FS1 (Year 1) – The Poisson and inomial Distribution Exam Questions (Edexcel)

Q1.

Patients arrive at a hospital accident and emergency department at random at a rate of 6 per hour.

(a) Find the probability that, during any 90 minute period, the number of patients arriving at the hospital accident and emergency department is

(i) exactly 7
(ii) at least 10

(5)

A patient arrives at 11.30 a.m.

(b) Find the probability that the next patient arrives before 11.45 a.m.

(3)

(Total 8 marks)

(Q01 6684/01, June 2014)

Q2.

(a) Write down the conditions under which the Poisson distribution may be used as an approximation to the Binomial distribution.

(2)

A call centre routes incoming telephone calls to agents who have specialist knowledge to deal with the call. The probability of the caller being connected to the wrong agent is 0.01

(b) Find the probability that 2 consecutive calls will be connected to the wrong agent.

(2)

(c) Find the probability that more than 1 call in 5 consecutive calls are connected to the wrong agent.

(3)

The call centre receives 1000 calls each day.

(d) Find the mean and variance of the number of wrongly connected calls.

(3)

(e) Use a Poisson approximation to find, to 3 decimal places, the probability that more than 6 calls each day are connected to the wrong agent.

(2)

(Total 12 marks)

(Q03 6684/01, June 2007)

Q3.
An engineering company manufactures an electronic component. At the end of the manufacturing process, each component is checked to see if it is faulty. Faulty components are detected at a rate of 1.5 per hour.

(a) Suggest a suitable model for the number of faulty components detected per hour.

(1)

(b) Describe, in the context of this question, two assumptions you have made in part (a) for this model to be suitable.

(2)

(c) Find the probability of 2 faulty components being detected in a 1 hour period.

(2)

(d) Find the probability of at least one faulty component being detected in a 3 hour period.

(3)

(Total 8 marks)

(Q02 6684/01, June 2007)

Q4.
A disease occurs in 3% of a population.

(a) State any assumptions that are required to model the number of people with the disease in a random sample of size n as a binomial distribution.

(2)

(b) Using this model, find the probability of exactly 2 people having the disease in a random sample of 10 people.

(3)

(c) Find the mean and variance of the number of people with the disease in a random sample of 100 people.

(2)

A doctor tests a random sample of 100 patients for the disease. He decides to offer all patients a vaccination to protect them from the disease if more than 5 of the sample have the disease.

(d) Using a suitable approximation, find the probability that the doctor will offer all patients a vaccination.

(3)

(Total 10 marks)
(Q02 6684/01, Jan 2011)

Q5.
(a) Write down the conditions under which the Poisson distribution can be used as an approximation to the binomial distribution.

(2)

The probability of any one letter being delivered to the wrong house is 0.01 On a randomly selected day Peter delivers 1000 letters.

(b) Using a Poisson approximation, find the probability that Peter delivers at least 4 letters to the wrong house.

Give your answer to 4 decimal places.

(3)

(Total 5 marks)
(Q02 6684/01, Jan 2013)

Q6.

A plumbing company receives call-outs during the working day at an average rate of 2.4 per hour.

(a) Find the probability that the company receives exactly 7 call-outs in a randomly selected 3-hour period of a working day

(2)

The company has enough staff to respond to 28 call-outs in an 8-hour working day.

(b) Show that the probability that the company receives more than 28 call-outs in a randomly selected 8-hour working day is 0.022 to 3 decimal places.

(2)

In a random sample of 100 working days each of 8 hours,

(c) (i) find the expected number of days that the company receives more than 28 call-outs,

(1)

(ii) find the standard deviation of the number of days that the company receives more than 28 call-outs,

(2)

(iii) use a Poisson approximation to estimate the probability that the company receives more than 28 call-outs on at least 6 of these days.

(3)

(Total for question = 10 marks)

(Q01 8FM0/23, Oct 2020)

Q7.

Two car hire companies hire cars independently of each other.

Car Hire *A* hires cars at a rate of 2.6 cars per hour.

Car Hire *B* hires cars at a rate of 1.2 cars per hour.

(a) In a 1 hour period, find the probability that each company hires exactly 2 cars.

(2)

(b) In a 1 hour period, find the probability that the total number of cars hired by the two companies is 3

(2)

(c) In a 2 hour period, find the probability that the total number of cars hired by the two companies is less than 9

(2)

On average, 1 in 250 new cars produced at a factory has a defect.

In a random sample of 600 new cars produced at the factory,

(d) (i) find the mean of the number of cars with a defect,

(ii) find the variance of the number of cars with a defect.

(2)

(e) (i) Use a Poisson approximation to find the probability that no more than 4 of the cars in the sample have a defect.

(ii) Give a reason to support the use of a Poisson approximation.

(2)

(Total for question = 10 marks)

Q03 8FM0/2G/sA, Specimen papers)

Q8.
A cloth manufacturer knows that faults occur randomly in the production process at a rate of 2 every 15 metres.

(a) Find the probability of exactly 4 faults in a 15 metre length of cloth.

(2)

(b) Find the probability of more than 10 faults in 60 metres of cloth.

(3)

A retailer buys a large amount of this cloth and sells it in pieces of length x metres. He chooses x so that the probability of no faults in a piece is 0.80

(c) Write down an equation for x and show that $x = 1.7$ to 2 significant figures.

(4)

The retailer sells 1200 of these pieces of cloth. He makes a profit of 60p on each piece of cloth that does not contain a fault but a loss of £1.50 on any pieces that do contain faults.

(d) Find the retailer's expected profit.

(4)

(Total 13 marks)
(Q03 6684/01, June 2009)

Q9.
Bhim and Joe play each other at badminton and for each game, independently of all others, the probability that Bhim loses is 0.2

Find the probability that, in 9 games, Bhim loses

(a) exactly 3 of the games,

(3)

(b) fewer than half of the games.

(2)

Bhim attends coaching sessions for 2 months. After completing the coaching, the probability that he loses each game, independently of all others, is 0.05

Bhim and Joe agree to play a further 60 games.

(c) Calculate the mean and variance for the number of these 60 games that Bhim loses.

(2)

(d) Using a suitable approximation calculate the probability that Bhim loses more than 4 games.

(3)

(Total 10 marks)
(Q02 6684/01, June 2010)