Week 4/5
Term 1
2023

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MM1 Learning Brief: Counting, Sample Space and Probability

1. Goals

By the end of this week, you should be able to:

- review probability as a measure of 'the likelihood of occurrence' of an event
- review the probability scale: $0 \leq P(A) \leq 1$ for each event A, with $P(A) = 0$ if A is an impossibility and $P(A) = 1$ if A is a certainty
- review the rules: $P(A') = 1 - P(A)$ and $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- use the notation $P(A|B)$ and the formula $P(A \cap B) = P(A|B)P(B)$
- understand the notion of independence of an event A from an event B, as defined by $P(A|B) = P(A)$
- establish and use the formula $P(A \cap B) = P(A)P(B)$ for independent events A and B, and recognise the symmetry of independence
- use relative frequencies obtained from data as point estimates of conditional probabilities and as indications of possible independence of events

2. Theoretical Components

Knowledge checklist
Define experiment, outcome, event, probability and equally likely
Recognise the difference between outcomes that are equally likely and not equally likely to occur
Determine the probability of simple and compound events
Use tree diagrams to determine the sample space of compound events
Use Venn diagrams to determine the probability of compound events
Use Karnaugh Maps to determine the sample space of compound events
Use the addition principle to compute probabilities of mutually exclusive (and non-mutually exclusive or inclusive) events
Understand the definition of conditional probability
Use the relative frequency approach to assigning probability to find the conditional probability of an event from a two-way table
Use the formula for conditional probability
Use the multiplication rule to find the probability of the intersection of two events
Use the multiplication rule to find the probability of the intersection of more than two events
Determine if two events are independent

Videos
https://www.khanacademy.org/math/probability/probability-and-combinatorics-topic/probability_combinatorics/v/events-and-outcomes-3

https://www.khanacademy.org/math/probability/probability-and-combinatorics-topic/probability_combinatorics/v/getting-exactly-two-heads-combinatorics

https://www.khanacademy.org/math/probability/probability-and-combinatorics-topic/probability_combinatorics/v/probability-using-combinations

3. Practical Components

Chapter 11 and 12 of **Maths Quest 11 Mathematical Methods** (pdf - Google Classroom). Make notes as needed then complete the following questions.

11C Tree diagrams and lattice diagrams
- Qs 1, 3, 7, 11, 15, 17, 22

11D The Addition Law of Probabilities
- Qs 1, 3, 5, 11, 13, 15, 20, 24

11E Karnaugh maps and probability tables
- Qs 1(a, c), 5, 7, 8, 10, 12, 13, 15

12H Applications to probability
- Qs 1-7, 12-18

11F Conditional probability
- Qs 1, 3, 5, 9-12, 14, 15, 17, 19

11H Independent events
- Qs 1(a, e), 2, 3, 5, 9, 16, 18

4. Investigation

The purpose of this investigation is to find a rule for calculating P(A *and* B) for two events A and B that are independent. Suppose a coin is tossed and a die is rolled at the same time. The result of the coin toss will be called outcome A, and the result of the die roll will be outcome B.
a) Draw up a **tree diagram** to show all the outcomes possible.
b) Copy and complete the table:

	P(A and B)	P(A)	P(B)
P(a head and a 4)			
P(a head and an odd number)			
P(a tail and a number larger than 1)			
P(a tail and a number less than 3)			

c) What is the connection between P(A and B), P(A), and P(B)?
d) Find P(B|A) for the four events. What do you notice?

QFO
Quiz/Forum/Other

*You will need a CAS calculator for this course – see link on Google Classroom.

In your double lesson of **week 5** you are to sit n **in-class test** (worth 10%). It is an "open book" task given under test conditions. Further details will be posted on GC.