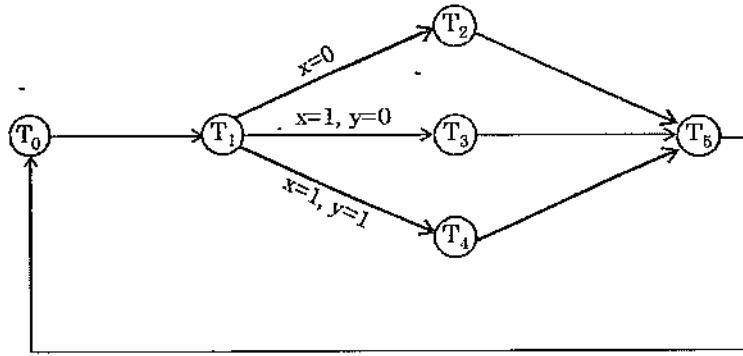
V_1	V_0	Output function
0	0	A+9's complement of B
0	1	A+B
1	0	A+10's Complement of B
1	1	A+B+1



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- 39 A control state diagram is given below. Design the Hardwired control using minimum number of T-flip flops.









SPACE FOR ROUGH WORK / रफ कार्य के लिए जगह



SEAL

