May/June 2002

1 Events A and B are such that $P(A) = 0.3$, $P(B) = 0.8$ and $P(A \text{ and } B) = 0.4$. State, giving a reason in each case, whether events A and B are

(i) independent, [2]

(ii) mutually exclusive. [2]

May/June 2003

6 The people living in 3 houses are classified as children (C), parents (P) or grandparents (G). The numbers living in each house are shown in the table below.

House number 1	House number 2	House number 3
$4C$, $1P$, $2G$	$2C$, $2P$, $3G$	$1C$, $1G$

(i) All the people in all 3 houses meet for a party. One person at the party is chosen at random. Calculate the probability of choosing a grandparent. [2]

(ii) A house is chosen at random. Then a person in that house is chosen at random. Using a tree diagram, or otherwise, calculate the probability that the person chosen is a grandparent. [3]

(iii) Given that the person chosen by the method in part (ii) is a grandparent, calculate the probability that there is also a parent living in the house. [4]

May/June 2004

6 When Don plays tennis, 65% of his first serves go into the correct area of the court. If the first serve goes into the correct area, his chance of winning the point is 90%. If his first serve does not go into the correct area, Don is allowed a second serve, and of these, 80% go into the correct area. If the second serve goes into the correct area, his chance of winning the point is 60%. If neither serve goes into the correct area, Don loses the point.

(i) Draw a tree diagram to represent this information. [4]

(ii) Using your tree diagram, find the probability that Don loses the point. [3]

(iii) Find the conditional probability that Don's first serve went into the correct area, given that he loses the point. [2]

May/June 2005

5 Data about employment for males and females in a small rural area are shown in the table.

	Unemployed	Employed
Male	206	412
Female	358	305

A person from this area is chosen at random. Let M be the event that the person is male and let E be the event that the person is employed.

(i) Find $P(M)$. [2]

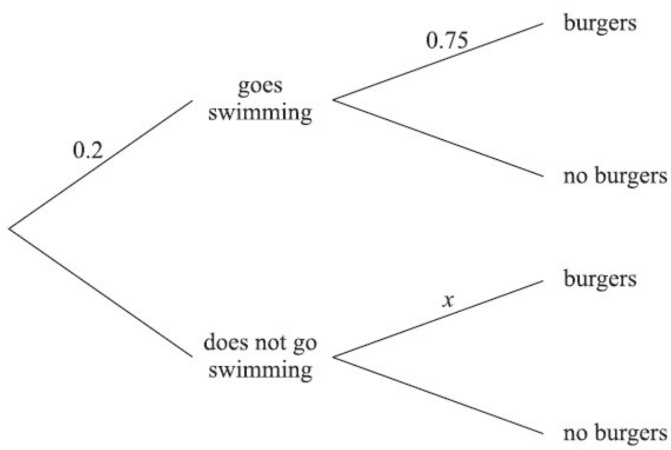
(ii) Find $P(M \text{ and } E)$. [1]

(iii) Are M and E independent events? Justify your answer. [3]

[2]

May/June 2006

2 The probability that Henk goes swimming on any day is 0.2. On a day when he goes swimming, the probability that Henk has burgers for supper is 0.75. On a day when he does not go swimming the probability that he has burgers for supper is x. This information is shown on the following tree diagram.



The probability that Henk has burgers for supper on any day is 0.5.

(i) Find x. [4]

(ii) Given that Henk has burgers for supper, find the probability that he went swimming that day. [2]

May/June 2007

2 Jamie is equally likely to attend or not to attend a training session before a football match. If he attends, he is certain to be chosen for the team which plays in the match. If he does not attend, there is a probability of 0.6 that he is chosen for the team.

(i) Find the probability that Jamie is chosen for the team. [3]

(ii) Find the conditional probability that Jamie attended the training session, given that he was chosen for the team. [3]

May/June 2008

2 In country A 30% of people who drink tea have sugar in it. In country B 65% of people who drink tea have sugar in it. There are 3 million people in country A who drink tea and 12 million people in country B who drink tea. A person is chosen at random from these 15 million people.

(i) Find the probability that the person chosen is from country A. [1]

(ii) Find the probability that the person chosen does not have sugar in their tea. [2]

(iii) Given that the person chosen does not have sugar in their tea, find the probability that the person is from country B. [2]

May/June 2009

5 At a zoo, rides are offered on elephants, camels and jungle tractors. Ravi has money for only one ride. To decide which ride to choose, he tosses a fair coin twice. If he gets 2 heads he will go on the elephant ride, if he gets 2 tails he will go on the camel ride and if he gets 1 of each he will go on the jungle tractor ride.

(i) Find the probabilities that he goes on each of the three rides. [2]

The probabilities that Ravi is frightened on each of the rides are as follows:

elephant ride $\frac{6}{10}$, camel ride $\frac{7}{10}$, jungle tractor ride $\frac{8}{10}$.

(ii) Draw a fully labelled tree diagram showing the rides that Ravi could take and whether or not he is frightened. [2]

Ravi goes on a ride.

(iii) Find the probability that he is frightened. [2]

(iv) Given that Ravi is **not** frightened, find the probability that he went on the camel ride. [3]

Oct/Nov 2001

3 A lecturer wishes to give a message to a student. The probabilities that she uses e-mail, letter or personal contact are 0.4, 0.1 and 0.5 respectively. She uses only one method. The probabilities of the student receiving the message if the lecturer uses e-mail, letter or personal contact are 0.6, 0.8 and 1 respectively.

(i) Find the probability that the student receives the message. [3]

(ii) Given that the student receives the message, find the conditional probability that he received it via e-mail. [3]

4 A survey was made of the number of people attending church services on one particular Sunday morning. A random sample of 500 churches was taken. The results are as follows.

Number of people attending	1–20	21–40	41–60	61–100	101–200	201–300
Number of churches	46	110	122	100	86	36

(i) Draw a histogram on graph paper to represent these results. [5]

(ii) Find the probability that, in each of 3 churches chosen at random from the sample, the number of people attending was less than 61. [2]

Oct/Nov 2002

2 Ivan throws three fair dice.

(i) List all the possible scores on the three dice which give a total score of 5, and hence show that the probability of Ivan obtaining a total score of 5 is $\frac{1}{36}$. [3]

(ii) Find the probability of Ivan obtaining a total score of 7. [3]

5 Rachel and Anna play each other at badminton. Each game results in either a win for Rachel or a win for Anna. The probability of Rachel winning the first game is 0.6. If Rachel wins a particular game, the probability of her winning the next game is 0.7, but if she loses, the probability of her winning the next game is 0.4. By using a tree diagram, or otherwise,

(i) find the conditional probability that Rachel wins the first game, given that she loses the second, [5]

(ii) find the probability that Rachel wins 2 games and loses 1 game out of the first three games they play. [4]

Oct/Nov 2003

5 In a certain country 54% of the population is male. It is known that 5% of the males are colour-blind and 2% of the females are colour-blind. A person is chosen at random and found to be colour-blind. By drawing a tree diagram, or otherwise, find the probability that this person is male. [6]

Oct/Nov 2004

3 When Andrea needs a taxi, she rings one of three taxi companies, A, B or C. 50% of her calls are to taxi company A, 30% to B and 20% to C. A taxi from company A arrives late 4% of the time, a taxi from company B arrives late 6% of the time and a taxi from company C arrives late 17% of the time.

(i) Find the probability that, when Andrea rings for a taxi, it arrives late. [3]

(ii) Given that Andrea's taxi arrives late, find the conditional probability that she rang company B. [3]

Oct/Nov 2005

1 A study of the ages of car drivers in a certain country produced the results shown in the table.

Percentage of drivers in each age group

	Young	Middle-aged	Elderly
Males	40	35	25
Females	20	70	10

Illustrate these results diagrammatically. [4]

2 Boxes of sweets contain toffees and chocolates. Box A contains 6 toffees and 4 chocolates, box B contains 5 toffees and 3 chocolates, and box C contains 3 toffees and 7 chocolates. One of the boxes is chosen at random and two sweets are taken out, one after the other, and eaten.

(i) Find the probability that they are both toffees. [3]

(ii) Given that they are both toffees, find the probability that they both came from box A. [3]

Oct/Nov 2006

4 Two fair dice are thrown.

(i) Event A is 'the scores differ by 3 or more'. Find the probability of event A. [3]

(ii) Event B is 'the product of the scores is greater than 8'. Find the probability of event B. [2]

(iii) State with a reason whether events A and B are mutually exclusive. [2]

Oct/Nov 2007

7 Box A contains 5 red paper clips and 1 white paper clip. Box B contains 7 red paper clips and 2 white paper clips. One paper clip is taken at random from box A and transferred to box B. One paper clip is then taken at random from box B.

(i) Find the probability of taking both a white paper clip from box A and a red paper clip from box B. [2]

(ii) Find the probability that the paper clip taken from box B is red. [2]

(iii) Find the probability that the paper clip taken from box A was red, given that the paper clip taken from box B is red. [2]

Oct/Nov 2008

6 There are three sets of traffic lights on Karinne's journey to work. The independent probabilities that Karinne has to stop at the first, second and third set of lights are 0.4, 0.8 and 0.3 respectively.

(i) Draw a tree diagram to show this information. [2]

(ii) Find the probability that Karinne has to stop at each of the first two sets of lights but does not have to stop at the third set. [2]

(iii) Find the probability that Karinne has to stop at exactly two of the three sets of lights. [3]

(iv) Find the probability that Karinne has to stop at the first set of lights, given that she has to stop at exactly two sets of lights. [3]

Oct/Nov 2009/11

6 A box contains 4 pears and 7 oranges. Three fruits are taken out at random and eaten. Find the probability that

(i) 2 pears and 1 orange are eaten, in any order, [3]

(ii) the third fruit eaten is an orange, [3]

(iii) the first fruit eaten was a pear, given that the third fruit eaten is an orange. [3]

Oct/Nov 2009/12

3 Maria chooses toast for her breakfast with probability 0.85. If she does not choose toast then she has a bread roll. If she chooses toast then the probability that she will have jam on it is 0.8. If she has a bread roll then the probability that she will have jam on it is 0.4.

(i) Draw a fully labelled tree diagram to show this information. [2]

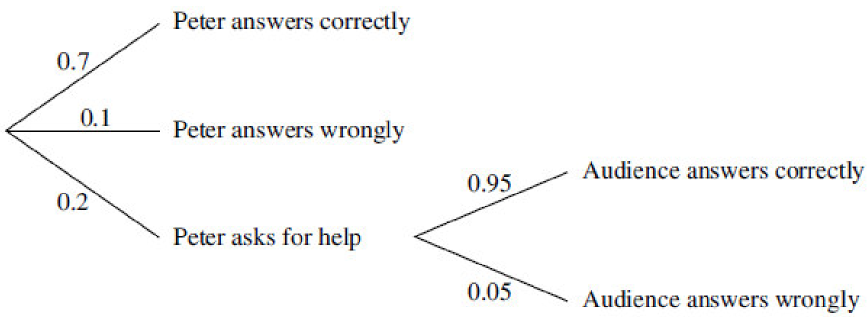
(ii) Given that Maria did **not** have jam for breakfast, find the probability that she had toast. [4]

May/June 2010/61

7 In a television quiz show Peter answers questions one after another, stopping as soon as a question is answered wrongly.

- The probability that Peter gives the correct answer himself to any question is 0.7.
- The probability that Peter gives a wrong answer himself to any question is 0.1.
- The probability that Peter decides to ask for help for any question is 0.2.

On the first occasion that Peter decides to ask for help he asks the audience. The probability that the audience gives the correct answer to any question is 0.95. This information is shown in the tree diagram below.



(i) Show that the probability that the first question is answered correctly is 0.89. [1]

On the second occasion that Peter decides to ask for help he phones a friend. The probability that his friend gives the correct answer to any question is 0.65.

(ii) Find the probability that the first two questions are both answered correctly. [6]

(iii) Given that the first two questions were both answered correctly, find the probability that Peter asked the audience. [3]

May/June 2010/62

5 Two fair twelve-sided dice with sides marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 are thrown, and the numbers on the sides which land face down are noted. Events Q and R are defined as follows.

Q : the product of the two numbers is 24.

R : both of the numbers are greater than 8.

(i) Find $\mathrm{P}(Q)$. [2]

(ii) Find $\mathrm{P}(R)$. [2]

(iii) Are events Q and R exclusive? Justify your answer. [2]

(iv) Are events Q and R independent? Justify your answer. [2]

May/June 2010/63

1 A bottle of sweets contains 13 red sweets, 13 blue sweets, 13 green sweets and 13 yellow sweets. 7 sweets are selected at random. Find the probability that exactly 3 of them are red. [3]

3 Christa takes her dog for a walk every day. The probability that they go to the park on any day is 0.6. If they go to the park there is a probability of 0.35 that the dog will bark. If they do not go to the park there is a probability of 0.75 that the dog will bark.

(i) Find the probability that they go to the park on more than 5 of the next 7 days. [2]

(ii) Find the probability that the dog barks on any particular day. [2]

(iii) Find the variance of the number of times they go to the park in 30 days. [1]

Oct/Nov 2010/61

5 Three friends, Rick, Brenda and Ali, go to a football match but forget to say which entrance to the ground they will meet at. There are four entrances, A, B, C and D. Each friend chooses an entrance independently.

- The probability that Rick chooses entrance A is $\frac{1}{3}$. The probabilities that he chooses entrances B, C or D are all equal.
- Brenda is equally likely to choose any of the four entrances.
- The probability that Ali chooses entrance C is $\frac{2}{7}$ and the probability that he chooses entrance D is $\frac{3}{5}$. The probabilities that he chooses the other two entrances are equal.

(i) Find the probability that at least 2 friends will choose entrance B. [4]

(ii) Find the probability that the three friends will all choose the same entrance. [4]

Oct/Nov 2010/62

3 A fair five-sided spinner has sides numbered 1, 2, 3, 4, 5. Raj spins the spinner and throws two fair dice. He calculates his score as follows.

- If the spinner lands on an **even-numbered** side, Raj **multiplies** the two numbers showing on the dice to get his score.
- If the spinner lands on an **odd-numbered** side, Raj **adds** the numbers showing on the dice to get his score.

Given that Raj's score is 12, find the probability that the spinner landed on an even-numbered side. [6]

Oct/Nov 2010/63

3 It was found that 68% of the passengers on a train used a cell phone during their train journey. Of those using a cell phone, 70% were under 30 years old, 25% were between 30 and 65 years old and the rest were over 65 years old. Of those not using a cell phone, 26% were under 30 years old and 64% were over 65 years old.

(i) Draw a tree diagram to represent this information, giving all probabilities as decimals. [2]

(ii) Given that one of the passengers is 45 years old, find the probability of this passenger using a cell phone during the journey. [3]