

Discrete Random Variables 2

Q1.

The probability that Sue completes a Sudoku puzzle correctly is 0.75.

- (i) Sue attempts n Sudoku puzzles. Find the least value of n for which the probability that she completes all n puzzles correctly is less than 0.06. [3]

Sue attempts 14 Sudoku puzzles every month. The number that she completes successfully is denoted by X .

- (ii) Find the value of X that has the highest probability. You may assume that this value is one of the two values closest to the mean of X . [3]
- (iii) Find the probability that in exactly 3 of the next 5 months Sue completes more than 11 Sudoku puzzles correctly. [5]
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Q2.

A team of 4 is to be randomly chosen from 3 boys and 5 girls. The random variable X is the number of girls in the team.

- (i) Draw up a probability distribution table for X . [4]
- (ii) Given that $E(X) = \frac{5}{2}$, calculate $\text{Var}(X)$. [2]
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Q3.

A triangular spinner has one red side, one blue side and one green side. The red side is weighted so that the spinner is four times more likely to land on the red side than on the blue side. The green side is weighted so that the spinner is three times more likely to land on the green side than on the blue side.

- (i) Show that the probability that the spinner lands on the blue side is $\frac{1}{8}$. [1]
- (ii) The spinner is spun 3 times. Find the probability that it lands on a different coloured side each time. [3]
- (iii) The spinner is spun 136 times. Use a suitable approximation to find the probability that it lands on the blue side fewer than 20 times. [5]
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Q4.

A factory makes a large number of ropes with lengths either 3 m or 5 m. There are four times as many ropes of length 3 m as there are ropes of length 5 m.

- (i) One rope is chosen at random. Find the expectation and variance of its length. [4]
 - (ii) Two ropes are chosen at random. Find the probability that they have different lengths. [2]
 - (iii) Three ropes are chosen at random. Find the probability that their total length is 11 m. [3]
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Q5.

A spinner has 5 sides, numbered 1, 2, 3, 4 and 5. When the spinner is spun, the score is the number of the side on which it lands. The score is denoted by the random variable X , which has the probability distribution shown in the table.

x	1	2	3	4	5
$P(X = x)$	0.3	0.15	$3p$	$2p$	0.05

- (i) Find the value of p . [1]

A second spinner has 3 sides, numbered 1, 2 and 3. The score when this spinner is spun is denoted by the random variable Y . It is given that $P(Y = 1) = 0.3$, $P(Y = 2) = 0.5$ and $P(Y = 3) = 0.2$.

- (ii) Find the probability that, when both spinners are spun together,
 - (a) the sum of the scores is 4, [3]
 - (b) the product of the scores is less than 8. [3]
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Q6.

In a certain mountainous region in winter, the probability of more than 20 cm of snow falling on any particular day is 0.21.

- (i) Find the probability that, in any 7-day period in winter, fewer than 5 days have more than 20 cm of snow falling. [3]
 - (ii) For 4 randomly chosen 7-day periods in winter, find the probability that exactly 3 of these periods will have at least 1 day with more than 20 cm of snow falling. [4]
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Q7.

The random variable X has the probability distribution shown in the table.

x	2	4	6
$P(X = x)$	0.5	0.4	0.1

Two independent values of X are chosen at random. The random variable Y takes the value 0 if the two values of X are the same. Otherwise the value of Y is the larger value of X minus the smaller value of X .

- (i) Draw up the probability distribution table for Y . [4]
- (ii) Find the expected value of Y . [1]
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Q8.

The six faces of a fair die are numbered 1, 1, 1, 2, 3, 3. The score for a throw of the die, denoted by the random variable W , is the number on the top face after the die has landed.

- (i) Find the mean and standard deviation of W . [3]
- (ii) The die is thrown twice and the random variable X is the sum of the two scores. Draw up a probability distribution table for X . [4]
- (iii) The die is thrown n times. The random variable Y is the number of times that the score is 3. Given that $E(Y) = 8$, find $\text{Var}(Y)$. [3]
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Q9.

Lengths of rolls of parcel tape have a normal distribution with mean 75 m, and 15% of the rolls have lengths less than 73 m.

- (i) Find the standard deviation of the lengths. [3]

Alison buys 8 rolls of parcel tape.

- (ii) Find the probability that fewer than 3 of these rolls have lengths more than 77 m. [3]
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