Practical 1

Question 1

Four nurses get into a lift at the ground floor of a building that has seven higher floors. Write down a suitable sample space for each of the following experiments:

(a) Recording the number of nurses who get out at the 3^{rd} floor.

(b) Recording the floor at which a particular nurse gets out.

(c) Recording the number of floors at which one or more nurses get out.

[You can assume that no nurses exit the lift on the ground floor].

Question 2

A Costa Rican rural community was surveyed for intestinal parasites using faecal examination. The results are shown in the table:

Age (years)	Relative frequency	Proportion infected with hookworm in age group
0–4	0.20	0.09
5–9	0.18	0.25
10–19	0.22	0.43
20–39	0.24	0.46
40+	0.16	0.37

A person is selected at random from the population. Draw a probability tree to show the possible outcomes.

Find the probability that this person is:

(a) between 10 and 19 years of age

(b) between 10 and 19 years of age and infected with hookworm

(c) between 10 and 39 years of age

(d) between 10 and 39 years of age and infected with hookworm

(e) between 10 and 39 years of age and not infected with hookworm

(f) infected with hookworm

(g) What is the probability that a person aged between 10 and 39 years is infected with hookworm?

Question 3

A doctor's name is chosen haphazardly from the British Medical Register. The probability that a doctor is male is 0.8. The probability that a doctor qualified at an English school is 0.6.

(a) What is the probability that the doctor is male and qualified in England? What important assumption needs to be made?

(b) What is the probability that the doctor either is male or qualified in England, or both?

(c) Discuss possible ways in which the assumption in (a) could be violated.

Question 4

A 50-year old man has probability 0.05 of dying before reaching age 60. The probabilities of dying in the next 10 years for 60, 70, 80, 90 and 100 year old men are 0.15, 0.20, 0.50, 0.70 and 1.00 respectively.

(a) Draw a probability tree that illustrates the survival experience of a 50-year old man.

(b) Calculate the probability that a 50-year old man will survive until he is 80.

(c) Calculate the probability that a 50-year old man will die between the ages of 70 and 90.

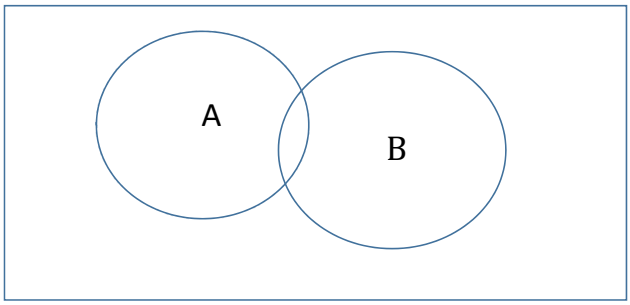
Additional questions

The additional questions relate to important material and we strongly advise students go through these questions carefully. We will not go through the solutions to additional questions in the practical sessions. Detailed written solutions are provided.

Questions marked as optional are not required, but are intended to give students opportunities to apply their probability knowledge to more challenging, or counter-intuitive settings.

Additional: Question 5

Show, using the axioms of probability, that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. You may find the diagram below useful.



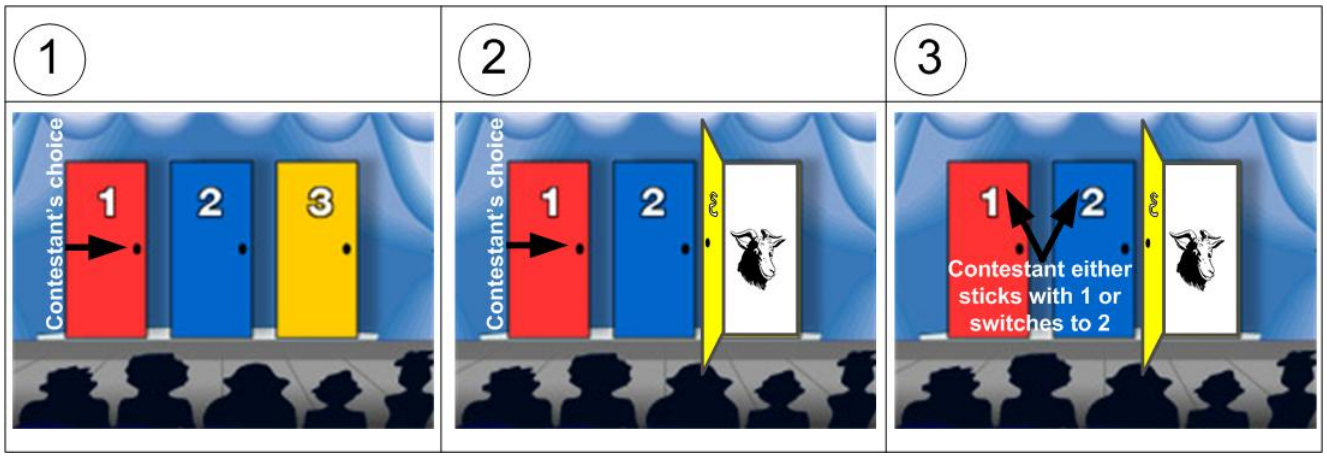
Optional: Brainteaser

In a television game show, there are three doors. Behind one of the doors is a car; behind the other two doors there are goats. The game show host knows behind which door (1, 2 or 3) the car is hidden, but the contestant does not know and must guess. The contestant chooses a door at random.

Then, the host opens one of the **other** two doors and reveals a goat. He makes sure that he reveals a goat and not the car.

Now, the host asks the contestant if she would like to stick with her original choice, or switch to the other unopened door.

Once this decision has been made, the contestant can open her door and keep whatever is behind it.



Imagine that you are the contestant. Assuming that you want the car, would you stick with your original choice, switch to the other unopened door, or does it make no difference?