3. The probability of a telesales representative making a sale on a customer call is 0.15

Find the probability that

(a) no sales are made in 10 calls,

(2)

(b) more than 3 sales are made in 20 calls.

(2)

Representatives are required to achieve a mean of at least 5 sales each day.

(c) Find the least number of calls each day a representative should make to achieve this requirement.

(2)

(d) Calculate the least number of calls that need to be made by a representative for the probability of at least 1 sale to exceed 0.95

(3)

1. 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)

2. 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)

1. A manufacturer supplies DVD players to retailers in batches of 20. It has 5% of the players returned because they are faulty.

(a) Write down a suitable model for the distribution of the number of faulty DVD players in a batch.

(2)

Find the probability that a batch contains

(b) no faulty DVD players,

(2)

(c) more than 4 faulty DVD players.

(2)

(d) Find the mean and variance of the number of faulty DVD players in a batch.

(2)

1. A bag contains a large number of counters of which 15% are coloured red. A random sample of 30 counters is selected and the number of red counters is recorded.

(a) Find the probability of no more than 6 red counters in this sample.

(2)

A second random sample of 30 counters is selected and the number of red counters is recorded.

(b) Using a Poisson approximation, estimate the probability that the total number of red counters in the combined sample of size 60 is less than 13.

(3)

June 2009

5. A factory produces components of which 1% are defective. The components are packed in boxes of 10. A box is selected at random.

(a) Find the probability that the box contains exactly one defective component.

(2)

(b) Find the probability that there are at least 2 defective components in the box.

(3)

(c) Using a suitable approximation, find the probability that a batch of 250 components contains between 1 and 4 (inclusive) defective components.

(4)

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5. Sue throws a fair coin 15 times and records the number of times it shows a head.

    (a) State the distribution to model the number of times the coin shows a head.

    (2)

    Find the probability that Sue records

    (b) exactly 8 heads,

    (2)

    (c) at least 4 heads.

    (2)

    Sue has a different coin which she believes is biased in favour of heads. She throws the coin 15 times and obtains 13 heads.

    (d) Test Sue's belief at the 1% level of significance. State your hypotheses clearly.

    (6)