Applied Year 1 Chapter 7 – Hypothesis Testing Exam Questions (65 mins)

1. A single observation x is to be taken from a Binomial distribution B(20, 0.3).

This observation is used to test $H_0 : p = 0.3$ against $H_1 : p \neq 0.3$

(a) Using a 5% level of significance, find the critical region for this test.

(3)

The actual value of x obtained is 3.

(b) State a conclusion that can be drawn based on this value giving a reason for your answer.

(2)

(c) State the actual significance level of this test. **(2)**

(Total 7 marks)

2. Linda regularly takes a taxi to work five times a week. Over a long period of time she finds the taxi is late once a week. The taxi firm changes her driver and Linda thinks the taxi is late more often. In the first week, with the new driver, the taxi is late 3 times.

You may assume that the number of times a taxi is late in a week has a Binomial distribution.

Test, at the 5% level of significance, whether or not there is evidence of an increase in the proportion of times the taxi is late. State your hypotheses clearly.

(Total 7 marks)

3. Past records suggest that 30% of customers who buy baked beans from a large supermarket buy them in single tins. A new manager questions whether or not there has been a change in the proportion of customers who buy baked beans in single tins. A random sample of 20 customers who had bought baked beans was taken.

(a) Using a 10% level of significance, find the critical region for a two-tailed test to answer the manager's question.

(5)

The manager found that 11 customers from the sample of 20 had bought baked beans in single tins.

(b) Comment on this finding in the light of your critical region found in part (a).

(2)

(c) Write down the actual significance level of a test based on your critical region from part (a).

(1)

(Total 8 marks)

4. (a) Define the critical region of a test statistic.

(2)

A discrete random variable x has a Binomial distribution B(30, p).
A single observation is used to test $H_0 : p = 0.3$ against $H_1 : p \neq 0.3$

(b) Using a 1% level of significance find the critical region of this test.

(5)

The value of the observation was found to be 15.

(c) Comment on this finding in light of your critical region.

(2)

(d) Write down the actual significance level of the test.

(1)
(Total 10 marks)

5. It is known from past records that 1 in 5 bowls produced in a pottery have minor defects. To monitor production a random sample of 25 bowls was taken and the number of such bowls with defects was recorded.

(a) Using a 5% level of significance, find critical regions for a two-tailed test of the hypothesis that 1 in 5 bowls have defects. The probability of rejecting should be as close to 2.5% (even if that is over 2.5%).

(6)

(b) State the actual significance level of the above test.

(1)

At a later date, a random sample of 20 bowls was taken and 2 of them were found to have defects.

(c) Test, at the 10% level of significance, whether or not there is evidence that the proportion of bowls with defects has decreased. State your hypotheses clearly.

(7)

(Total 14 marks)

6. A company claims that a quarter of the bolts sent to them are faulty. To test this claim the number of faulty bolts in a random sample of 50 is recorded.

(a) Give two reasons why a binomial distribution may be a suitable model for the number of faulty bolts in the sample.

(2)

(b) Using a 5% significance level, find the critical region for a two-tailed test of the hypothesis that the probability of a bolt being faulty is $\frac{1}{4}$.

(3)

(c) Find the actual significance level of this test.

(2)

In the sample of 50 the actual number of faulty bolts was 8.

(d) Comment on the company's claim in the light of this value. Justify your answer.

(2)

The machine making the bolts was reset and another sample of 50 bolts was taken. Only 5 were found to be faulty.

(e) Test at the 1% level of significance whether or not the probability of a faulty bolt has decreased. State your hypotheses clearly.

(6)

(Total 15 marks)