

A scientist carries out an experiment to investigate the quantity  $X$ , which takes the values 0, 1, 2, 3, 4, 5 or 6. He believes that the values taken by  $X$  follow a binomial distribution. He conducts 250 trials. His results are summarised in the following table.

$x$	0	1	2	3	4	5	6
Observed frequency	22	83	72	53	17	3	0

- (i) Show that unbiased estimates of the mean and variance for these results are 1.876 and 1.266 respectively, correct to 3 decimal places. By evaluating the mean and variance of the distribution  $B(6, 0.313)$ , explain why  $X$  could have this distribution. [4]

The expected frequencies corresponding to the distribution  $B(6, 0.313)$  are shown in the following table.

$x$	0	1	2	3	4	5	6
Observed frequency	22	83	72	53	17	3	0
Expected frequency	26.3	71.9	81.8	49.7	17.0	3.1	0.2

- (ii) Show how the expected frequency for  $x = 4$  is calculated. [2]
- (iii) Test at the 5% significance level whether the scientist's belief is correct. [8]