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**ARKAJAIN**  
**University**  
Jharkhand

**3<sup>rd</sup> Semester Examination -2021-22**

Subject : Design & Analysis Of Algorithm  
Course : BCA  
Full Marks : 70

Roll No: .....

Time : 3 Hours.

**Instructions to the Candidates:**

- Read the question paper very carefully.
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**PART A**

**MULTIPLE CHOICE QUESTIONS**

(12x1=12)

1. The number of elements in the adjacency matrix of a graph having 7 vertices is \_\_\_\_\_  
a) 7                      b) 14                      c) 3                      d) 49
2. Adjacency matrix of all graphs is symmetric.  
a) False                      b) True
3. The time complexity to calculate the number of edges in a graph whose information is stored in form of an adjacency matrix is \_\_\_\_\_  
a)  $O(V)$                       b)  $O(E^2)$                       c)  $O(E)$                       d)  $O(V^2)$
4. Breadth First Search is equivalent to which of the traversal in the Binary Trees?  
a) Pre-order Traversal                      b) Post-order Traversal  
c) Level-order Traversal                      d) In-order Traversal
5. Time Complexity of Breadth First Search is? ( $V$  – number of vertices,  $E$  – number of edges)  
a)  $O(V + E)$                       b)  $O(V)$                       c)  $O(E)$                       d)  $O(V * E)$
6. Regarding implementation of Breadth First Search using queues, what is the maximum distance between two nodes present in the queue? (considering each edge length 1)  
a) Can be anything                      b) 0  
c) At most 1                      d) Insufficient Information
7. The Data structure used in standard implementation of Breadth First Search is?  
a) Stack                      b) Queue                      c) Linked List                      d) Tree
8. The Breadth First Search traversal of a graph will result into?  
a) Linked List                      b) Tree                      c) Graph with back edges                      d) Arrays

9. Which of the following is not an application of Breadth First Search?
- a) Finding shortest path between two nodes      b) Finding bipartiteness of a graph  
 c) GPS navigation system                              d) Path Finding
10. If an optimal solution can be created for a problem by constructing optimal solutions for its sub problems, the problem possesses \_\_\_\_\_ property.
- a) Overlapping sub problems                              b) Optimal substructure  
 c) Memorization    d) Greedy
11. Backtracking algorithm is faster than the brute force technique
- a) true    b) false
12. Which of the following can be referred to as applications of Randomized algorithm?
- a) Quick sort    b) Min Cut  
 c) Verifying Matrix Multiplication                      d) All of the mentioned

**PART B**

**ANSWER ANY FOUR OUT OF SIX**

**(4x7=28)**

1. Explain 3 notation of time complexity with graph.
2. What are the characteristics of algorithm? Explain knapsack problem.
3. Explain quick sort with example.
4. Explain how to find maximum and minimum with example.
5. Explain minimum cost spanning trees with example.
6. Short notes on:
  - a. Breadth first search.
  - b. Depth first search.

**PART C**

**ANSWER ANY TWO OUT OF FOUR**

**(2x15=30)**

1. Solve the function and find out theta, omega and big-oh

$$F(n) = 2n+5$$

2. Write short notes on: -

- a. Pseudo-code.
- b. Algorithm.
- c. Adjacency matrix.
- d. Adjacency list.

3. Sort using quick sort, use 45 as pivot.

45	26	77	4	68	61	97	39	99	100
----	----	----	---	----	----	----	----	----	-----

4. Solve using Strassen's matrix multiplication.

$$A = \begin{bmatrix} 1 & 3 \\ 7 & 5 \end{bmatrix} \quad B = \begin{bmatrix} 6 & 7 \\ 3 & 8 \end{bmatrix}$$



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**PART A**

**MULTIPLE CHOICE QUESTIONS**

(12x1=12)

1. \_\_\_\_\_ are the basic building blocks of a database.  
a. Tables                      b. Record                      c. Fields                      d. All of the above
2. By default the name of the table is \_\_\_\_\_.  
a. Tab 1                      b. Table 1                      c. First Table                      d. Untitled 1
3. In an ER model, ..... is described in the database by storing its data.  
a. Entity                      b. Attribute                      c. Relationship                      d. Notation
4. All the values in \_\_\_\_\_ are of same type.  
a. Records                      b. Table                      c. Database                      d. Fields
5. \_\_\_\_\_ represent a single data item in a table.  
a. Tuples                      b. Attributes                      c. Relation                      d. All of the above
6. \_\_\_\_\_ are used to identify which type of data we are going to store in the database.  
a. Datatype                      b. Record                      c. Table                      d. Attributes
7. Char is a \_\_\_\_\_ length data type and varchar is a \_\_\_\_\_ length data type.  
a. Fixed, Variable                      b. Variable, Fixed  
c. Variable, Variable                      d. Fixed, Fixed

8. .... clause is an additional filter that is applied to the result.

- a. Select                      b. Group-by                      c. Having                      d. Order by

9. A logical schema

- a. is the entire database  
b. is a standard way of organizing information into accessible parts.  
c. Describes how data is actually stored on disk.                      d. All of the above

10. .... is a full form of PL/SQL.

- a. Procedural language in extension to SQL                      b. Sequential query language  
c. Procedural Language in SQL                      d. Programming Language in extension to SQL.

11. A relational database developer refers to a record as

- a. a criteria                      b. a relation                      c. a tuple                      d. an attribute

12. Which field is suitable for storing records of employees?

- a. EmpNo                      b. Empname                      c. Salary                      d. All of the above

### PART B

ANSWER ANY FOUR OUT OF SIX

(4x7=28)

1. Explain the advantages of Data based management approach over File based approach
2. Explain Relational Algebra.
3. Define Attributes. Explain different types of Attributes with examples of each.
4. PL/SQL program to display average of three numbers.
5. Differentiate between Strong and Weak Entity set. Explain with examples
6. Describe various Integrity rules of RDBMS.

### PART C

ANSWER ANY TWO OUT OF FOUR

(2x15=30)

1. What are the ACID properties of a transaction?
2. Explain BCNF and 3NF with examples
3. How can we equivalent two functional dependencies. Explain with examples..
4. Find Candidate key and Super key

R(ABCDEFGH)

AB->C

A->DE

B->F

F->GH

The relation R belongs to which normal form. Explain



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**PART A**

**MULTIPLE CHOICE QUESTIONS**

(12x1=12)

1. The process-to-process delivery of entire message is the responsibility of the \_\_\_\_\_ layer.  
a. Network                      b. Transport                      c. Application                      d. Physical
2. The \_\_\_\_\_ layer is the layer closest to the transmission medium.  
a. Physical                      b. Data link                      c. Network                      d. Transport
3. As the data packet moves from upper to lower layer, headers are \_\_\_\_\_.  
a. Added                      b. Removed                      c. Rearranged                      d. Modified
4. Layer 2 lies between the Physical and \_\_\_\_\_ layer.  
a. Network                      b. Data link                      c. Transport                      d. None of the above
5. The \_\_\_\_\_ layer changes the bits into electromagnetic Signals.  
a. Physical                      b. Data link                      c. Transport                      d. None of the above
6. Which of the following is an application layer service?  
a. Remote log-in                      b. File transfer and access                      c. Mail service                      d. All the above
7. Why was the OSI model developed?  
a. Manufacturers disliked the TCP/IP protocol suite  
b. The rate of data transfer was increasing exponentially  
c. Standards were needed to allow any two systems to communicate  
d. None of the above

8. The physical layer is concerned with the movement of \_\_\_\_\_ over the physical medium.  
 a. Programs                      b. Dialogs                      c. Protocols                      d. Bits
9. In the OSI model, encryption and decryptions are the function of \_\_\_\_\_ layer.  
 a. Transport                      b. Session                      c. Presentation                      d. Application
10. To deliver a message to the correct application program running on a host, address must be consulted.  
 a. Port                      b. Ip                      c. Physical                      d. None of the above.
11. IPv6 has \_\_\_\_\_ -bit  
 a. 32                      b. 64                      c. 128                      d. variable
12. \_\_\_\_\_ provides full transport layer services to applications.  
 a. TCP                      b. UDP                      c. ARP                      d. None of the above

### PART B

#### ANSWER ANY FOUR OUT OF SIX

(4x7=28)

1. Explain ICMP with its packet format description, diagram and its functions.
2. What are the basic components of data communication? Explain in brief.
3. What is IPv4? Explain with proper format and diagram.
4. What is HTTP? Explain its Features?
5. Differentiate between OSI and TCP/IP model.
6. What is FTP? Explain its mechanism? Write down its advantages and disadvantages.

### PART C

#### ANSWER ANY TWO OUT OF FOUR

(2x15=30)

1. What is OSI model? Explain in details with neat diagram.
2. Describe the various method of
  - (i) digital to digital conversion
  - (ii) analog to digital conversion
  - (iii) digital to analog conversion
  - (iv) analog to analog conversion
 with suitable examples.
3. What is IP address? What are the various types of IPs? Explain with proper format and diagram. Why there is a need of transition from IPv4 to IPv6?
4. Discuss Stop and wait protocol in details with neat diagram.



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**PART A**

**MULTIPLE CHOICE QUESTIONS**

**(12x1=12)**

1. Which colour is used to indicate instance methods in the standard "javadoc" format documentation:  
a. blue    b. red    c. purple    d. orange
2. Which methods can be legally applied to a string object?  
a. equals(String)    b. equals(Object)  
c. trim() & toString()    d. All of the above
3. What does the zeroth element of the string array passed to the public static void main method contain?  
a. The name of the program    b. The number of arguments  
c. The first argument if one is present    d. None of these
4. What will be the result of compiling the following code:  
public class Test  
{  
public static void main (String args [])  
{  
int age;  
age = age + 1;  
System.out.println("The age is " + age);  
}  
}  
a. Compiles and runs with no output    b. Compiles and runs printing out The age is 1  
c. Compiles but generates a runtime error    d. Does not compile
5. Which of the following is illegal:  
a. int i = 32;    b. float f = 45.0;    c. double d = 45.0;    d. float f = 15.0ff;

6. Which of the following is correct: temp = {"a", "b", "c"}; temp [] = {"a", "b", "c"};
- String temp [] = new String {"j" "a" "z"};
  - String temp [] = {"j" " " b" "c"};
  - String
  - None
7. Given the following code:
- ```
public class Test {
}
```
- Which of the following can be used to define a constructor for this class?
- public void Test() {...}
  - public Test() {...}
  - public static Test() {...}
  - public static void Test() {...}
8. Which of the following are Java keywords?
- Continue
  - malloc
  - extends
  - FALSE
9. Which variables cannot be an inner class access from the class which encapsulates it?
- All static variables
  - All final variables
  - Only final instance variables
  - All instance variables
10. Which of the following statements assigns "Hello Java" to the String variables?
- Char s = "Hello Java";
  - String s[] = "Hello Java";
  - String s = new String("Hello Java");
  - new String s = "Hello Java";
11. Which of the following statements is correct for a method which is overriding the following method:  
Public void add (int a) {...}
- The overriding method must return void
  - The overriding method must return int
  - The overriding method can return whatever it likes
  - None of these
12. Given the following sequence of Java statements
- StringBuffer sb = new StringBuffer("abc");
  - String s = new String("abc");
  - sb.append("def");
  - s.append("def");
  - sb.insert(1, "zzz");
  - s.concat(sb);
  - s.trim();
- Which of the following statements are true:
- The compiler would generate an error for line 1
  - The compiler would generate an error for line 2
  - The compiler would generate an error for line 4
  - The compiler would generate an error for line 6

### PART B

#### ANSWER ANY FOUR OUT OF SIX

(4x7=28)

- (a) What is the return type of program's main() method? What is the argument type of program's main() method?
  - (b) What are various data types in java? Explain them in detail?



2. (a) Differentiate between the final variable & static variable?  
 (b) Explain the different control statements in java?
3. Write a program in Java to calculate the monthly electricity bill of a consumer according to the units consumed. The tariff is given below:

| Units Consumed      | Charge          |
|---------------------|-----------------|
| Upto 100 units      | □ 1.25 per unit |
| For next 100 units  | □ 1.50 per unit |
| More than 200 units | □ 1.80 per unit |

Unit consumed = Present reading - Previous reading

Use a function named cal(int u) and print the information in the main function as per the given format:

| Consumer No. | Name | Units Consumed | Amount |
|--------------|------|----------------|--------|
| xxx          | xxx  | xxx            | xxx    |

4. Differentiate between while and do... while using suitable example.
5. Write a program to input 10 numbers and arrange them in ascending order using bubble sort technique.
6. (a) What is Exception Handling?  
 (b) Explain creating a thread, extending the thread class and an example of using the thread class?

### PART C

#### ANSWER ANY TWO OUT OF FOUR

(2x15=30)

1. Design a class Perfect to check if a given number is a perfect number or not. A number is said to be perfect if the sum of the factors of the number excluding itself is equal to the original number.

Example:

$6 = 1 + 2 + 3 = 6$ , where 1, 2, and 3 are factors of 6, excluding itself.

Some of the members of the class are given below:

**Class name:** Perfect

**Data members/instance variables:**

num: to store the number

**Methods/Member functions:**

Perfect (int n): parameterized constructor to initialize the data member num = n.

int sumOfFactors(int i): returns the sum of the factors of the number (num), excluding itself, using recursive technique.

void check(): checks whether the given number is perfect by invoking the function sumOfFactors(int) and displays the result with an appropriate message.

Specify the class Perfect, giving details of the constructor, int sumOfFactors(int) and void check(). Define the main() function to create an object and call the functions accordingly to enable the task.

2. A class Capital has been defined to check whether a sentence has words beginning with a capital letter or not.

Some of the members of the class are given below:

**Class name: Capital**

**Data members/instance variables:**

sent: to store a sentence.

freq: stores the frequency of words beginning with a capital letter.

**Member functions/methods:**

Capital (): default constructor.

void input(): to accept the sentence.

Boolean isCap(String w): checks and returns true if word begins with a capital letter, otherwise returns false.

void display(): displays the sentence along with the frequency of the words beginning with a capital letter.

Specify the class Capital, giving the details of the constructor, void input(), boolean isCap(String) and void display(). Define the main() function to create an object and call the function accordingly to enable the task.

3. A 'Happy Word' is defined as:

Take a word and calculate the word's value based on position of the letters in English alphabet. On the basis of word's value, find the sum of the squares of its digits. Repeat the process with the resultant number until the number equals 1 (one). If the number ends with 1 then the word is called a 'Happy Word'.

Write a program to input a word and check whether it is a 'Happy Word' or not. The program displays a message accordingly.

**Sample Input:** VAT

Place value of V = 22, A = 1, T = 20

[Hint: A = 1, B = 2, -----, Z = 26]

**Solution:**

$$22120 \Rightarrow 2^2 + 2^2 + 1^2 + 2^2 + 0^2 = 13$$

$$\Rightarrow 1^2 + 3^2 = 10$$

$$\Rightarrow 1^2 + 0^2 = 1$$

**Sample Output:** A Happy Word

4. Write a program to input a sentence and convert it into uppercase and count and display the total number of words starting with the letter 'A'.

**Example:**

**Sample Input:** ADVANCEMENT AND APPLICATION OF INFORMATION TECHNOLOGY ARE EVER CHANGING.

**Sample Output:** Total number of words starting with letter 'A' = 4.