4. A supermarket sells apples in trays. Each tray contains 10 apples.

Trays are inspected for rotten apples daily.

The following table shows the numbers of rotten apples in a random sample of 150 trays on one day.

Number of rotten apples	0	1	2	3	4	5	6
Frequency	25	47	37	24	8	6	3

The manager believes that these data can be modelled by a binomial distribution B(10, p)

(a) Use these data to estimate the value of the parameter p for this model.
Give your answer to 2 decimal places.

(2)

The manager uses the estimated value of p to 2 decimal places and calculates expected frequencies to 2 decimal places as follows.

Number of rotten apples	0	1	2	3	4	5	$\geqslant 6$
Expected frequency	20.62	45.26	44.71	26.17	10.05	r	s

(b) Show that the value of r is 2.65 to 2 decimal places.

(1)

(c) Find the value of s to 2 decimal places.

(1)

The manager says that the cells for 4, 5 and $\geqslant 6$ need to be combined into a single cell.

(d) Explain why it is necessary for the manager to do this.

(1)

The value of $\sum \frac{(O-E)^2}{E}$ for the first 4 frequencies given in each table is 2.51

(e) Using a 10% significance level, test whether or not a binomial distribution is a suitable model.
You must state your hypotheses, test statistic and the critical value used.

(7)

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Question 4 continued

(Total for Question 4 is 12 marks)