Logic

Discrete Mathematics

Number Theory

Topic 10 — End of Semester Review

Mathematical Proofs

Lecture 01 — Summary of Module

Dr Kieran Murphy ©①⑤

Recurrence Relations

Department of Computing and Mathematics,
Waterford IT.
(kmurphy@wit.ie)

Set Theory

Autumn Semester, 2021

Outline

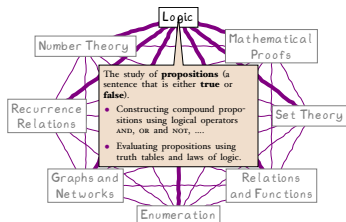Content coverage (in comparison to other years and past exam papers)

Structure of exam

Enumeration

Outline

Logic

- Logical operators
- Constructing truth tables
- Translating English $\leftrightarrow$ propositional logic
- Logic circuits $\leftrightarrow$ proposition
- Implication and contrapositive vs converse and contrapositive of a converse
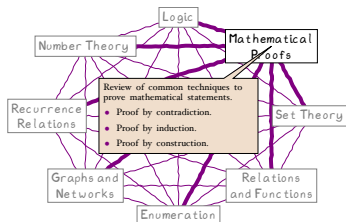
- Existence and universal qualifiers

- Proving Arguments using logic identities

Comparison to previous years

We did "fewer proving arguments" examples this year so suggest you ignore the more advanced questions related to this in previous exams papers — ask us if you not sure if a particular exam question is included.

Otherwise the material covered (see summary on website) this year is similar to previous years, so past year's exam paper questions are a good indicator for this year.

Mathematical Proofs

Logic

Number Theory

Mathematical Proofs

Recurrence Relations

Set Theory

Review of common techniques to prove mathematical statements.
- Proof by contradiction.
- Proof by induction.
- Proof by construction.

Graphs and Networks

Relations and Functions

Enumeration

Core skills

- Proof by cases
- Proof by contradiction

Intermediate topics

- Proof by contrapositive
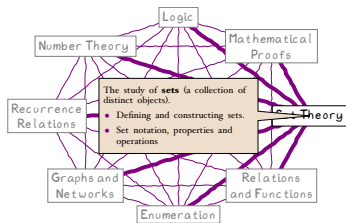- Proof by construction

Advanced topics

- Proof by induction

Comparison to previous years

The material covered (see summary on website) this year is similar to previous years, so previous exam paper questions are a good indicator for this year.

However, this topic is relatively harder than other topics so would recommend covering the core skills in other topics first.

Set Theory

- Set notation and operations
- Set properties — subset and proper subset, cardinality and power set
- Set builder notation
- Venn diagrams

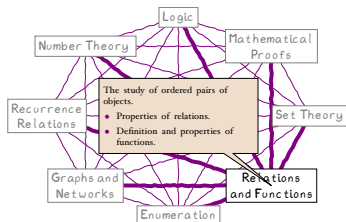- Proving set identities using membership tables (truth tables)

The material covered (see summary on website) this year is similar to previous years, so previous exam paper questions are a good indicator for this year.

Relations and Functions

The study of ordered pairs of objects.
- Properties of relations.
- Definition and properties of functions.

- Relation properties and notation
- Relations on set
- Equivalence relations — reflexive, symmetric and transitive
- Function properties and notation
- Representing relation/function as a Venn diagram, diagraph, Cartesian plane, and lookup table.
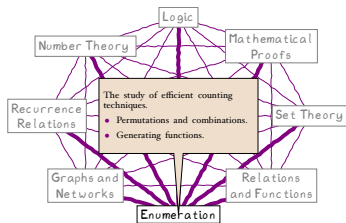
Intermediate topics

- Iterating relations
- additional properties — irreflexive, anti-symmetric, asymmetric.

Advanced topics

Comparison to previous years

The material covered (see summary on website) this year is similar to previous years, so previous exam paper questions are a good indicator for this year.

Enumeration

Number Theory

Mathematical
Proofs

The study of efficient counting
techniques.
• Permutations and combinations.
• Generating functions.

Recurrence
Relations

Set Theory

Graphs and
Networks

Relations
and Functions

Enumeration

Core skills

- Binomial coefficients — subsets, bit-strings, lattic paths

Intermediate topics

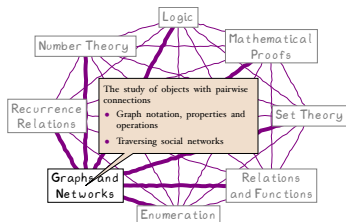- Selecting without replacement — general permutations and combinations problems

Advanced topics

- Advanced counting using stars and bars.

Comparison to previous years

The material covered this year is similar to previous years, so previous exam paper questions are a good indicator for this year.

Graphs and Networks

- Graph properties and notatioon
- Classic graphs

- Representing graphs using matrices
- Eulerian and Hamiltonian graphs
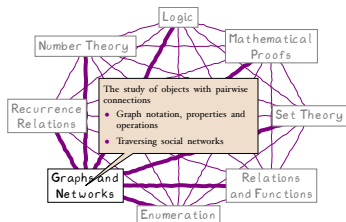
-

The material covered this year is similar to previous years, except:
- Did not cover graph connectively (Section 3 of A Survey of Graph Algorithms)
- Did not cover MST (Section 6 of A Survey of Graph Algorithms).

so previous exam paper questions on graphs (excluding the above subtopics) are a good indicator for this year.

Recurrence Relations

Logic

Number Theory

Mathematical Proofs

Recurrence Relations

Set Theory

The study of objects with pairwise connections
- Graph notation, properties and operations
- Traversing social networks

Graphs and Networks

Relations and Functions

Enumeration

Core skills

Intermediate topics

Advanced topics

Comparison to previous years

We did not cover this topic this year so ignore these questions in the exam papers.

Outline

Structure of exam paper

Paper

- 2 hours, 5 questions, no choice.
- Each question is worth 20 marks — mixture of topics per question.
- Each question has 3 to 5 subquestions.

Maximising your grade

- 120 minutes — could very roughly follow a 'minute per mark' strategy, leaving 20 minutes for review.
- Show workings — the more likely you are to make a mistake the more detail you should give.
- We are more interested in your demonstrating understanding/processes than you giving the "correct answer".
- Attempt all questions — usually first few marks are easiest to get.
- Your best guide to question style and level of difficulty is examples in notes, tutorial sheet questions and past exam papers,