PART - A

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

1. Compute value of $X$ in $2765_8 + F6A_{16} = X_8$.

2. When does an object become eligible for garbage collection?

4 When is a database relation in 3NF?

5 Write boolean expression to compute odd parity bit of a 4-bit data \( a_3 a_2 a_1 a_0 \).
public class java prog
{
    public static void main (String[ ] args)
    {
        int a[ ];
        try
        {
            a = new a[10];
            return;
            a[10] = 10;
            System.out.println("10th No = a[10]);
        }
        catch (Exception e)
        {
            System.out.println("Exception has occurred");
        }
        finally
        {
            System.out.println("Finally arrived");
        }
    }
}
7 Write a C program that initializes a dynamic memory array of size taken from input.

8 Define minterm and maxterm in context of minimization of boolean expression.

9 If minimum of a partition is selected as pivot element at each step, derive number of iterations needed for quicksort.
10 Differentiate horizontal microinstruction with vertical microinstruction.

11 What is Von-Neuman model?

12 Consider the statement: "OR gate in negative logic is equivalent to AND gate in positive logic." Prove or disprove this statement.
What is the output of the following C program?

```c
#include <stdio.h>

main( )
{
    int a, b = 0;
    static int c[10] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 0};
    for (a = 0; a < 10; ++a)
        if ((c[a] % 2) == 0) b += c[a];
    printf("%d", b);
}
```

How can a stack be implemented by queue(s)?
15. How can NaN and Infinity be represented in IEEE floating point standard?

16. Microprogrammed processor translates the instruction ADD \( r_1, r_2, r_3 \) into six micro operations. Write two of them.

17. Write SQL command that find second maximum value of field1 in table table1.
18 Write pseudocode for recursive preorder in a ternary tree (a node can have up to three children - left, middle and right).

19 Suppose a relation R = (A, B, C, D, E) with following functional dependencies 
\{CE \rightarrow D; D \rightarrow B; C \rightarrow A\} 
Find all candidate keys and identify best normal form.

20 What does ACID stands for?
PART – B

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

21 Draw K-map of the following function $f(A, B, C, D) = \Sigma m \{0, 1, 2, 3, 5, 7, 8, 9, 11, 14\}$. 
22. Consider two sorted arrays A and B of size m and n respectively. A is sorted in ascending order and B sorted in descending order. If A and B represent two sets, explain method for storing intersection of two sets into an array C.

23. Design a 2-bit comparator that outputs 1 when 2-bit input A is greater than or equal to 2-bit input B.
24 Consider a 2D array as char A[5][6] stored in contiguous memory locations starting from location 1000\(^n\) in column major order. What would the address of a[i][d]?

25 Design a circuit to compute 2's complement of a binary number.
26 Write pseudocode for deleting a value from Binary search tree. Illustrate working of your method with help of an example.

27 Suggest an appropriate data structure and algorithm that can determine whether set $S$ is a subset of $T$ in $O(n+r)$ time where $S = \{x_1, x_2, \ldots, x_n\}$ and $T = \{y_1, y_2, \ldots, y_r\}$

for $x$, $1 \leq x_i \leq m$, $1 \leq i \leq n$ and $1 \leq y_i \leq m$, $1 \leq i \leq r$ for $T$

All $x_i$'s and $y_i$'s are integers.
28 An adjacency matrix of a matrix of a directed graph is given below. Write its adjacency list.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

29 If it takes 5 ns to read an instruction from memory, 2 ns to decode the instruction, 3 ns to read the register file, 4 ns to perform the computation required by the instruction and 2 ns to write the result into the register file. What is the maximum clock rate of the processor?
Differentiate between direct and indirect addressing with example for each?

Database table by name Loan_Records is given below:

<table>
<thead>
<tr>
<th>Borrower</th>
<th>Bank_Manager</th>
<th>Loan_Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramesh</td>
<td>Sunderajan</td>
<td>10000.00</td>
</tr>
<tr>
<td>Suresh</td>
<td>Rangopal</td>
<td>5000.00</td>
</tr>
<tr>
<td>Mahesh</td>
<td>Sunderajan</td>
<td>7000.00</td>
</tr>
</tbody>
</table>

What is the output of the following SQL query?

```sql
SELECT count(*)
FROM (SELECT Borrower, Bank_Manager FROM Loan_Records) AS S
NATURAL JOIN (SELECT Bank_Manager, Loan_Amount FROM Loan_Records) AS T;
```
32 Write the SQL queries for the following schema.
Suppliers (Sid, SName, Address)
Parts(Pid, PName, Color)
Catalog(Sid, Pid, Cost)
(a) Find names of parts supplied by “ABC”
(b) Find name of parts for which there is some supplier.
Note: Attempt any 5 questions. Each question carries 20 marks. Answer should not exceed 200 words.

33 What are different addressing techniques?
34 Explain transitive dependency and multivalued dependency with help of examples. For each of the following sets of functional dependencies in relation set \{ABCDE\}, what is the key.

(i) \(A \rightarrow B, BC \rightarrow E\) and \(DE \rightarrow A\)

(ii) \(C \rightarrow D, C \rightarrow E, AD \rightarrow E\)
Write DFS algorithm for graph traversal and obtain DFS tree for the graph containing the following edges: (A, E), (A, D), (A, F), (D, F), (D, E), (D, B), (D, C), (C, E), (C, B), (F, B)
Design a counter that produces a sequence 0, 3, 5, 6, 2 using T flip flop only.
A perfect number is a positive integer that is equal to the sum of its proper divisors. A proper divisor is a positive integer other than the number itself that divides the number evenly. For example, proper divisors for 6 are 1, 2, and 3, their sum is \(1 + 2 + 3 = 6\). Hence 6 is a perfect number, but \(1 + 2 + 4 \neq 8\) hence, 8 is not a perfect number.

Write a program in Java that displays proper divisors of a number accepted from keyboard and decides whether it is perfect or not.
What is a sparse matrix? How is it stored in the memory of a computer? Write a function to find the transpose of a sparse matrix using this representation.
Describe different types of two phase locking systems. Can it avoid deadlock? Explain through example.