Logic

Number Theory

Mathematical Proofs

Recurrence Relations

Discrete Maths

Set Theory

Enumeration

Discrete Mathematics

Topic 10 — End of Semester Review

Lecture 01 — Summary of Module

Dr Kieran Murphy ©(i)(s)

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

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Outline

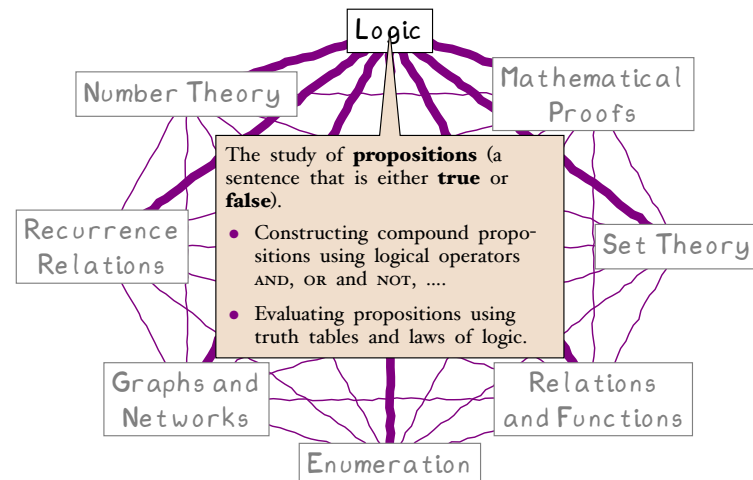Content coverage (in comparison to other years and past exam papers)

Structure of exam

Outline

Logic

Logic

Number Theory

Mathematical Proofs

The study of **propositions** (a sentence that is either **true** or **false**).

- Constructing compound propositions using logical operators AND, OR and NOT, ...
- Evaluating propositions using truth tables and laws of logic.

Recurrence Relations

Set Theory

Graphs and Networks

Relations and Functions

Enumeration

Core skills

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

Intermediate topics

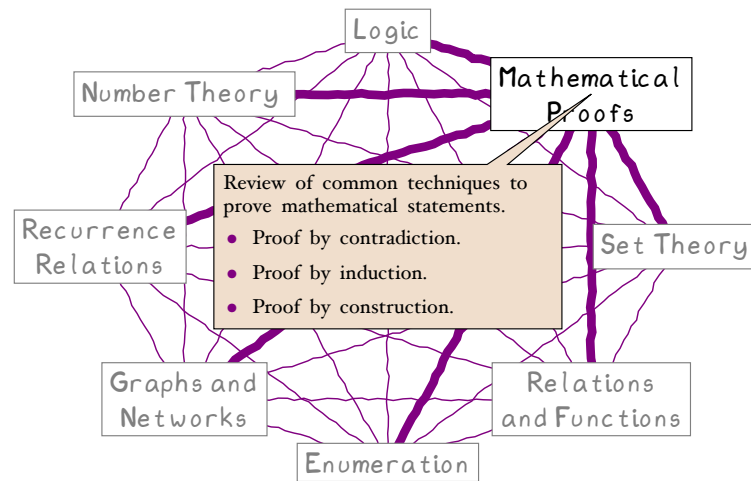- Existence and universal qualifiers

Advanced topics

- 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
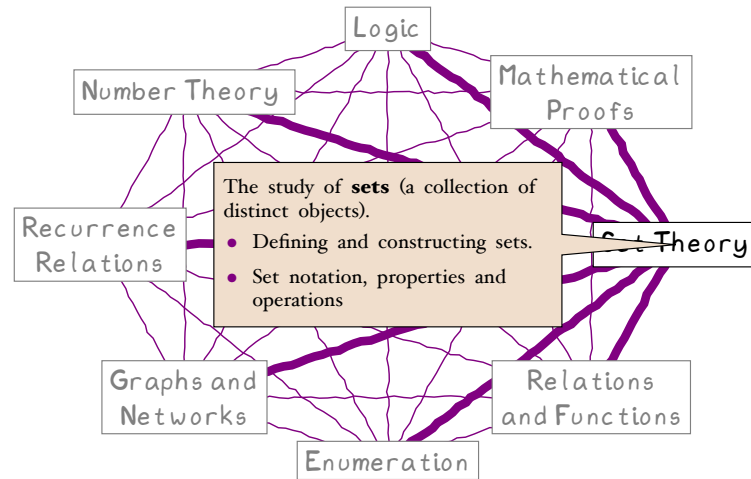- Proof by construction

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

Logic

Number Theory

Mathematical Proofs

The study of **sets** (a collection of distinct objects).
- Defining and constructing sets.
- Set notation, properties and operations

Recurrence Relations

Set Theory

Graphs and Networks

Relations and Functions

Enumeration

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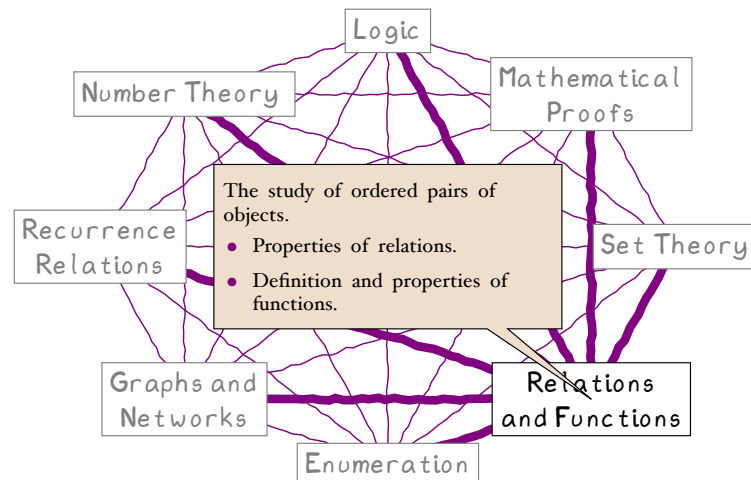- Venn diagrams

Intermediate topics

- Proving set identities using membership tables (truth tables)

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.

Relations and Functions

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

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Relations and Functions

Enumeration

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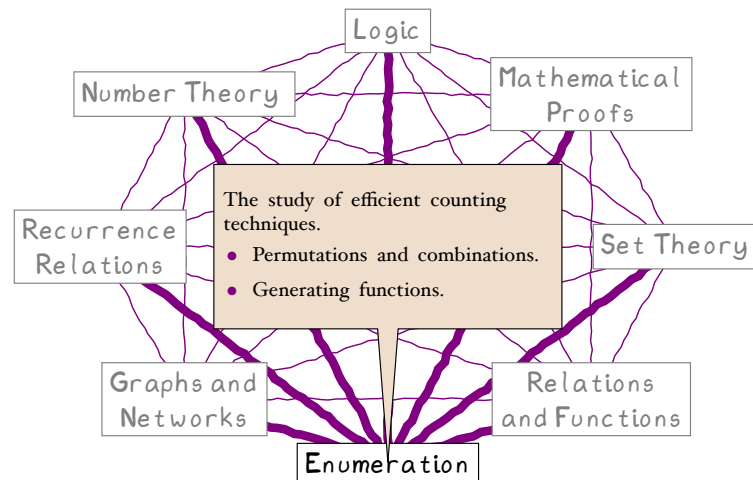- Representing relation/function as a Venn diagram, diagraph, Cartesian plane, and lookup table.

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

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

Logic

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

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

- Selecting without replacement — general permutations and combinations problems

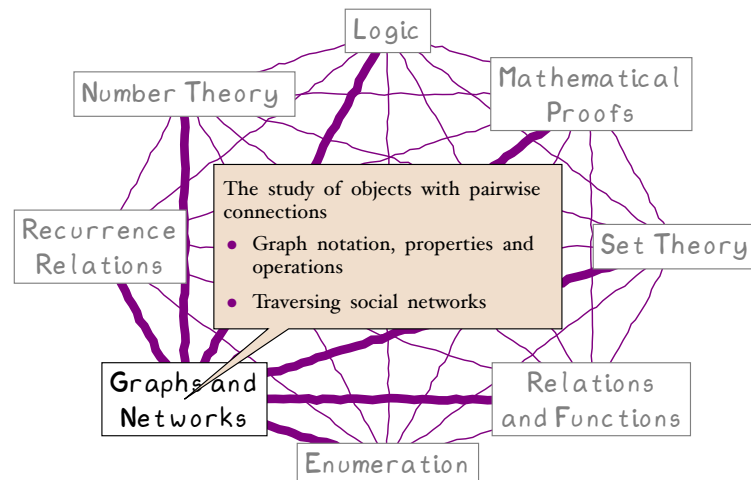- Advanced counting using stars and bars.

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

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

- Graph properties and notatioon
- Classic graphs

Intermediate topics

- Representing graphs using matrices
- Eulerian and Hamiltonian graphs
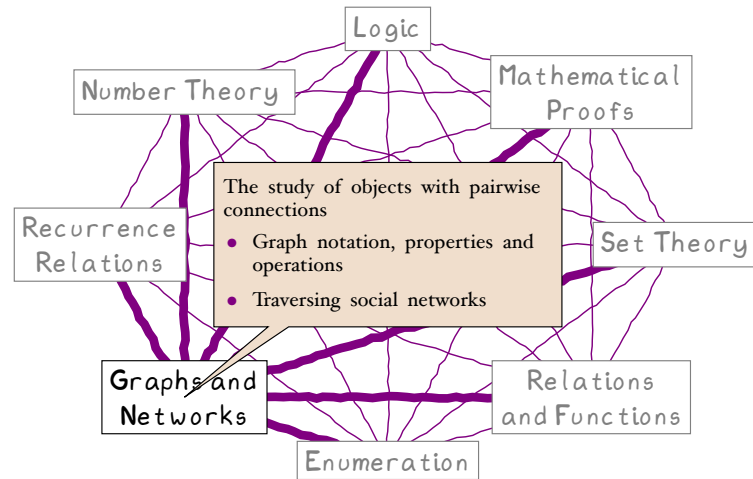
Advanced topics

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Comparison to previous years

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

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

Recurrence Relations

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Graphs and Networks

Relations and Functions

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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,