

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086**  
**(For candidates admitted from the academic year 2015-16 & thereafter)**

**SUBJECT CODE : 15MT/PC/RT24**

**M. Sc. DEGREE EXAMINATION, APRIL 2019**  
**BRANCH I – MATHEMATICS**  
**SECOND SEMESTER**

**COURSE : CORE**

**PAPER : RESEARCH METHODS AND TOOLS**

**TIME : 3 HOURS**

**MAX. MARKS : 100**

**THEORY**

**Answer any two questions:**

**(2 × 10 = 20)**

1. What is research methodology? Explain the research problem and how is it formulated?
2. Discuss briefly about Analyzing and Processing of data collection?
3. Explain about report writing.

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## PRACTICAL

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Answer any four without omitting any section

(4 × 20 = 80)

### SECTION – A

1. Create .tex file for the following document.

#### Application of Graph Theory in Social Media

**Abstract**— A graph is made up of nodes; just like that a social media is a kind of a social network, where each person or organization represents a node. These nodes in a social media are interdependent on each other via common interests, relations, mutual friends, knowledge, common dislikes, beliefs etc. The overall graphical structure of a social media can be very complex with millions of nodes and thousands of interconnections amongst them based upon various grounds. Many researchers have revealed that social network works on various levels and helps in understanding many things such as how an entire organization is run.

#### I. INTRODUCTION

A graph represents a network which consists of a set of objects, mathematically called vertices or nodes. Graph can be of two types based upon the type of edges:

1. **Directed Edges:** Here the arcs between two vertices have a particular direction;
2. **Undirected Edges:** Here the edges do not have any particular direction from one vertex to another;
3. A graph can again be classified based upon the presence or absence of cycles formed in the graph:
  - i. **Cyclic Graph:** If a cycle is formed in a graph then it is called a cyclic graph.
  - ii. **Acyclic Graph:** If the graph forms no cycle then it is called an acyclic graph.

#### II. GRAPH THEORY AND SOCIAL MEDIA:

The concept of graph theory is extensively used in social media.

- **Graph Theory in Facebook:** Majority are familiar with Facebook these days.
- **Graph Theory in Twitter:** Here the persons are considered as nodes and if one person follows another then that is considered as the edge between the two

2. Create .tex file for the following document.

#### Representation of graphs

A graph can be represented mainly as two ways:

**Adjacency Matrices:** Here the graph is represented as an  $n \times n$  square matrix;  $M$ .  $n$  represents the number of vertices present in the graph.

If  $M_{ij} = 1$ , it means there is an edge connecting vertex  $i$  and vertex  $j$  and if  $M_{ij} = 0$ , it means there is no edge connecting vertex  $i$  and vertex  $j$ . Let us consider the following  $6 \times 6$  matrix:

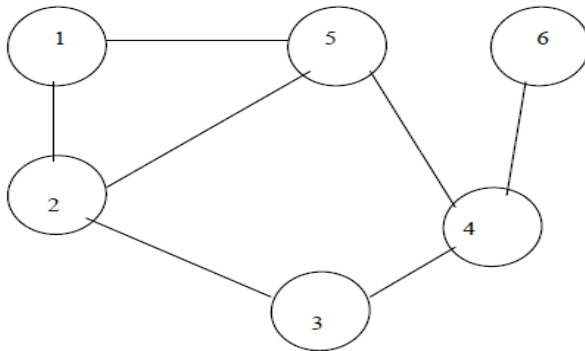


Figure 1 : Adjacency Matrix

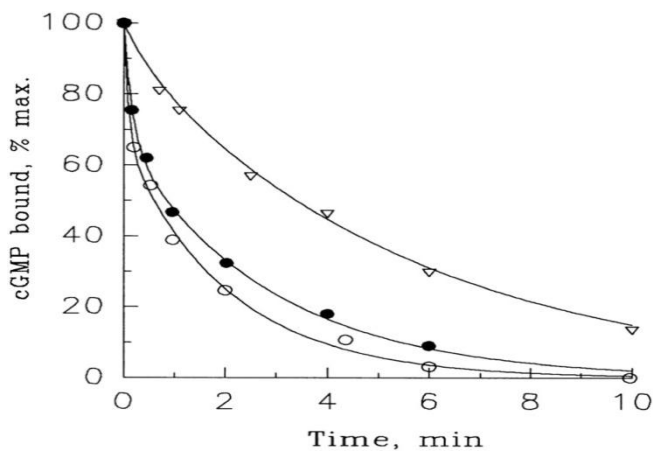
	1	2	3	4	5	6
1	0	1	0	0	1	0
2	1	0	1	0	1	0
3	0	1	0	1	0	0
4	0	0	1	0	1	1
5	1	1	0	1	0	0
6	0	0	0	1	0	0

Table 1 : Adjacency Matrix and its correspondency graph

Although the computation process in adjacency matrix is quite simple but it contains lots of zeroes and wastes a lots of space. In adjacency list representation of graphs, this disadvantage has been eliminated.

### SECTION – B

3. Draw the following using layers in flash



4. Create a flash movie using interaction for a multiple piece of paper dropping through the air.

## SECTION – C

5. Using MATHCAD solve the following:

a. Find  $AB$  and  $BA$  if  $A = \begin{pmatrix} -1 & 2 & 0 \\ 2 & -1 & 1 \\ -2 & 2 & 1 \end{pmatrix}$  and  $B = \begin{pmatrix} 2 & -1 & 0 \\ 1 & 5 & -1 \\ 0 & -1 & 3 \end{pmatrix}$

b. Find the sum of integers between 100 and 200 which are divisible by 7.

c. Differentiate  $g(x) = x^3 e^{2x}$

d. Evaluate  $(\log x)^2 dx$ .

6. Using MATHCAD do the following

a. Draw the curve  $f(x) = \frac{e^x}{1+e^x}$ .

b. Trace the curve  $y = x^3$

