Hypothesis Testing - Edexcel Past Exam Questions

1. A drugs company claims that 75% of patients suffering from depression recover when treated with a new drug.

A random sample of 10 patients with depression is taken from a doctor's records.

(*a*) Write down a suitable distribution to model the number of patients in this sample who recover when treated with the new drug. **(2)**

Given that the claim is correct,

(*b*) find the probability that the treatment will be successful for exactly 6 patients. **(2)**

The doctor believes that the claim is incorrect and the percentage who will recover is lower. From her records she took a random sample of 20 patients who had been treated with the new drug. She found that 13 had recovered.

(*c*) Stating your hypotheses clearly, test, at the 5% level of significance, the doctor's belief. **(6)**

(*d*) From a sample of size 20, find the greatest number of patients who need to recover from the test in part (*c*) to be significant at the 1% level. **(4)**

June 05 Q7

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2. A teacher thinks that 20% of the pupils in a school read the Deano comic regularly.

He chooses 20 pupils at random and finds 9 of them read the Deano.

(*a*) (i) Test, at the 5% level of significance, whether or not there is evidence that the percentage of pupils that read the Deano is different from 20%. State your hypotheses clearly.

(ii) State all the possible numbers of pupils that read the Deano from a sample of size 20 that will make the test in part (*a*)(i) significant at the 5% level. **(9)**

Jan 06 Q7*(edited)*

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3. 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, in either tail, should be as close to 2.5% as possible. **(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)**

June 06 Q7

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4. Past records from a large supermarket show that 20% of people who buy chocolate bars buy the family size bar. On one particular day a random sample of 30 people was taken from those that had bought chocolate bars and 2 of them were found to have bought a family size bar.

(*a*) Test, at the 5% significance level, whether or not the proportion *p* of people who bought a family size bar of chocolate that day had decreased. State your hypotheses clearly.

(6)

Jan 07 Q6*(edited)*

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5. 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. **(7)**

June 07 Q6

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6. Dhriti grows tomatoes. Over a period of time, she has found that there is a probability 0.3 of a ripe tomato having a diameter greater than 4 cm. She decides to try a new fertiliser. In a random sample of 40 ripe tomatoes, 18 have a diameter greater than 4 cm. Dhriti claims that the new fertiliser has increased the probability of a ripe tomato being greater than 4 cm in diameter.

Test Dhriti's claim at the 5% level of significance. State your hypotheses clearly. **(7)**

Jan 08 Q5

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7. 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)**

June 08 Q5

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

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. The probability of rejecting either tail should be as close as possible to 2.5%. **(3)**

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

The actual value of x obtained is 3.

(*c*) State a conclusion that can be drawn based on this value, giving a reason for your answer. **(2)**

Jan 09 Q3

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9. 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. You should state the probability of rejection in each tail which should be less than 0.05. **(5)**

(*b*) Write down the actual significance level of a test based on your critical region from part (*a*). **(1)**

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

(*c*) Comment on this finding in the light of your critical region found in part (*a*). **(2)**

June 09 Q4

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10. (*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. You should state the probability of rejection in each tail which should be as close as possible to 0.005. **(5)**

(*c*) Write down the actual significance level of the test. **(1)**

The value of the observation was found to be 15.

(*d*) Comment on this finding in light of your critical region. **(2)**

Jan 10 Q6

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11. 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 $\frac{1}{4}$. The probability of rejection in either tail should be as close as possible to 0.025. **(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)**

June 10 Q6

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12. A student takes a multiple choice test. The test is made up of 10 questions each with 5 possible answers. The student gets 4 questions correct. Her teacher claims she was guessing the answers. Using a one tailed test, at the 5% level of significance, test whether or not there is evidence to reject the teacher's claim.

State your hypotheses clearly. **(6)**

Jan 11 Q2

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13. A shopkeeper knows, from past records, that 15% of customers buy an item from the display next to the till. After a refurbishment of the shop, he takes a random sample of 30 customers and finds that only 1 customer has bought an item from the display next to the till.

(a) Stating your hypotheses clearly, and using a 5% level of significance, test whether or not there has been a change in the proportion of customers buying an item from the display next to the till. **(6)**

June 11 Q6 *(edited)*
