EE2 Mathematics – Probability & Statistics

Exercise 1

1. Let A, B and C be three arbitrary events. Using only the operations of union, intersection and complement, write down expressions for the events that, of A, B, C,

   (a) Only A occurs
   (b) A and B occur, but not C.
   (c) All three events occur.
   (d) At least one event occurs.
   (e) At least two events occur.
   (f) One and only one event occurs.
   (g) Exactly two events occur.
   (h) No events occur.
   (i) Not more that two events occur.

2. Let A, B and C be three arbitrary events. Simplify the following expressions:

   (a) $(A \cup B) \cap (A \cup \overline{B})$
   (b) $(A \cap B) \cup (A \cap \overline{B})$
   (c) $(A \cup B) \cap (B \cup C)$
   (d) $(A \cup B) \cap (\overline{A} \cup B) \cap (A \cap \overline{B})$
   (e) $(A \cup B) \cap (\overline{A} \cup B) \cap (A \cup \overline{B})$

3. A fair six-sided die is thrown twice.

   (a) Write down the sample space for this experiment.
   (b) Let B be the event that the first number thrown is no larger than 3, and let C be the event that the sum of the two numbers thrown equals 6. Find the probabilities of B, C, and $B \cap C$.

4. Events A, B and C have probabilities 0.7, 0.8 and 0.9 respectively. In addition,

   $$P(A \cap B) = 0.6, \quad P(B \cap C) = 0.7, \quad P(A \cap C) = 0.6, \quad P(A \cap B \cap C) = 0.5.$$

   Calculate the following:

   (a) $P(A \cap \overline{B})$
   (b) $P(A \cup B)$
   (c) $P(A \cap B \cap \overline{C})$
   (d) $P(A \cup B \cup C)$