5.4 Exercise

Question 1

A binomial random variable X has the distribution $X \sim B(250, 0.44)$
It is to be approximated with a normal distribution, $Y \sim N(\mu, \sigma^2)$.

(i) Calculate the value of μ

(ii) Calculate the value of σ

Question 2

(a) For the random variable $X \sim B(325, 0.55)$ determine a suitable normal distribution, Y, that could be used as an approximation.

(b) Use your part (a) normal approximation to estimate

(i) $P(X \leqslant 186)$

(ii) $P(170 \leqslant X \leqslant 182)$

(iii) $P(X \geqslant 190)$

Question 3

S2 Examination Question from January 2004, Q3

The discrete random variable X is distributed $B(n, p)$

(a) Write down the value of p that will give the most accurate estimate when approximating the binomial distribution by a normal distribution.

[1 mark]

(b) Give a reason to support your value.

[1 mark]

(c) Given that $n = 200$ and $p = 0.48$, find $P(90 \leqslant X < 105)$ by using an appropriate approximating normal distribution.

[7 marks]

Question 4

S2 Examination Question from January 2007, Q3

For a particular type of plant 45% have white flowers and the remainder have coloured flowers. Gardenmania sells plants in batches of 12.
A batch is selected at random.

Calculate the probability this batch contains

(a) exactly 5 plants with white flowers

[3 marks]

(b) more plants with white flowers than coloured flowers

[2 marks]

Gardenmania takes a random sample of 10 batches of plants

(c) Find the probability that exactly 3 of these batches contain more plants with white flowers than coloured flowers

[3 marks]

Due to an increasing demand for these plants by large companies, Gardenmania decides to sell them in batches of 50

(d) Use a suitable approximation to calculate the probability that a batch of 50 plants contains more than 25 plants with white flowers

[7 marks]

Question 5

At a Rolling Stones concert, 57% of the audience are male and 43% are female. A random sample of 80 members in the audience are invited backstage after the concert. Using a suitable approximation, find the probability that more than half of the sample are male.

[6 marks]

Question 6

Bikx-U-Scoff manufactures biscuits which are packed at random in boxes, each box containing 20 biscuits. The company produces 45% chocolate biscuits, the remainder being plain biscuits.

A box is selected at random from the production line.

(a) Calculate the probability that this box contains more chocolate biscuits than plain biscuits.

The Bikx-U-Scoff company quality assurance manager takes a random sample of 10 boxes of biscuits.

(b) Calculate the probability that exactly 4 of them contain more chocolate biscuits than plain biscuits.

For a special order, Bikx-U-Scoff produces a box containing 120 biscuits.

(c) Using a suitable normal distribution approximation, calculate the probability that this box contains at least 50 but not more than 60 chocolate biscuits.

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