FS1 (Year 2) – Geometric and Negative Binomial Distribution Exam Questions (Edexcel)

Q1.

Indre works on reception in an office and deals with all the telephone calls that arrive. Calls arrive randomly and, in a 4-hour morning shift, there are on average 80 calls.

(a) Using a suitable model, find the probability of more than 4 calls arriving in a particular 20-minute period one morning.

(3)

Indre is allowed 20 minutes of break time during each 4-hour morning shift, which she can take in 5-minute periods. When she takes a break, a machine records details of any call in the office that Indre has missed.

One morning Indre took her break time in 4 periods of 5 minutes each.

(b) Find the probability that in exactly 3 of these periods there were no calls.

(2)

On another occasion Indre took 1 break of 5 minutes and 1 break of 15 minutes.

(c) Find the probability that Indre missed exactly 1 call in each of these 2 breaks.

(3)

(Total for question = 8 marks)

(Q02 9FM0/03B, June 2019)

Q2.

Each time a spinner is spun, the probability that it lands on red is 0.2

(a) Find the probability that the spinner lands on red

(i) for the 1st time on the 4th spin

(2)

(ii) for the 3rd time on the 8th spin

(2)

(iii) exactly 4 times during 10 spins

(2)

Each time the spinner is spun, the probability that it lands on yellow is 0.4

In a game with this spinner, a player must choose one of two events

R is the event that the spinner lands on **red** for the **1st** time in at most 4 spins
Y is the event that the spinner lands on **yellow** for the **3rd** time in at most 7 spins

(b) Showing your calculations clearly, determine which of these events has the greater probability.

(7)

(Total for question = 13 marks)

(Q07 9FM0/03B, June 2023)

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Q3.

Asha, Davinda and Jerry each have a bag containing a large number of counters, some of which are white and the rest are red.

Each person draws counters from their bag one at a time, notes the colour of the counter and returns it to their bag.

The probability of Asha getting a red counter on any one draw is 0.07

(a) Find the probability that Asha will draw at least 3 white counters before a red counter is drawn.

(2)

(b) Find the probability that Asha gets a red counter for the second time on her 9th draw.

(2)

The probability of Davinda getting a red counter on any one draw is p.

Davinda draws counters until she gets n red counters. The random variable D is the number of counters Davinda draws.

Given that the mean and the standard deviation of D are 4400 and 660 respectively,

(c) find the value of p.

(4)

Jerry believes that his bag contains a smaller proportion of red counters than Asha's bag. To test his belief, Jerry draws counters from his bag until he gets a red counter. Jerry defines the random variable J to be the number of counters drawn up to and including the first red counter.

(d) Stating your hypotheses clearly and using a 10% level of significance, find the critical region for this test.

(5)

Jerry gets a red counter for the first time on his 34th draw.

(e) Giving a reason for your answer, state whether or not there is evidence that Jerry's bag contains a smaller proportion of red counters than Asha's bag.

(2)

Given that the probability of Jerry getting a red counter on any one draw is 0.011

(f) show that the power of the test is 0.702 to 3 significant figures.

(3)

(Total for question = 18 marks)

(Q05 9FM0/03B, Oct 2021)

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Q4.

In a game a spinner is spun repeatedly. When the spinner is spun, the probability of it landing on blue is 0.11

(a) Find the probability that the spinner lands on blue

(i) for the first time on the 6th spin,

(2)

(ii) for the first time before the 6th spin,

(2)

(iii) exactly 4 times during the first 6 spins,

(2)

(iv) for the 4th time on or before the 6th spin.

(4)

Zac and Izana play the game. They take turns to spin the spinner. The winner is the first one to have the spinner land on blue. Izana spins the spinner first.

(b) Show that the probability of Zac winning is 0.471 to 3 significant figures.

(3)

(Total for question = 13 marks)

(Q04 9FM0/03B, June 2022)

Q5.

A spinner can land on red or blue. When the spinner is spun, there is a probability of $\frac{1}{3}$ that it lands on blue. The spinner is spun repeatedly.

The random variable B represents the number of the spin when the spinner first lands on blue.

(a) Find (i) $P(B = 4)$

(ii) $P(B \leq 5)$

(4)

(b) Find $E(B^2)$

(3)

Steve invites Tamara to play a game with this spinner.

Tamara must choose a colour, either red or blue.

Steve will spin the spinner repeatedly until the spinner first lands on the colour Tamara has chosen. The random variable X represents the number of the spin when this occurs.

If Tamara chooses red, her score is e^X

If Tamara chooses blue, her score is X^2

(c) State, giving your reasons and showing any calculations you have made, which colour you would recommend that Tamara chooses.

(5)

(Total for question = 12 marks)

(Q07 9FM0/03B, June 2019)

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Q6.

The probability of winning a prize when playing a single game of *Pento* is $\frac{1}{5}$

When more than one game is played the games are independent.

Sam plays 20 games.

(a) Find the probability that Sam wins 4 or more prizes.

(2)

Tessa plays a series of games.

(b) Find the probability that Tessa wins her 4th prize on her 20th game.

(2)

Rama invites Sam and Tessa to play some new games of *Pento*.

They must pay Rama £1 for each game they play but Rama will pay them £2 for the first time they win a prize, £4 for the second time and £($2w$) when they win their wth prize ($w > 2$)

Sam decides to play n games of *Pento* with Rama.

(c) Show that Sam's expected profit is $£\frac{1}{25}\left(n^2 - 16n\right)$

(6)

Given that Sam chose $n = 15$

(d) find the probability that Sam does not make a loss.

(4)

Tessa agrees to play *Pento* with Rama. She will play games until she wins r prizes and then she will stop.

(e) Find, in terms of r, Tessa's expected profit.

(4)

(Total for question = 18 marks)

(Q07 9FM0/03B, June 2024)

Q7.

The probability of Richard winning a prize in a game at the fair is 0.15

Richard plays a number of games.

(a) Find the probability of Richard winning his second prize on his 8th game,

(2)

(b) State two assumptions that have to be made, for the model used in part (a) to be valid.

(2)

Mary plays the same game, but has a different probability of winning a prize. She plays until she has won r prizes. The random variable G represents the total number of games Mary plays.

(c) Given that the mean and standard deviation of G are 18 and 6 respectively, determine whether Richard or Mary has the greater probability of winning a prize in a game.

(4)

(Total for question = 8 marks)

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(Q05 9FM0/3B-4B, Specimen papers)

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