

WM181-15 Discrete Mathematics

25/26

Department

WMG

Level

Undergraduate Level 1

Module leader

Henry Caushi

Credit value

15

Module duration

30 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

Discrete mathematics forms the mathematical foundation of computer science and cyber security. It forms the basis of how computers work, allows us to prove system correctness and security, and underlies modern cryptography. This course introduces the discrete structures used by computers, as well as how to use them to solve problems in cyber security.

Module aims

This module aims to give students an understanding of the discrete structures used in cyber security, and how to use them to solve problems in cyber security.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Numbers and sets: Basic algebra: Types of numbers and their properties. Sets and their operations, set countability and power sets.

Logic and proof: Proposition and predicates. Common proof techniques including direct proof, contrapositive, exhaustion, induction and more. Common mistakes made in proofs.

Functions and relations: Functions and their inverses. Injections, surjections and bijections. Properties of relations including (anti-)symmetry, reflexivity and transitivity. Partial orderings, total orderings and equivalence relations.

Number theory: Divisibility, modular arithmetic and Fermat's little theorem. The fundamental theorem of arithmetic. The GCD and LCM, and Euclid's algorithm.

Combinatorics: The multiplication and addition principles. Permutations.

Probability: Uniform distribution. Independent and mutually exclusive events.

Graph theory: Adjacency, distance and incidence matrices. Minimum spanning trees.

Learning outcomes

By the end of the module, students should be able to:

- Reason mathematically about the discrete structures used in cyber security
- Use a variety of techniques to prove and disprove mathematical statements
- Recognise common mistakes made in mathematical proofs
- Apply a variety of proof techniques to solve cyber security problems

Indicative reading list

Johnsonbaugh, R., 2019. Discrete Mathematics, 8th Edition. Pearson Education.

Balakrishnan, V. K., 1995. Schaum's Outline of Combinatorics. McGraw-Hill.

Karumanchi, N., 2011. Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles, 2 Ed. CareerMonk.

Subject specific skills

This course equips students with the foundational mathematical skills necessary in computer science and cyber security, including logic and proof, functions and their inverses, graphs, and probability, and applies these skills in a cyber context.

Transferable skills

Numeracy, logical reasoning, problem solving, written communication skills, and increased numerical confidence

Study

Study time

Type	Required
Lectures	18 sessions of 1 hour (12%)
Tutorials	18 sessions of 1 hour (12%)
Total	150 hours

Type	Required
Private study	54 hours (36%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Time spent doing the weekly example sheets and revising the course content

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time	Eligible for self-certification
In-class test 1	20%	15 hours	No
An in-class test covering content taught in the first half of the module.			
In-class test 2	20%	15 hours	No
An in-class test covering content taught in the second half of the module.			
End-of-module exam	60%	30 hours	No
An online open-book exam covering all content in the syllabus. The exam may also apply the material covered to a cyber security scenario.			

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- Online examination: No Answerbook required

Assessment group R

	Weighting	Study time	Eligible for self-certification
Reassessment exam	100%		No
An online open-book exam covering all content in the syllabus. The exam may also apply the material covered to a cyber security scenario.			

Weighting

Study time

Eligible for self-certification

~Platforms - WAS

- Online examination: No Answerbook required

Feedback on assessment

Students will receive a per-question breakdown of their mark along with any specific comments on their answers, and a mark scheme for each paper will be released once all submissions are marked.

[Past exam papers for WM181](#)

Availability

Courses

This module is Core for:

- UWMA-H651 Undergraduate Cyber Security
 - Year 1 of H651 Cyber Security
 - Year 1 of H651 Cyber Security
 - Year 1 of H651 Cyber Security