Conditional Probability with Tree Diagrams and Two-Way Tables (From Edexcel 6683)

Q1, (Jun 2005, Q7)

In a school there are 148 students in Years 12 and 13 studying Science, Humanities or Arts subjects. Of these students, 89 wear glasses and the others do not. There are 30 Science students of whom 18 wear glasses. The corresponding figures for the Humanities students are 68 and 44 respectively.

A student is chosen at random.

Find the probability that this student

(a) is studying Arts subjects,

(4)

(b) does not wear glasses, given that the student is studying Arts subjects.

(2)

Amongst the Science students, 80% are right-handed. Corresponding percentages for Humanities and Arts students are 75% and 70% respectively.

A student is again chosen at random.

(c) Find the probability that this student is right-handed.

(3)

(d) Given that this student is right-handed, find the probability that the student is studying Science subjects.

(3)

Q2, (Jan 2007, Q2)

In a factory, machines A, B and C are all producing metal rods of the same length. Machine A produces 35% of the rods, machine B produces 25% and the rest are produced by machine C. Of their production of rods, machines A, B and C produce 3%, 6% and 5% defective rods respectively.

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

(3)

(b) Find the probability that a randomly selected rod is

(i) produced by machine A and is defective,

(ii) is defective.

(5)

(c) Given that a randomly selected rod is defective, find the probability that it was produced by machine C.

(3)

Q3, (Jun 2008, Q1)

A disease is known to be present in 2% of a population. A test is developed to help determine whether or not someone has the disease.

Given that a person has the disease, the test is positive with probability 0.95

Given that a person does not have the disease, the test is positive with probability 0.03

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

(3)

A person is selected at random from the population and tested for this disease.

(b) Find the probability that the test is positive.

(3)

A doctor randomly selects a person from the population and tests him for the disease. Given that the test is positive,

(c) find the probability that he does not have the disease.

(2)

(d) Comment on the usefulness of this test.

(1)

Q4, (Jan 2009, Q2)

A group of office workers were questioned for a health magazine and $\frac{2}{5}$ were found to take regular exercise. When questioned about their eating habits $\frac{2}{3}$ said they always eat breakfast and, of those who always eat breakfast $\frac{9}{25}$ also took regular exercise.

Find the probability that a randomly selected member of the group

(a) always eats breakfast and takes regular exercise,

(2)

(b) does not always eat breakfast and does not take regular exercise.

(4)

(c) Determine, giving your reason, whether or not always eating breakfast and taking regular exercise are statistically independent.

(2)

Q5, (Jun 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)

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

(i) Bill travels by foot and is late,

(ii) Bill is not late.

(4)

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

(4)

Q6, (Jun 2012, Q7)

A manufacturer carried out a survey of the defects in their soft toys. It is found that the probability of a toy having poor stitching is 0.03 and that a toy with poor stitching has a probability of 0.7 of splitting open. A toy without poor stitching has a probability of 0.02 of splitting open.

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

(3)

(b) Find the probability that a randomly chosen soft toy has exactly one of the two defects, poor stitching or splitting open.

(3)

The manufacturer also finds that soft toys can become faded with probability 0.05 and that this defect is independent of poor stitching or splitting open. A soft toy is chosen at random.

(c) Find the probability that the soft toy has none of these 3 defects.

(2)

(d) Find the probability that the soft toy has exactly one of these 3 defects.

(4)

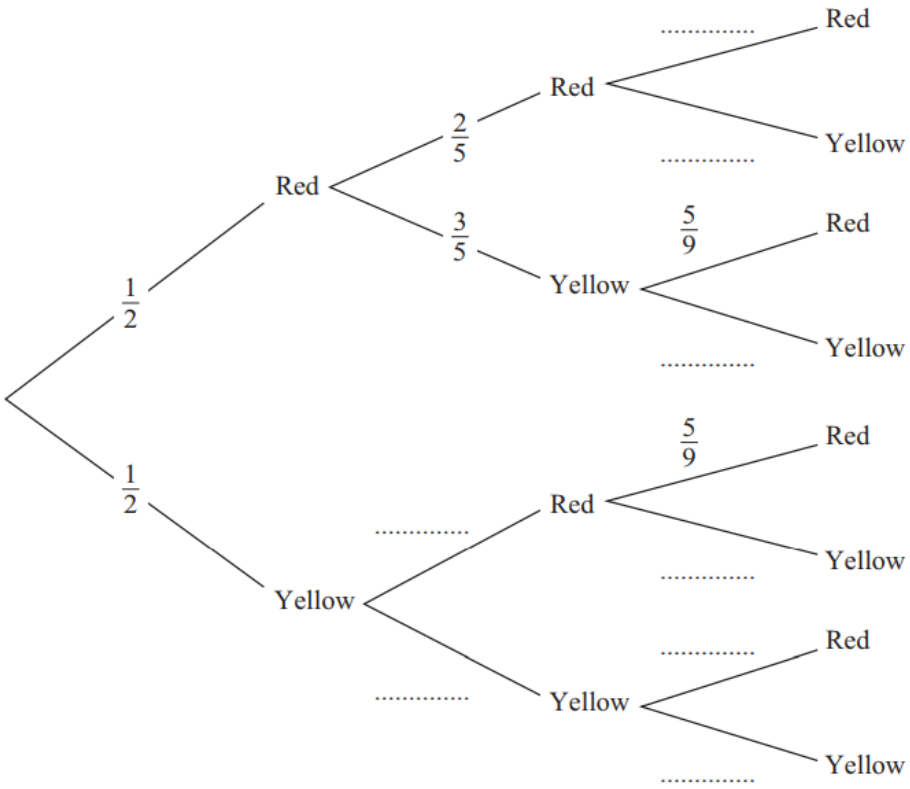
Q7, (Jan 2011, Q7)

The bag P contains 6 balls of which 3 are red and 3 are yellow.
The bag Q contains 7 balls of which 4 are red and 3 are yellow.
A ball is drawn at random from bag P and placed in bag Q. A second ball is drawn at random from bag P and placed in bag Q.
A third ball is then drawn at random from the 9 balls in bag Q.

The event A occurs when the 2 balls drawn from bag P are of the same colour.
The event B occurs when the ball drawn from bag Q is red.

(a) Complete the tree diagram shown below.

(4)



(b) Find P(A)

(3)

(c) Show that $P(B) = \frac{5}{9}$

(3)

(d) Show that $P(A \cap B) = \frac{2}{9}$

(2)

(e) Hence find $P(A \cup B)$

(2)

(f) Given that all three balls drawn are the same colour, find the probability that they are all red.

(3)

Q8, (Jun 2014, Q4)

In a factory, three machines, J, K and L, are used to make biscuits.

Machine J makes 25% of the biscuits.

Machine K makes 45% of the biscuits.

The rest of the biscuits are made by machine L.

It is known that 2% of the biscuits made by machine J are broken, 3% of the biscuits made by machine K are broken and 5% of the biscuits made by machine L are broken.

(a) Draw a tree diagram to illustrate all the possible outcomes and associated probabilities.

(2)

A biscuit is selected at random.

(b) Calculate the probability that the biscuit is made by machine J and is not broken.

(2)

(c) Calculate the probability that the biscuit is broken.

(2)

(d) Given that the biscuit is broken, find the probability that it was not made by machine K.

(3)