EdExcel Statistics 2

Hypothesis Tests

Section 1: Introducing Hypothesis Testing

Exercise

1. A school estimates the probability that a student gets an A or B pass in a Statistics component to be 0.4. The school appoints a new teacher, who has never taught statistics before. The Head of Maths is concerned that the A and B pass-rate may decrease. Although all students passed in the following year, out of a group of 15 students only 2 got an A or B grade.
   Comment on the Head of Department's concerns, by using a hypothesis test with a 5% significance level.

2. A coin is suspected to be biased towards heads.
   (i) The coin is tossed 10 times and 8 heads come up. Test at the 5% significance level whether the coin is biased towards heads.
   (ii) The coin is tossed 20 times and 16 heads come up. Test at the 5% significance level whether the coin is biased towards heads.
   (iii) The coin is tossed 50 times. Find the critical region for this test.

3. A small estate agent is concerned that the housing market appears to be slowing down. His records in recent years show that on average, he sells 6 houses during the month of June each year. In June this year, he sells only 2 houses.
   Does this provide evidence, at the 5% level, that the mean number of houses he sells during the month of June has decreased?

4. Using recent data provided by the low-cost airline Brianair, it is estimated that the probability that a passenger loses his suitcase on a flight is 0.05. From newspaper reports I think the figure is higher. On 25 different occasions I take a flight with Brianair. My luggage does not arrive on 3 occasions. Using a hypothesis test, with a significance level of 5%, does this data confirm my suspicions?

5. The probability that a certain type of seed germinates is estimated to be 0.65. A new method of storing the seeds is being trialled, and the company wish to know whether this changes the proportion of seeds that germinate.
   A sample of 40 seeds is tested.
   Construct a critical region for a hypothesis test with a 5% significance level.
   19 of the seeds germinate. Is there evidence of a change in the proportion of seeds that germinate?

6. A county survey recently claimed that 70% of students in a sixth form do no fitness training or sporting activity out of school.
   This was criticised by several sporting groups who felt that it over-estimated the proportion.
   I conducted a survey in my school and found only 5 out of 10 students in a sixth form do no fitness training or sporting activity out of school.
   Construct a critical region for a hypothesis test with a 10% significance level.

Is the claim of 70% too high?

7. Peter, who is always very concerned about his health, keeps a record of the number of colds he has each year. Over many years he has found that on average he has 4 colds each year.
   Peter starts a new job and believes that his office is inadequately heated. He thinks this will result in more colds than usual. In his first year in his new job, Peter gets 7 colds.
   Is there evidence to suggest that Peter has had more colds than usual this year?

8. Records from a hospital show that 3 out of every 10 casualties who come to the casualty department have to wait more than 30 minutes before receiving medical attention. The hospital decided to increase the staffing, and in a random sample of 20 patients it was found that only 2 patients had to wait more than 30 minutes before receiving medical attention.

   (i) Test at the 5% level whether the extra staffing has reduced the proportion of casualties who have to wait more than 30 minutes.
   (ii) Test at the 2% level whether the extra staffing has reduced the proportion of casualties who have to wait more than 30 minutes.
   (iii) Construct a critical region at the 5% level.

9. Records from a school show that 60% of students got grades A to C in Mathematics. In the following year 16 out of 20 students get grades A to C.

   (i) The Head of Sixth form claimed at the start of the year that the results would be different because of a new tutor team. Test this claim at the 5% level.
   (ii) The Head of Mathematics claims this improvement is due to the appointment of a brilliant new teacher. Test this claim at the 5% level.