

## 1. [PJC 18 MYE]

Tomatoes are sold in boxes of 16. On average, 15% of them are damaged.

- (a) State, in context, two assumptions needed for the number of damaged tomatoes in a box to be well modelled by a binomial distribution. [2]

Assume now that the number of damaged tomatoes in a box has a binomial distribution.

- (b) Find the most likely number of damaged tomatoes in a randomly chosen box. [2]
- (c) Find the probability that a box contains less than 6 damaged tomatoes. [1]
- (d) A box contains less than 6 damaged tomatoes. Find the probability that it contains at least 2 damaged tomatoes. [3]
- (e) Two boxes of tomatoes are randomly selected. Find the probability that one box has at least 2 damaged tomatoes and the other box has none. [2]
- (f) A market trader buys 80 boxes of tomatoes. Find the probability that there are more than 60 boxes with at least 2 damaged tomatoes, giving your answers to 4 decimal places. [3]

## 2. [DHS 17 Prelims (modified)]

A sample of 5 people is chosen from a village of large population. The number of people in the sample who are underweight is denoted by  $X$ .

- (a) On average, the proportion of people in the village who are underweight is  $p$ . It is known that the mode of  $X$  is 2. Use this information to show that  $\frac{1}{3} < p < \frac{1}{2}$ . [3]

For the rest of the question, use  $p = 0.393$ .

- (b) Two random samples of 5 people are chosen.  
Find the probability that the first sample has at least 4 people who are underweight and has more people who are underweight than the second sample. [3]