This Homework will be marked at the beginning of next lesson. Make sure it is completed!

(P) **5** In a manufacturing process the proportion (p) of faulty articles has been found, from long experience, to be 0.1.
A sample of 100 articles from a new manufacturing process is tested, and 8 are found to be faulty.
The manufacturers wish to test at the 5% level of significance whether or not there has been a reduction in the proportion of faulty articles.

a Suggest a suitable test statistic.

b Write down two suitable hypotheses.

c Explain the condition under which the null hypothesis is rejected.

(P) **6** Polls show that 55% of voters support a particular political candidate. A newspaper releases information showing that the candidate avoided paying taxes the previous year. Following the release of the information, a polling company asked 20 people whether they support the candidate. 7 people said that they did. The polling company wants to test at the 2% level of significance whether the level of support for the candidate has reduced.

a Write down a suitable test statistic.

b Write down two suitable hypotheses.

c Explain the condition under which the null hypothesis would be accepted.

(E) **7** The discrete random variable $X \sim \text{B}(30, 0.73)$. Find:

a $\text{P}(X = 20)$ **(1 mark)**

b $\text{P}(X \leqslant 13)$ **(1 mark)**

c $\text{P}(11 < X \leqslant 25)$ **(2 marks)**

(P) **8** A coin is biased so that the probability of a head is $\frac{2}{3}$.The coin is tossed repeatedly.
Find the probability that:

a the first tail will occur on the sixth toss

b in the first 8 tosses there will be exactly 2 tails.

(P) **9** Records kept in a hospital show that 3 out of every 10 patients who visit the accident and emergency department have to wait more than half an hour. Find, to 3 decimal places, the probability that of the first 12 patients who come to the accident and emergency department:

a none

b more than 2

will have to wait more than half an hour.

(E/P) **10** **a** State clearly the conditions under which it is appropriate to assume that a random variable has a binomial distribution. **(2 marks)**

A door-to-door canvasser tries to persuade people to have a certain type of double glazing installed. The probability that his canvassing at a house is successful is 0.05.

b Find the probability that he will have at least 2 successes out of the first 10 houses he canvasses. **(2 marks)**

c Calculate the smallest number of houses he must canvass so that the probability of his getting at least one success exceeds 0.99. **(4 marks)**

E/P **13** A manufacturer produces large quantities of plastic chairs. It is known from previous records that 15% of these chairs are green. A random sample of 10 chairs is taken.

a Define a suitable distribution to model the number of green chairs in this sample. **(1 mark)**

b Find the probability of at least 5 green chairs in this sample. **(3 marks)**

c Find the probability of exactly 2 green chairs in this sample. **(3 marks)**

E/P **14** A bag contains a large number of beads of which 45% are yellow. A random sample of 20 beads is taken from the bag. Use the binomial distribution to find the probability that the sample contains:

a fewer than 12 yellow beads **(2 marks)**

b exactly 12 yellow beads. **(3 marks)**

E/P **15** An archer hits the bullseye with probability 0.6. She shoots 20 arrows at a time.

a Find the probability that she hits the bullseye with at least 50% of her arrows. **(3 marks)**

She shoots 12 sets of 20 arrows.

b Find the probability that she hits the bullseye with at least 50% of her arrows in 7 of the 12 sets of arrows. **(2 marks)**

c Find the probability that she hits the bullseye with at least 50% of her arrows in fewer than 6 sets of arrows. **(2 marks)**