Probability and Statistics
Coursework 2 - Discrete Random Variables

Question

Molly the dog is very particular about her food, so she created a start-up to make cartons of her favourite food, which she called MollyBix. These cartons are produced in three plants, in Lancashire, Derbyshire and Yorkshire, and supplied to customers through various distribution centres. MollyBix production is not an exact science, and not every carton is approved by Molly. She likes 95%, 40% and 25% of the MollyBix made in Lancashire, Derbyshire and Yorkshire, each plant of which produces 50%, 20% and 30% of cartons, respectively. Molly's food-orders come in boxes of 500 cartons that are sourced randomly from all three plants.

1. If a carton of MollyBix is selected at random from a box, what is the probability that Molly will like it?
2. Molly doesn't like a randomly selected carton. What are the probabilities that it was produced at each of the plants?
3. In a particular box, assume that the numbers of cartons produced at each plant are *exactly* in proportion to the production percentages given, e.g. 250 were produced at the Lancashire plant. What are the expectation and standard deviation of the number of cartons in the box that Molly will like? (*Hint*: Let X_i be the number of cartons that Molly likes out of those produced at plant i. Model X_i as a Binomial distribution.)

Guidelines

- You can submit individually or in a group of two.
- Use only concepts, techniques, and known results seen in the module lectures, tutorials, and exercises.
- Clearly state the assumptions used in the derivations.
- Some marks may be taken off for submissions that are terse (lacking detail) or difficult to parse for the markers (untidy or hard to read).

Feedback

We aim to return to you feedback before the next coursework deadline.