4 A research student is investigating the number of children who are girls in families with 4 children.

The table below shows her results for 200 such families.

Number of girls	0	1	2	3	4
Frequency	15	68	69	38	10

The research student suggests that a binomial distribution with $p = \frac{1}{2}$ could be a suitable model for the number of children who are girls in a family of 4 children.

(a) Using her results and a 5% significance level, test the research student's claim.
You should state your hypotheses, expected frequencies, test statistic and the critical value used.

(8)

The research student decides to refine the model and retains the idea of using a binomial distribution but does not specify the probability that the child is a girl.

(b) Use the data in the table to show that the probability that a child is a girl is 0.45

(2)

The research student uses the probability from part (b) to calculate a new set of expected frequencies, none of which are less than 5

The statistic $\sum \frac{(O-E)^2}{E}$ is evaluated and found to be 2.47

(c) Test, at the 5% significance level, whether using a binomial distribution is suitable to model the number of children who are girls in a family of 4 children.
You should state your hypotheses and the critical value used.

(4)

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Question 4 continued

(Total for Question 4 is 14 marks)