Discrete Mathematics and Probability

Lecture 1

Welcome to the Course

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The University of Edinburgh

Monday 16 September 2024

Welcome to DMP

Discrete Mathematics and Probability

This is a second-year undergraduate course for students in the School of Informatics.

The course covers topics fundamental to many areas of computer science: sets, numbers, functions, relations, methods of proof, counting methods, probability, random variables, distributions, and statistics.

Many of you will recognize some of this material and be more or less confident in using it; for everyone some part will include new things. The aim is that end of the course all of you will be capable in working across all the topics covered.

Lectures	Mondays and Thursdays 1410–1500
Tutorials	Tuesdays and Wednesdays, starting in Week 2
Coursework	Weekly online quizzes and written homework
Exam	Mid-semester class test and end-of semester final exam

DMP Course Lecturers

Rob van Glabbeek

Heather Yorston

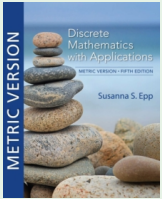
Ian Stark

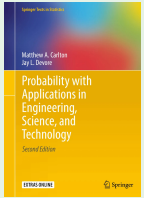
Resources

Lectures

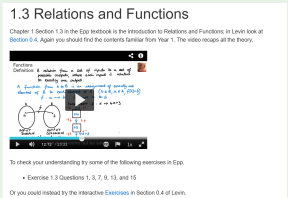
Tutorials

Textbooks





Study Guides



Lectures

1410–1500 Monday and Thursday every week

Mondays Lecture Theatre B of the 40 George Square Lecture Theatres

Thursdays **Week 1:** Paterson's Land G1; **Weeks 2–11:** Gordon Aikman Lecture Theatre

Lectures will be streamed live and then available for reviewing. Access is through Learn.

Warning: Some published timetables have the right times but the wrong places.

40 George Square Lecture Theatres

Paterson's Land

Gordon Aikman Lecture Theatre

Tutorials

Tutorials start in Week 2 and run on Tuesdays and Wednesdays.

There are six tutorial groups, with automated allocation to fit with existing timetable commitments. Each group has two assigned tutors.

In the tutorial students work in small groups on a problem sheet for the week. There is also opportunity to review homework exercises and discuss with tutors.

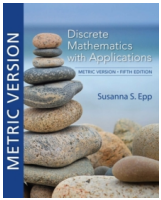
If you are unable to attend your assigned tutorial group one week then please go to one of the other groups, telling the tutor there when you arrive.

If you wish to switch to a different tutorial group then please submit a Group Change Request through the *Personalized Timetable* section of the Timetabling website.

Textbooks

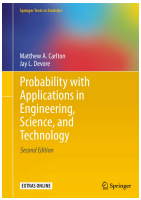
The University Library has paid for students to have access to both course textbooks. Visit *Library Resources* in Learn to use them.

Susanna S. Epp
Discrete Mathematics with Applications
Fifth Edition, Metric Version. Cengage, Australia.



Warning: Do not use the "Download" option: this limits access by other students for 24 hours. Instead always choose "Read Online".

Matthew A. Carlton and Jay L Devore
Probability with Applications
Second Edition. Springer International.



The library provides PDF and EPUB versions to download.

Some Generally Helpful Practices

Be precise and correct.

Second order precision: know when you are being precise, and to what degree; know when it matters to be precise; know when it does not.

"We demand rigidly defined areas of doubt and uncertainty" — *Vroomfondel*
The Hitchhikers Guide to the Galaxy, Douglas Adams

Be prepared to code switch: is set complement A^c or $\overline{A}$ or ...?

Postel's Law — RFC 761

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2.10.  Robustness Principle
TCP implementations should follow a general principle of robustness:
be conservative in what you do, be liberal in what you accept from
others.
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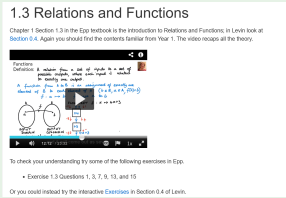
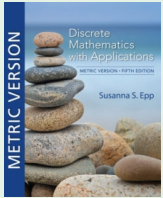
Weekly Study Guides

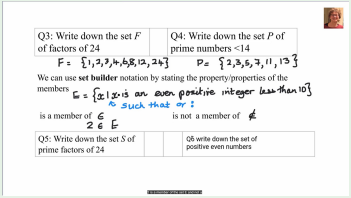
Study Guides



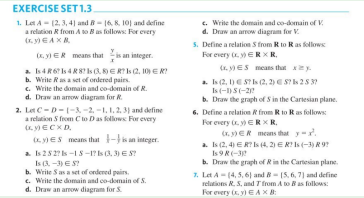
Reading



Videos



Exercises



More Ways to Learn

Quizzes

Question 1

Not yet answered

Marked out of 1.00

Flag question

Let X be the number of flights that, on any given day, arrive late at Edinburgh Airport. It is estimated that X has the probability distribution function p shown here.

x	0	1	2	3
$p(x)$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{6}$

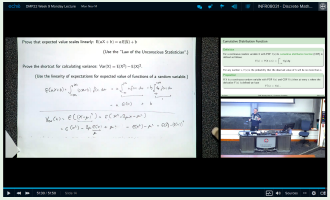
Find the expected value of X and X^2, and hence find the variance of X. Give your answers as fractions.

$E(X) =$ ____

$E(X^2) =$ ____

$V(X) =$ ____

Recordings



Homework Exercises

Question 1

A biscuit factory has three machines used to pack biscuits into large boxes that are then sent out to supermarkets. The machines are labelled A, B, and C, and every day each machine packs many boxes of biscuits. The machines work at different speeds: from all the boxes produced on a given day 40% were packed by A, another 40% by B, and the remaining 20% by machine C.

Some biscuits break during the packing process, which is a problem. Machine A does this quite a lot: for any box packed by A there is a probability 0.1 that it contains some broken biscuits. Machine B is better, with a probability 0.03 that a box from that machine will contain some broken biscuits. Machine C is best of all, with a probability of just 0.01 that a box it packs will have some broken biscuits. All of these probabilities are independent for every box.

Before the boxes are sent out from the factory a few are picked out at random and checked to see whether they contain any broken biscuits.

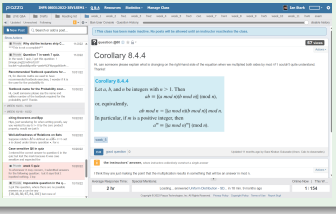
1.1 What is the probability that a box contains some broken biscuits?

1.2 One of the boxes being checked does contain broken biscuits. What is the probability that it was packed by machine B?

For each part include your working as well as the final answer. State any important results that you use in your calculation.

[*7 marks*]

Piazza



Online Quizzes

Weekly online quizzes are released on Thursdays for completion by noon on the following Thursday. Quizzes run on STACK/CodeRunner, reached through Learn.

Quizzes on STACK are randomized: every student sees the same questions, but with different values and answers.

Once starting a quiz you have 60 minutes to complete it. You are allowed up to two attempts and keep the highest mark. Students with additional time in exams also get more time to complete each quiz. There are no extensions or adjustments for late submission.

The online STACK tool provides automatic marking and custom feedback for each submission: if you get a question wrong then the tool explains why, and after your final submission it sets out a correct answer.

There are ten quizzes to complete: the highest eight marks contribute to final course grades.

Homework Exercises

Weekly homework exercises are released on Thursdays for completion by noon on the following Thursday. Submission is by upload to GradeScope, reached through Learn. There are no extensions or extra time adjustments for weekly exercises.

If you are unable to complete one week's homework then submit what you have and move on.
This need not affect your grade as only your highest four marks count.

Submissions are marked by tutors and returned with comments in time for your next tutorial where you can discuss your work with each other and the tutors.

There are six homework exercise sets: the highest four marks contribute to final course grades.

Weekly Timetable

Thursday 1410–1500 Lecture and release of study guide, videos, homework, online quizzes

Monday 1410–1500 Lecture

Tuesday, Wednesday Tutorials

Thursday 1200 Deadline for completion of online quizzes and upload of homework solutions

Thursday 1410–1500 Lecture

This course accounts for 1/3 of your academic credit this semester and you should plan to spend on it a correspondingly substantial fraction of your study time. I recommend a baseline of *at least 10 hours each week* across in-person activities, studying, and coursework.

Assessment

Class Test in Week 6 with questions from the first part of the course

Final Exam in December with questions from the second part of the course and stretch questions covering all of DMP

Results of homework, quizzes, class test, and final exam are combined in ratio 1:2:3:4 to give a weighted mean mark and overall grade for the course. The overall pass threshold is 40/100 and there is no "force-fail" or requirement to pass components individually.

(Homework: 10%; Quizzes: 20%; Class Test: 30%; Final Exam: 40%)

A resit examination in August 2025 offers a complete retest of all material in the course.

Course Syllabus

Discrete Mathematics

Weeks 1–5: Rob van Glabbeek

Logic and set theory; proof by cases, counterexamples, contraposition, and contradiction; integers, rationals, and divisibility; sequences and sums; mathematical induction; functions and relations; cardinality; modular arithmetic and cryptography.

Probability

Weeks 7–11: Heather Yorston, Ian Stark

Counting and sampling; conditional probability; Bayes' Theorem; random variables; probability distributions; density functions; discrete vs. continuous probability; normal distribution; covariance and correlation; Central Limit Theorem.

What To Do Next

- Log in to DMP on Learn through MyEd or directly at https://www.learn.ed.ac.uk.
- Follow the Week 0 to-do list there.
- Visit the course web pages at https://opencourse.inf.ed.ac.uk/dmp.
- Follow the Week 1 Study Guide there.
- Complete the Week 1 Online Quiz (access through Learn $\rightarrow$ Assessment $\rightarrow$ STACK).
- Attend Thursday's lecture at 1400 in Paterson's Land room G1.

Any Questions? Raise your hand or come up to the front at the end of the lecture.