Lesson 4

A-Level Applied Mathematics : Year 1
Statistics : Set Theory & Probability

4.1 Tree Diagrams : Conditional Probability

Example
A jar contains coloured beads:

- ◇ 7 red
- ◇ 3 white
- ◇ 1 blue

Two beads are drawn at random from the jar without replacement.

(i) In the space below, draw a tree diagram to illustrate all possible outcomes and associated probabilities.
State your probabilities clearly.

(ii) Find the probability that a red and a blue bead are drawn from the jar.

4.2 Exercise

Question 1

A teacher calculates that if a student regularly completes their homework the probability that they will pass the examination is 0.8 and that if the student does not do their homework regularly the probability of passing is only 0.4.
Only 75% of the students do their homework regularly.

(i) In the space below, draw a tree diagram to illustrate all possible outcomes and associated probabilities.
State your probabilities clearly.

(ii) Calculate the probability that a randomly selected student:

(a) Does not do the homework regularly and passes the examination.

(b) Passes the examination.

Question 2

S1 Examination Question from January 2010 Q1

A jar contains 2 red, 1 blue and 1 green bead.

Two beads are drawn at random from the jar without replacement.

(a) In the space below, draw a tree diagram to illustrate all possible outcomes and associated probabilities.
State your probabilities clearly.

[3 marks]

(b) Find the probability that a blue bead and a green bead are drawn at random from the jar.

[2 marks]

Question 3

S1 Examination Question from May 2009 Q2

On a randomly chosen day the probability that Bill travels to school by car, by bicycle or on foot is $\frac{1}{2}$, $\frac{1}{6}$ and $\frac{1}{3}$ respectively.

The probability of being late when using these methods of travel is $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{1}{10}$ respectively.

(a) Draw a tree diagram to represent this information.

[3 marks]

(b) Find the probability that on a randomly chosen day

(i) Bill travels by foot and is late

(ii) Bill is not late

[4 marks]

(c) Given that Bill is late, find the probability that he did not travel on foot.

[4 marks]

Question 4

There are 10 beads in a box.
n of the beads are red, the others green.
Mavis takes one bead at random from the box and does not replace it.
She takes a second bead at random from the box
The probability that she takes 2 red beads is $\frac{1}{3}$

(i) Show that

$$n^2 - n - 30 = 0$$

(ii) Determine how many of the original beads were red

(iii) What is the probability that both beads chosen were green ?

Question 5

There are *n* beads in a box.
7 of the beads are blue, the others yellow.
Harry takes one bead at random from the box and does not replace it.
He takes a second bead at random from the box
The probability that he takes 2 yellow beads is $\frac{13}{30}$

(i) Determine how many of beads were in the box to begin with

(iii) What is the probability that both beads chosen were blue ?

Question 6

In a box are 12 beads, n of which are orange, the rest purple.
Charles takes one bead at random from the box.
He places it into a second box which already contained 9 beads, m of which were orange, the rest purple.
Charles now takes one bead at random from this second box.
The probability that Charles takes 2 orange beads is $\frac{7}{40}$
The probability that Charles takes 2 purple beads is $\frac{12}{40}$

Determine the values of n and m