

1 The discrete random variable $X \sim B(20, 0.41)$

(a) Find $P(3 < X \leq 7)$

(2)

(b) Previous research by a restaurant found that 30% of customers will order a starter.
On one day a random sample of 40 customers is taken and 7 order a starter.

Test at the 5% significance level whether the proportion of customers ordering a starter has decreased.

(5)

(c) State the conclusion you would have reached if you tested at the 10% significance level.

(1)

(Total for question 1 is 8 marks)

2 The discrete random variable $X \sim B(30, 0.58)$

(a) Find $P(X \geq 12)$

(2)

(b) A cafe expects 30% of customers to order a coffee with their breakfast. On one particular day a random sample of 40 customers that ordered breakfast is taken and 19 of them ordered a coffee. Test at the 1% significance level whether the proportion of customers ordering a coffee had increased. State your hypotheses clearly.

(5)

(c) State the conclusion you would have reached if a 5% significance level had been used for this test.

(1)

(Total for question 2 is 8 marks)

3 The chance of getting a 3 on a fair spinner is $\frac{1}{4}$. The spinner is spun 12 times.

(ai) Find the probability that the spinner lands on 3 exactly 2 times.

(1)

(aii) Find the probability that the spinner lands on 3 more than 4 times.

(2)

(b) Alex believes that the spinner is not fair and the chance of the spinner landing on 3 is greater than $\frac{1}{4}$. To test this claim she spins the spinner 40 times and the spinner lands on 3 15 times. Stating your hypotheses clearly, test Alex's claim at the 5% significance level.

(4)

(Total for question 3 is 7 marks)

- 4** The chance of a webpage visitor clicking on a link is 0.15. Angela believes that increasing the font size for the link will increase the proportion of visitors that click on the link.

After increasing the font size a sample of 90 visitors is taken and 20 clicked on the link.

Stating your hypotheses clearly test, at the 5% level of significance, whether or not there is evidence to support Angela's belief.

(Total for question 4 is 5 marks)

5 Billy plays darts. He assumes that each dart throw is independent and he knows from past experience that the probability of hitting the bullseye is 0.2

(a) Billy throws 9 darts. Calculate the probability that at least 3 of the darts will hit the bullseye.

(2)

(b) Billy believes he has improved and the chance of hitting the bullseye is greater than 0.2. He throws 20 darts and 6 hit the bullseye. Stating your hypotheses clearly test, at the 5% level of significance, whether or not there is evidence to support Billy's belief.

(4)

(Total for question 5 is 6 marks)

6 A company produces pens. The probability that any pen is defective is 0.08.

(a) A sample of 15 pens is taken. Find the probability that 2 or more pens are defective.

(2)

(b) An employee claims that the probability that a pen is defective is more than 0.08. They take a sample of 20 pens and 3 are defective. Stating your hypothesis clearly, test the employee's claim at the 5% significance level.

(5)

(Total for question 6 is 7 marks)

7 Andy plays tennis. The probability that Andy will get one of his serves in court is 60%.

(ai) Andy serves 20 times. Find the probability Andy gets exactly 15 serves in court.

(1)

(aii) Andy serves 20 times. Find the probability more than 15 of the serves will be in court.

(2)

(b) Andy's coach thinks that the probability of Andy getting a serve in court has changed. Andy serves 50 times in a set and 35 are in court. Stating your hypothesis clearly, test the coach's claim at the 10% significance level.

(4)

(Total for question 7 is 7 marks)

8 The probability of a bias dice landing on 6 is 0.4. The dice is going to be rolled 20 times.

(a) Find the probability that the dice will land on 6 exactly 5 times.

(1)

(b) Write down the hypotheses that should be used to test Polly's suspicion

(1)

(c) Using a 10% significance level find the critical region for a two tailed test to test Polly's suspicion. You should state the probability of rejection in each tail, which should be less than 0.05

(4)

(d) Find the actual significance level of a test based on your critical region from part (c)

(1)

(e) Polly rolls the dice 20 times. The dice lands on six 11 times. Comment on Polly's suspicion in light of the experiment

(1)

(Total for question 8 is 8 marks)
