Access to Science, Engineering and Agriculture: Mathematics 2
MATH00040
Chapter 5 Exercises

1. (a) If we pick a card from a deck of cards, what is the probability that it is either a black card (Club or Spade) or a face card (Jack, Queen or King)?

   (b) In a group of 90 undergraduate students at UCD, there are 57 first years, 46 females and 23 female first years. If one of these students is selected at random, what is the probability that they will either be a first year or male?

   (c) In a hospital wing, the medical staff consists of five doctors and eleven nurses. Two of the doctors are male and seven of the nurses are female. What is the probability of a staff member picked at random being either a nurse or male?

   (d) A physics lecturer gave his class two tests. Eleven percent of the class failed the first test and five percent of the class failed both tests. If we pick a student who failed the first test at random, then what is the probability that they also failed the second test?

   (e) A bag contains black and white marbles. Two marbles are chosen with the second being chosen without the first being replaced. The probability of selecting a white marble followed by a black marble is 0.31, and the probability of selecting a white marble first is 0.57. What is the probability of selecting a black marble second, given that the first marble drawn was white?

   (f) In a supermarket survey, it was found that the probability that a customer likes chocolate ice cream is 0.65 and the probability that a customer likes both chocolate ice cream and strawberry ice cream is 0.4. What is the probability that someone who likes chocolate ice cream also likes strawberry ice cream?

2. (a) Suppose that we toss a coin thirteen times. What is the probability of getting nine heads?

   (b) Suppose that we are given a bag containing five white balls and nine black balls and suppose that we draw nine balls from the bag, replacing each ball before drawing the next. What is the probability of drawing two white balls?

   (c) Suppose that we toss a coin eleven times. What is the probability of getting at most five heads?

   (d) Suppose that we are given a bag containing three white balls and seven black balls and suppose that we draw ten balls from the bag, replacing each ball before drawing the next. What is the probability of drawing at most six black balls?

   (e) Suppose that we toss a coin fifteen times. What is the probability of getting at least ten heads?

(f) Suppose that we are given a bag containing four white balls and six black balls and suppose that we draw eleven balls from the bag, replacing each ball before drawing the next. What is the probability of drawing at least eight black balls?

3. (a) A particular type of bacterium is randomly distributed in a certain river at an average concentration of one per 50 cm^3 of water. If we draw from the river a test tube containing 125 cm^3 of water, what is the chance that the sample contains exactly two of these bacteria?

(b) The number of births per week in a particular town is four. What is the probability that there will be exactly three births in the next two days?

(c) It has been observed that the average rate of customers arriving at a supermarket checkout between 5pm and 6 pm on a Friday evening is two per minute. What is the probability of less than fifteen customers arriving between 5.30pm and 5.36pm on Friday?

(d) It has been observed that the average rate of cars arriving at a petrol station between 5pm and 6pm on a Sunday evening is one per six minutes. What is the probability of at most five cars arriving between 5.30pm and 6pm on Sunday?

(e) The average number of passengers arriving at a bus stop between 3pm and 4pm on a Saturday is twelve. What is the probability that at least five passengers will arrive between 3pm and 3.30pm next Saturday?

(f) The average number of cyclists arriving at UCD between 9am and 10am on Monday is 5 per minute. What is the probability that more than 10 cyclists arrive between 9am and 9.03am next Monday?

4. (a) If Z is a random variable with the standard normal distribution, find $P(Z \leqslant 2.12)$.

(b) If Z is a random variable with the standard normal distribution, find $P(Z > 0.14)$.

(c) If Z is a random variable with the standard normal distribution, find $P(-2.33 \leqslant Z \leqslant -0.04)$.

(d) Suppose that the marks in a particular exam are normally distributed with mean 55 and standard deviation 12. What is the probability of a student scoring less than 40?

(e) Suppose that the heights of adult females in Ireland are normally distributed with mean 170cm and standard deviation 8cm. What is the probability of a woman chosen at random in Ireland being taller than 168cm?

(f) A particular brand of light bulb is known to have a life normally distributed with mean 1375 hours and standard deviation 100 hours. What is the probability of a randomly selected light bulb of this brand lasting between 1200 hours and 1500 hours?