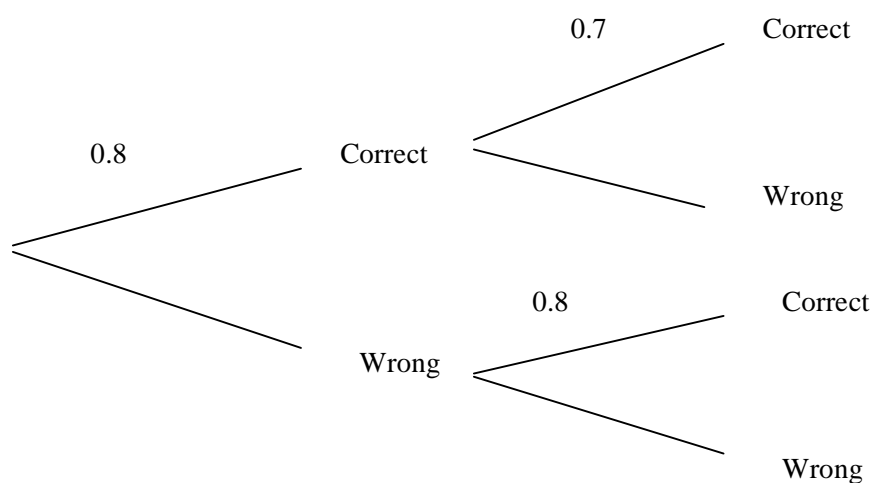


Tree diagrams and conditional probability

IB SL/HL

1. A computer program generates random questions in arithmetic that children have to answer within a fixed time. The probability of the question being answered correctly is 0.8. Whenever a question is answered correctly, the next question generated is more difficult, and the probability of a correct answer being given is reduced by 0.1. Whenever a question is answered wrongly, the next question is of the same standard, and the probability of a correct answer remains unchanged. The following tree diagram shows this information for the first two questions generated.



- a) Find the probability that the second question is answered correctly. [2]
- b) By extending the tree diagram, or otherwise, find the probability that the second question is answered correctly given that the third question is answered correctly. [4]
2. A box contains 20 chocolates, of which 15 have soft centres and 5 have hard centres. Two chocolates are taken at random, one after the other. Calculate the probability that,
- a) both chocolates have soft centres, [2]
- b) one of each chocolate is taken, [2]
- c) both chocolates have hard centres, given that the second chocolate has a hard centre. [4]

3. A student who is traveling by train through Europe decides not to buy a ticket for the train. The train is traveling through both France and Germany and as such he may be asked to show his ticket to either the French or the German train guard.

The probability of being caught without a ticket by the German guard is 0.8, and the probability of getting caught by the French guard is 0.3. The probabilities of each are independent from one another.

- a) Draw a tree diagram to represent the information in the paragraph above. [3]
- b) Calculate the probability of being caught by both guards. [2]
- c) Given that the student has been caught by one of the guards only, find the probability that he was caught by,
- i) the French guard,
 - ii) the German guard. [4]
4. A bus serving a number of outlying villages is due to arrive in a particular village at 10 o'clock. Past experience tells the people waiting in the village for the bus that the probability of the service being cancelled on any day is 0.05, and that, when it runs, the probability of the bus being more than 10 minutes late is 0.1.

Using a tree diagram, or otherwise, find the conditional probability that the service has been cancelled, given that at 10 minutes past 10 the bus has not arrived in the village. [6]

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Answers

1. a) 0.72

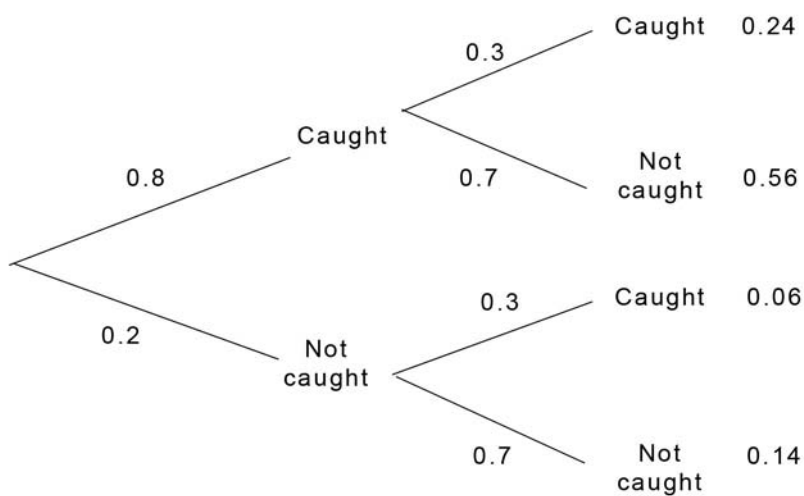
b) $\frac{56}{81}$

2. a) $\frac{21}{38}$

b) $\frac{15}{38}$

c) $\frac{4}{19}$

3. a)



b) 0.24

c) i) $\frac{3}{31}$

ii) $\frac{28}{31}$

4. $\frac{10}{29}$