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

SUBJECT CODE :15MT/PC/RT24

M. Sc. DEGREE EXAMINATION, APRIL 2016
BRANCH I – MATHEMATICS
SECOND SEMESTER

COURSE : CORE
PAPER : RESEARCH METHODS AND TOOLS (THEORY)
TIME : 3 HOURS **MAX. MARKS : 100**

Answer any two questions (2 X 10 = 20)

1. Briefly describe the different steps involved in a research process.

2. Enumerate the different methods of collecting data giving one example each.

3. Explain are the characteristics of a good report.

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Answer any four without omitting anysection (4 X 20 = 80)

SECTION – A

1. Create .tex file for the following document.

Isomorphism of graphs

DEFINITION. Two graphs G and H are **isomorphic**, denoted by $G \cong H$, if there exists a bijection $\alpha\colon V_G \to V_H$ such that

$$uv \in E_G \iff \alpha(u)\alpha(v) \in E_H$$

for all $u, v \in G$.

Other representations

Plane figures catch graphs for our eyes, but if a problem on graphs is to be *programmed*, then these figures are, to say the least, unsuitable. Integer matrices are ideal for computers, since every respectable programming language has array structures for these, and computers are good in crunching numbers.

Let $V_G = \{v_1, \ldots, v_n\}$ be ordered. The **adjacency matrix** of G is the $n \times n$-matrix M with entries $M_{ij} = 1$ or $M_{ij} = 0$ according to whether $v_iv_j \in G$ or $v_iv_j \notin G$. For instance, the graph in Example 1.1 has an adjacency matrix on the right. Notice that the adjacency matrix is always symmetric (with respect to its diagonal consisting of zeros).

$$\begin{pmatrix} 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \end{pmatrix}$$

A graph has usually many different adjacency matrices, one for each ordering of its set V_G of vertices. The following result is obvious from the definitions.

..2

Theorem 1.1. *Two graphs G and H are isomorphic if and only if they have a common adjacency matrix. Moreover, two isomorphic graphs have exactly the same set of adjacency matrices.*

Graphs can also be represented by sets. For this, let $\mathcal{X} = \{X_1, X_2, \ldots, X_n\}$ be a family of subsets of a set X, and define the **intersection graph** $G_{\mathcal{X}}$ as the graph with vertices $X_1, \ldots, X_n$, and edges X_iX_j for all i and j $(i \neq j)$ with $X_i \cap X_j \neq \emptyset$.

Theorem 1.2. *Every graph is an intersection graph of some family of subsets.*

Proof. Let G be a graph, and define, for all $v \in G$, a set

$$X_v = \{\{v, u\} \mid vu \in G\}.$$

Then $X_u \cap X_v \neq \emptyset$ if and only if $uv \in G$. □

Let $s(G)$ be the smallest size of a base set X such that G can be represented as an intersection graph of a family of subsets of X, that is,

$$s(G) = \min\{|X| \mid G \cong G_{\mathcal{X}} \text{ for some } \mathcal{X} \subseteq 2^X\}.$$

How small can $s(G)$ be compared to the order ν_G (or the size ε_G) of the graph? It was shown by KOU, STOCKMEYER AND WONG (1976) that it is algorithmically difficult to determine the number $s(G)$ – the problem is NP-complete.

2. Create .tex file for the following document.

Microfinance: Issues and Challenges in India

I. Introduction

The term "Microfinance" could be defined as *"provision of thrift, credit and other financial services and products of very small amounts to the poor in rural, semi urban or urban areas, for enabling them to raise their income levels and improve living standards"* (NABARD 99).

Objective of the study: The present study has been conducted to know the following related to microfinance in India:-

- To study the present scenario of demand and supply gap of microfinance in India.
- To identify the opportunities and challenges faced by Microfinance Institutions in India.

Finance is one of the crucial inputs for economic activity, growth and development. Provision of services to the poor and underprivileged sections of the society has always been in focus of various programmes initiated by the governments since independence[1].

The following tables showing the growth of microfinance institutions around the world:-

Table 1:Growth of Micro-Finance Sector at Global Level

Region	Total Number of MFIs	Active borrower million	Share of all Borrowers (%)	Loan Portfolio (US$)	Share of Total Portfolio (%)	Average loan Balance (US$)
Africa	261	7.3	8	7889	8	1081
East Asia & the Pacific	151	12.8	14	34760	37	2716
Eastern Europe and central Asia	182	2.4	3	6783	7	2826
Latin America and the Caribbean	362	19.2	22	35134	37	1830

Source: www.mixmarket.org

Reference

1 Gupta Das, 2001 "An informal Journey through Selp Help Groups", Indian Journal of Agriculture Economics, vol. 56, No. 3.

2 *India-New Global Poverty estimates" World Bank*

3 *Jay Mandal. "Poverty Reduction."http://www.undp.org.in/whatwedo/poverty_reduction.*

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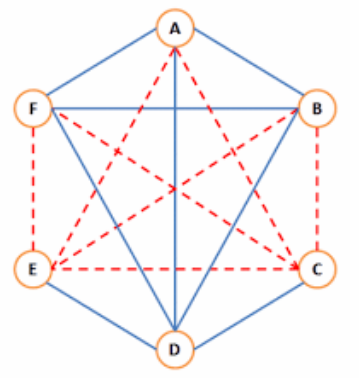
[1]*Dasgupta, "An informal Journey through Selp Help Groups", Indian Journal of Agriculture Economics, vol. 56, No. 3, 2001*

SECTION – B

3. Draw the following figure using layers in Flash.



4. Create a flash movie using tweening and interacting.

SECTION – C

5. Using Mathcad solve the following. (4+4+4+4+4)

a. Find AB and BA if $A = \begin{bmatrix} 2 & 1 \\ 3 & 0 \\ -1 & 4 \end{bmatrix}_{3\times 2}$ and $B = \begin{bmatrix} 2 & 3 & -1 \\ 1 & 0 & 4 \end{bmatrix}_{2\times 3}$

b. Solve the equation $\begin{vmatrix} x & 2 & 3 \\ 2 & x & 3 \\ 2 & 3 & x \end{vmatrix} = 0$

c. Find the sum all integers between 200 & 700 which are divisible by 3 and 11.

d. Evaluate $\int \frac{x - 3}{x^2+2x+1}\, dx$

e. A lake is stocked with 1000 fish. It is found that N(t), the number of fish after t years, increases so that its rate of increase is governed by the equation: $\frac{dN}{dt} = k\, N\, (10{,}000 - N)$ (called the "Logistic Equation"). Show that the rate of change, $\frac{dN}{dt}$, is a maximum when the population is 5,000 fish.

6. Using Mathcad do the following. (6 + 6 +8)

a. Draw the curve y=sin(x)

b. Trace the curve $x^2 + y^2 = 5$

c. plot the surface f(x, y) = sin(x) + cos(y), -5<= x,y<= 5