

## Midterm Topics

## 1. The basics of probability.

### (i) Review of set theory notation.

- ▶ intersection, union, complement and how they combine
- ▶ manipulating multiple events
- ▶ partitions

### (ii) Sample spaces and events.

- ▶ definitions and terminology

(iii) The probability axioms and their consequences.

- ▶ definitions
- ▶ axioms
- ▶ corollaries
- ▶ general addition rule
- ▶ probability tables

(iv) Probability spaces with equally likely outcomes.

- ▶ Decomposition of  $S$  into equally likely sample outcomes
- ▶ Calculations of the form

$$P(A) = \frac{n_A}{n_S}$$

## (v) Combinatorial probability.

- ▶ multiplication principle
- ▶ selecting with and without replacement
- ▶ permutations
- ▶ multinomial coefficients and partitioning sets
- ▶ combinations
- ▶ binary sequences
- ▶ hypergeometric selection

## (vi) Conditional probability and independence.

- ▶ concept of conditional probability
- ▶ definition
- ▶ properties
- ▶ independence
- ▶ mutual independence
- ▶ general multiplication (or chain) rule

(vii) The Theorem of Total Probability.

- ▶ ‘proof’ by partitioning
- ▶ consequences
- ▶ probability trees

(viii) Bayes Theorem.

- ▶ ‘proof’ by definition of conditional probability
- ▶ interpretation and consequences
- ▶ probability trees



## 2. Random variables and probability distributions.

### (i) Random variables.

- ▶ definition
- ▶ elementary examples

### (ii) Discrete random variables and distributions

- ▶ pmfs
- ▶ basic properties
- ▶ basic computations

# Instructions

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- Exam will last one hour and twenty minutes.
- Exam will contain 4 questions, 10 marks each.
- Rescaling of the final mark may occur.
- Answer the questions in the booklet provided.
  - ▶ Write your name, ID number and exam version number on the booklet cover.
  - ▶ Exam version number will be in the top right hand corner of exam paper.
- At the end of the exam, return

**exam paper and booklet**

to invigilators.

**Room:** If you receive an email asking you to take the exam in a room other than the regular classroom, please comply with this request.