CO1012 Discrete Structures

Credits: *10* **Convenor:** *Prof R M Thomas* **Semester:** *1st*

Prerequisites: *Essential: GCSE Mathematics (or equivalent)*

Assessment: *Coursework: 100%*

Lectures:	*18*	*hours*	**Problem Classes:**	*6*	*hours*
Surgeries:	*14*	*hours*	**Class Tests:**	*6*	*hours*
			Private Study:	*31*	*hours*

Subject Knowledge

Aims This module introduces some basic concepts from discrete mathematics that are essential in the study of Computing or Computer Science.

Learning Outcomes Students will be able to:

- translate basic logical propositions to and from English;
- understand basic set notation and solve simple problems concerning sets;
- define relations, specify the matrix representation of a graph or a relation, and perform basic operations on matrices;
- solve simple problems on functions, including problems concerning partiality and composition;
- solve simple problems involving exponentials and logarithms, factorials, combinatorics and order notation.

Methods Class sessions together with course notes, surgeries, worksheets, problem classes.

Assessment Five class tests.

Skills

Aims To teach students scientific writing and problem solving skills.

Learning Outcomes Students will be able to:

- understand statements expressed in formal notation;
- solve abstract and concrete problems (both routine seen and simple unseen);
- write neat presentations of mathematical problems and their solutions;
- apply problem solving skills.

Methods Class sessions together with course notes, surgeries, worksheets, problem classes.

Assessment Five class tests.

Explanation of Prerequisites There is no prerequisite knowledge required for this module apart from some topics from GCSE Mathematics.

Course Description

The main purpose of this course is to teach the basic concepts from discrete mathematics that are needed in the study of computer science. While the main purpose is to learn the necessary mathematics, the course is taught from a computer science viewpoint throughout. We do not assume any prior knowledge of mathematics other than some basic concepts from GCSE Mathematics (or equivalent).

There will be problem classes (for going through the assessed work) and a surgery session each week (to enable to students to attempt questions and overcome any difficulties they are having with the material).

Detailed Syllabus

1. Elementary logic. Notation for logical connectives. Translating statements into formal notation. Methods of proof.
2. Sets. Basic operations on sets (union, intersection, difference, powerset). Properties of these operations. Cardinality of a set.
3. Cartesian products. Relations between sets. Examples of relations. Types of relation. Composition of relations.
4. Partial and total functions. Composition of functions. Recursive definitions of functions from the set of natural numbers. Graphs. Trees. Subtrees. Simple searching problems on trees.
5. Matrices. Adjacency matrix of a graph. Operations on matrices. Matrix representation of a relation. Composition of relations via matrices.
6. Exponentials and logarithms. Factorials. Basic concepts of algorithm analysis applied to simple algorithms. Permutations and combinations.
7. Elementary probability. Big O notation: concept and basic properties.

Reading List

[B] Kenneth H. Rosen, *Discrete Mathematics and Its Applications,*; McGraw-Hill.

Resources Textbook, web page, study guide, surgery questions, class tests; lecture rooms with whiteboards and data projector, surgery room with assistants.

Module Evaluation Course questionnaires, course review.