

CM1103 Week 9: Exercises 4 – Probability

1. List the sample space for the experiment of rolling a single 6-sided dice. Then list the outcomes in the event E of the roll being at least 3, and hence calculate the probability of this event.
2. Give an example of a pair of disjoint (mutually exclusive) events and a pair of independent events.
3.
 - (a) State the relationship between the probability of an event and its complement
 - (b) State the *sum rule* for probabilities.
 - (c) Explain why your answer to 3a is a special case of your answer to 3b
4. A (6-sided) dice is thrown twice. What is the probability that:
 - (a) Two sixes occur
 - (b) At least one six occurs
 - (c) Two different numbers occur
5. A (6-sided) dice is thrown *four times*. What is the probability that:
 - (a) Four sixes occur
 - (b) At least one six occurs
 - (c) Four different numbers occur
6. A card is drawn from a standard pack of 52. What is the probability that:
 - (a) The card is red
 - (b) The card is either a heart or a club
 - (c) The card is either a 5 or a 6
 - (d) The card is not a red ace
 - (e) The card is either not red or not an ace
7. A bag contains 4 red, 2 blue and 6 green balls. What is the probability that:
 - (a) Two balls are drawn *without replacement* and one is red and one is green
 - (b) Two balls are drawn *with replacement* and one is red and one is green
 - (c) Three balls are drawn *without replacement* and they are all red
 - (d) Three balls are drawn *without replacement* and they are all blue
 - (e) Three balls are drawn *without replacement* and there is one of each colour
8. How many times must I toss a coin so that the probability I get at least one head is:
 - (a) at least 0.75
 - (b) at least 0.95
9. Suppose a football player scores penalties with a probability of $\frac{2}{3}$. What is the probability that they score exactly once if they take 5 penalties?

10. Suppose a medical test for a certain disease has a probability of 0.99 of giving a positive result (disease is present) when applied to someone who has the disease, and a probability of 0.001 of a (false) positive result when applied to someone without the disease. If the disease is applied to a random member of the public, what is the probability of:

- a false positive (test is positive but they don't have the disease)
- a true positive
- a false negative (test is negative but they do have the disease)

when:

- (a) 1 in 100 people have the disease;
 - (b) 1 in 10,000 people have the disease.
11. List the sample space for the experiment of rolling a pair of 4-sided dice. List the outcomes in the event of the total being at most 4. Hence calculate the probability that the total is at most 4. Use the sum rule to calculate the probability that the sum is 5 or more.
12. Is the probability of two picture cards (J, Q or K) occurring if two cards are drawn from a standard pack higher *with* or *without* replacement?