

# Binomial and Hypothesis Testing Homework

**8** Mark is playing solitaire on his computer. The probability that he wins a game is 0.2, independently of all other games that he plays.

(i) Find the expected number of wins in 12 games. [2]

(ii) Find the probability that

(A) he wins exactly 2 out of the next 12 games that he plays, [3]

(B) he wins at least 2 out of the next 12 games that he plays. [3]

(iii) Mark's friend Ali also plays solitaire. Ali claims that he is better at winning games than Mark. In a random sample of 20 games played by Ali, he wins 7 of them. Write down suitable hypotheses for a test at the 5% level to investigate whether Ali is correct. Give a reason for your choice of alternative hypothesis. Carry out the test. [9]

**8** The Department of Health 'eat five a day' advice recommends that people should eat at least five portions of fruit and vegetables per day. In a particular school, 20% of pupils eat at least five a day.

(i) 15 children are selected at random.

(A) Find the probability that exactly 3 of them eat at least five a day. [3]

(B) Find the probability that at least 3 of them eat at least five a day. [3]

(C) Find the expected number who eat at least five a day. [2]

A programme is introduced to encourage children to eat more portions of fruit and vegetables per day. At the end of this programme, the diets of a random sample of 15 children are analysed. A hypothesis test is carried out to examine whether the proportion of children in the school who eat at least five a day has increased.

(ii) (A) Write down suitable null and alternative hypotheses for the test.

(B) Give a reason for your choice of the alternative hypothesis. [4]

(iii) Find the critical region for the test at the 10% significance level, showing all of your calculations. Hence complete the test, given that 7 of the 15 children eat at least five a day. [6]

- 6** A manufacturer produces tiles. On average 10% of the tiles produced are faulty. Faulty tiles occur randomly and independently.

A random sample of 18 tiles is selected.

- (i) (A) Find the probability that there are exactly 2 faulty tiles in the sample. [3]  
(B) Find the probability that there are more than 2 faulty tiles in the sample. [3]  
(C) Find the expected number of faulty tiles in the sample. [2]

A cheaper way of producing the tiles is introduced. The manufacturer believes that this may increase the proportion of faulty tiles. In order to check this, a random sample of 18 tiles produced using the cheaper process is selected and a hypothesis test is carried out.

- (ii) (A) Write down suitable null and alternative hypotheses for the test.  
(B) Explain why the alternative hypothesis has the form that it does. [4]
- (iii) Find the critical region for the test at the 5% level, showing all of your calculations. [4]
- (iv) In fact there are 4 faulty tiles in the sample. Complete the test, stating your conclusion clearly. [2]