MTH4108 Probability I

Mid-term Test

9:00am, Friday 13 November 2009

Duration: 40 minutes

Answer All Questions. Each question carries 25 marks.

Calculators are NOT permitted in this examination.

Write your answers on the question paper. If you need more space then use the blank pages at the end of the booklet and be sure to number your answers clearly.

NAME:

STUDENT NUMBER:

EXERCISE CLASS GROUP:

1. A fair six-sided die is rolled twice. Let A be the event that the first roll is odd and B be the event that the first roll is strictly less than the second roll.

i) Find $\mathbb{P}(A)$.

ii) Find $\mathbb{P}(B)$.

iii) Find $\mathbb{P}(A \cap B)$.

iv) Find $\mathbb{P}(A \setminus B)$.

iv) Find $\mathbb{P}(A \cup B)$.

2. I make an ordered selection of three distinct letters from the set $\{a, b, c, d, e\}$. Each selection is equally likely.

i) What is the probability my selection begins with a vowel i.e. the letter 'a' or the letter 'e'?

ii) What is the probability my selection contains no vowels?

iii) What is the probability my selection contains two vowels?

3. In order to get to Queen Mary I can either take the DLR from Lewisham to Bow Church and then a bus, or take a train from Lewisham to London bridge followed by the Northern Line from London Bridge to Bank and then the District Line from Bank to Stepney Green. Suppose that the probabilities that the DLR, bus, train, Northern Line and District Line are working are 4/5, 1/2, 9/10, 2/3 and 4/5, respectively, and that these events are mutually independent.

i) What is the probability that I can get to Queen Mary?

ii) What is the probability that I can get to Queen Mary given that the DLR is not working?

iii) What is the probability that the DLR is not working given that I can get to Queen Mary?

4. Let A and B be events in a sample space S and suppose that $\mathbb{P}(A)$ and $\mathbb{P}(B)$ are both greater than zero.

i) Define the conditional probability $\mathbb{P}(A|B)$.

ii) Prove that if $\mathbb{P}(A|B) > \mathbb{P}(A)$ then $\mathbb{P}(B|A) > \mathbb{P}(B)$.

iii) Prove that if A_1 and A_2 are disjoint events in S then $\mathbb{P}(A_1|B) + \mathbb{P}(A_2|B) = \mathbb{P}(A_1 \cup A_2|B)$.

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