

# Probability Tutorial Sheet

1. A fair coin is tossed three times. Write out the sample space  $S$  and the sample points of the following events:
  - (i) the event that the first toss is heads,
  - (ii) the event that the second toss is heads,
  - (iii) exactly two heads in a row.
2. Compute the probability  $p$  of each event:
  - (i) An even number appears in the toss of a fair die,
  - (ii) One or more tails appear in the toss of three fair coins,
  - (iii) A blue marble appears in a random drawing of one marble from a box containing four white, three blue, and five red marbles.
3. Suppose a pair of fair dice is thrown.
  - (i) What is the probability of getting a sum of 9 from two throws of a diceFind the probability that the sum is 10 or greater if
  - (ii) a 5 appears on the first die,
  - (iii) a 5 appears on at least one of the dice.
4. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5
5. In a class of 20 pupils, 11 have dark hair, 7 have fair hair and 2 have red hair.  
Two pupils are chosen at random to collect the homework. What is the probability that they
  - (a) both have fair hair
  - (b) each have hair of a different colour
6. Suppose an urn contains seven white, four black and three red beads. Three beads are picked at random without replacement. Find the probability that all three beads are the different in colour. at least two beads are the same colour.
  - (i) A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?
7. Suppose one urn contains three balls; one red, one blue and one green, and a second urn contain three balls; numbered 1, 2, and 3. An experiment consists of two balls being drawn at random (i.e. one from each urn).
  - (i) Write out the sample space for this experiment.

8. An IT consultant is responsible for three software engineering projects X, Y and Z. He knows that the probability of completing project X in time is 0.99, for project Y this probability is 0.95 and for project Z it is 0.80.
- What assumption do you need to make in order to calculate the probability of completing all three projects in time, from the information given?
  - Calculate the probability of completing all three projects in time.
  - Calculate the probability that only projects X and Y will be completed on time.
9. A doctor treating a patient issues a prescription for antibiotics and provides for two repeat prescriptions. The probability that the infection will be cleared by the first prescription is  $p_1 = 0.6$ . The probability that successive treatments are successful, given that previous prescriptions were not successful are  $p_2 = 0.5$ ,  $p_3 = 0.4$ . Calculate the probability that
- the patient is still infected after the third prescription
  - the patient is cured by the second prescription.
  - the patient is cured by the second prescription, given that the patient is eventually cured.
10. A driver passes through 3 traffic lights. The chance he/she will stop at the first is  $1/2$ , at the second  $1/3$  and at the third independently of what happens at any of the other lights.  
What is the probability that
- the driver makes the whole journey without being stopped at any of the lights
  - the driver is only stopped at the first and third lights
  - the driver is stopped at just one set of lights.
  - the driver stopped at the second set of lights, given he/she stopped at one set of lights.
11. One in 10,000 people have a particular condition. Given that an individual has this condition, a test for this condition gives a positive result with probability 0.999. Given that an individual does not have this condition, this test gives a positive result with probability 0.001.  
Suppose the individual tested is chosen at random from the population as a whole
- Calculate the probability that the test result is positive.
  - Calculate the probability that the individual has the condition, given that the result of the test is positive.