Discrete Mathematics and Probability
Lecture 21
Exam Preparation

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Outline

1. Exam: Information

2. Exam: Preparation

3. Examples

4. Exam: Technique

5. Closing

Exam: Date, Time, Place

DMP has a single two-hour written examination. This contributes 40% towards the final course grade, with the class test, quizzes, and homework exercises making up the rest.

Date Tuesday 19 December 2023
Time 1430–1630
Place Edinburgh International Conference Centre (EICC)
Code INFR08031

Exam timetables https://exams.is.ed.ac.uk
More information https://opencourse.inf.ed.ac.uk/dmp/assessment

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This information is current at 2023-11-30; please check your personalized timetable and the exam timetables link above closer to the date to check this and to confirm all of your exams.

Grade Calculation

From the course Assessment web page https://opencourse.inf.ed.ac.uk/dmp/assessment#exam

The exam lasts two hours and has two parts.

Part A contains four questions on probability, each marked out of 15. These are based on the second half of the course and may involved topic listed in the study guides.

Part B contains two questions on discrete mathematics, each marked out of 10. Rather than repeat the mid-semester class test this part focuses on more challenging questions.

Adding up the marks for each question gives a total out of 80.

Grade Calculation

From the course Assessment web page https://opencourse.inf.ed.ac.uk/dmp/assessment#exam

Component	Mark Calculation	Weighting
Homework Exercises	Best 4 out of 6	10%
Online Quizzes	Best 8 out of 10	20%
Class Test	Question total	30%
Written Exam	Question total	40%

The pass mark for the course is $40/100$ and there is no requirement to pass any individual component — no "Force Fail" — only the combined mark is used.

In the Exam

From the course Assessment web page and school web pages linked there.

Calculators

You may use a scientific calculator during the exam and will need to provide your own. It must not be graphing or programmable, able to retrieve text, or to communicate with any other device. The following are examples of suitable calculators.

- Casio: FX82, FX83, FX85, FX96, FX991 (all versions)
- Texas Instruments: TI30 (all versions)
- Sharp: EL-531 (all versions)
- HP: HP 10S+, HP 300S+

Exams in other courses may have different requirements, or not allow calculators at all.

Examples of Suitable Calculators

https://mathsgear.co.uk
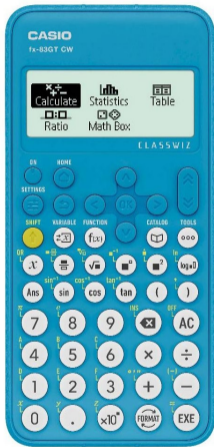
In the Exam

From the course Assessment web page and school web pages linked there.

Permitted Notes

You may bring into the exam up to 3 A4 pages (6 sides) of notes, printed or handwritten. There is no requirement to do so, however, and questions will not depend on such material.

Statistical Tables

Tables of the standard normal distribution, or other numerical references, will be provided alongside any question that needs them. You do not need to bring your own.

No Other Electronic Devices

You may take calculators in to the DMP but no other devices.

Exam Hall Regulations

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9. The use of mobile devices/personal electronic equipment is not permitted. Mobile devices must be switched off during an examination. These should be placed in your bag and should not be on your person.

Mobile devices are those which store/display data or connect to the internet, such as a mobile telephone, smart watches, smart glasses or any other communications equipment.

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Take care with this: make sure you do not accidentally carry in any connected device.

UNIVERSITY OF EDINBURGH

COLLEGE OF SCIENCE AND ENGINEERING

SCHOOL OF INFORMATICS

INFR08031

Tuesday 19$\underline{\text{th}}$ December 2023

14:30 to 16:30

INSTRUCTIONS TO CANDIDATES

1. Note that **ALL QUESTIONS ARE COMPULSORY.**

2. **DIFFERENT QUESTIONS MAY HAVE DIFFERENT NUMBERS OF TOTAL MARKS.** Take note of this in allocating time to questions.

3. This is a **NOTES AND CALCULATORS PERMITTED** examination: candidates may consult up to **THREE A4 pages (6 sides)** of notes. **CALCULATORS MAY BE USED IN THIS EXAMINATION.**

Exam Script Booklet

3.(c)

☐ Tick here if you have used additional pages for answering this question

During the Exam

- Write all your working and answers in the boxes in the booklet provided.

- Use blue or black pen, with pencil only for graphs or diagrams.

- You are allowed to write on the exam paper: for example, to tick off questions completed, or note the order you plan to attempt questions.

At the End of the Exam

- You may take away the exam paper.

- You must leave behind the booklet with your answers.

Outline

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Exam Preparation

(a) Read through the lecture slides, your own notes, the homework exercises, the tutorial sheets.

(b) Write your own notes on each topic. Summarize, organize, make lists of relevant points.

(For anything you really don't understand, go back to the study guide, videos, and textbook. That's a fallback, though — where you possibly can, try to maintain understanding week by week in any course.)

(c) Choose some exercises from the textbook for each topic. Write out your answers, in full.

(d) Practice past coursework questions. Write out your answers, in full.

(e) Repeat items (c)–(e).

Past Papers

The University Library has a set of past papers online for all courses.

http://exampapers.ed.ac.uk

Right now for DMP this has only the December 2022 exam but it may also be useful for other courses where you have exams.

Using Past Exam Questions

Past questions are a good source of practice material, and I strongly recommend you attempt as many of them as you can.

However, please note the following.

- The key exam preparation task is to *master the course material:* understand it and be able to apply it in practice.

  Conveniently, that's also the best possible outcome for you from this course

- Memorizing answers to previous questions is not a helpful way to tackle future ones.

- Attempting past exam questions yourself — to test your knowledge, and identify any gaps — is a much more effective way to learn.   Don't revise: practice

If you are puzzled by a past question or its solution then ask on *Piazza*.

Outline

Example

The PDF of a continuous random variable X is given as:

$$f(x) = \begin{cases} \frac{1}{18}x^2 & \text{if } |x| \leqslant a \\ 0 & \text{if } |x| > a \end{cases}$$

for some value a.

Find the value of a and calculate $P(-\frac{a}{2} < X < \frac{a}{2})$.

Example: Carlton & Devore Chapter 4 Question 77 (page 288)

77. A 1-ft-long stick is broken at a point X (measured from the left end) chosen randomly uniformly along its length. Then the left part is broken at a point Y chosen randomly uniformly along its length. In other words, X is uniformly distributed between 0 and 1 and, given $X = x$, Y is uniformly distributed between 0 and x.

   (a) Determine $E(Y|X = x)$ and then $\text{Var}(Y|X = x)$.
   (b) Determine $f(x,y)$ using $f_X(x)$ and $f_{Y|X}(y|x)$.
   (c) Determine $f_Y(y)$.
   (d) Use $f_Y(y)$ from (c) to get $E(Y)$ and $\text{Var}(Y)$.
   (e) Use (a) and the Laws of Total Expectation and Variance to get $E(Y)$ and $\text{Var}(Y)$.

Bonus Question   +

> If a stick is broken at random into three pieces then what is the probability they can be arranged
> as the sides of a triangle?

The probability depends on the method used to break it "at random".

- Choose two points independently.
- Choose one point, break the stick, then break the left-hand part.
- Choose one point, break the stick, then break the right-hand part.
- Choose one point, break the stick, choose one part at random, break that.
- Choose one point, break the stick, then break the longer part.
- Choose one point, break the stick, then break the shorter part.

Even assuming individual choices are made uniformly along the length of the stick or substick,
these don't necessarily all give the same result.

Outline

What Kinds of Things are Assessed?

Subject area content obviously varies dramatically between different courses and their examinations, but some factors remain steady and most exams try to assess a range of skills.

Here is one listing of different elements that questions aim to stimulate and assess:

- Knowledge   Do you know the thing?
- Understanding   Do you know you know the thing?
- Ability to explain   Can you tell me the thing?
- Application of knowledge   Can you use the thing?
- Judgement   Can you tell which thing to use when?

In most cases questions and parts of questions will call on more than one of these; and there are also many other ways to classify learning and assessment goals.

Working through the Exam Paper

Don't start writing until you know what you are doing.

- Read all questions before beginning the paper.

- You don't need to do the questions in order.

- Don't assume a question is only using one part of the course.

- If you get stuck on one question: don't waste too much time on it; do go on to the next question; come back later. Don't give up!

All questions give information about marks available for each section.

Adding up the marks you achieve for each question gives your total mark for the exam.

Answering a Question

Don't start writing until you know what you are doing.

- Read the question.

- Identify what the question is asking for.

- Work out how to answer the question.

- Write an answer to the question that shows you know what you are doing and explains how you achieved the result.

- Read the question again and make sure your answer provides all the details requested.

Look at the mark counts for an indication of how much or how little is required.

Look at the mark counts to check how you are using time.

Exam Marking

The exam is marked by the course lecturers with support from tutors.

- Marking is anonymous: we don't see your name or UUN.

- Spelling and grammar are not part of the assessment; although it is important that the markers can read what you have written.

- Marks are not "curved" or "scaled". You keep all the marks you get.

- There is no ranking of student performance — your mark and grade do not in any way depend on how others do in the course.

Once individual exam papers are marked and the scores combined with coursework grades, all this is passed for review to the Board of Examiners with oversight from an External Examiner. The Board meets in January after which results will be posted in EUCLID.

Outline

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You can do this

The DMP syllabus and exam questions are written to be achievable. Every year large numbers of students do well in the course writing straightforward correct answers about things they understand. You can do this too.

Anything Else?

If you have further questions about the course content, tutorial exercises, the exam, or anything else, please:

- Post a question on *Piazza*; *or*
- Ask your course tutor, in person or by email; *or*
- Ask me, in person or by email.

Thank you for your attention

We're done here