Section 2: More about hypothesis testing

Exercise level 2

1. A school estimates the probability that a student gets an A or B pass in a Biology exam to be 0.6. The school appoints a new teacher, who has never taught this topic before. The Head of Science is concerned that the A and B pass-rate may decrease. Although all students passed in the following year, out of a group of 19 students only 8 got an A or B grade. Construct a critical region for a hypothesis test with a 5% significance level. Comment on the Head of Department's concerns.

2. A coin is tossed 18 times and 11 heads come up. Construct a critical region for a hypothesis test with a 5% significance level, in order to test the hypothesis that the coin is unbiased as opposed to being biased towards heads. Comment on the results.

3. The probability that a certain type of seed germinates is estimated to be 0.65. A new batch of seeds is produced which appear to have a lower probability.
   To check this, a sample of 16 seeds is tested and 8 germinate.
   Construct a critical region for a hypothesis test with a 5% significance level.
   Is this evidence, at a 5% significance level, of a reduction in the probability?

4. 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?

5. 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 waiting time.
   (ii) Test at the 2% level whether the extra staffing has reduced the waiting time.
   (iii) Construct a critical region at the 5% level.

6. Records from a school show that 2 out of 3 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.

7. Records from a well-known Division 1 football team show that 6 out of every 10 passes are misplaced. Following the appointment of an ex-Premiership manager as coach, it was found that in a sample of 17 passes only 5 are misplaced.
    Investigate the following claims at the 5% level:

    (i)   The coach thinks that the extra passing in practice has had a positive effect.
    (ii) The existing manager stated that there was no difference in the way the team were playing.