Linear Combinations of Random Variables – 2022 A2 Nov

1. June/2022/Paper_9709/61/No.3

The lengths, in centimetres, of two types of insect, A and B, are modelled by the random variables $X \sim N(6.2, 0.36)$ and $Y \sim N(2.4, 0.25)$ respectively.

Find the probability that the length of a randomly chosen type A insect is greater than the sum of the lengths of 3 randomly chosen type B insects. [5]

2. June/2022/Paper_9709/61/No.4

The independent random variables X and Y have distributions Po(2) and $B(20, \frac{1}{4})$ respectively.

(a) Find the mean and standard deviation of $X - 3Y$. [5]

(b) Find $P(Y = 15X)$. [3]

3. June/2022/Paper_9709/62/No.6

The masses, in kilograms, of large and small sacks of grain have the distributions N(53, 11) and N(14, 3) respectively.

(a) Find the probability that the mass of a randomly chosen large sack is greater than four times the mass of a randomly chosen small sack. [5]

(b) A lift can safely carry a maximum mass of 1000 kg.

Find the probability that the lift can safely carry 12 randomly chosen large sacks and 25 randomly chosen small sacks. [5]

4. June/2022/Paper_9709/63/No.4

Each box of Seeds & Raisins contains S grams of seeds and R grams of raisins. The weight of a box, when empty, is B grams. S, R and B are independent random variables, where $S \sim N(300, 45)$, $R \sim N(200, 25)$ and $B \sim N(15, 4)$. A full box of Seeds & Raisins is chosen at random.

(a) Find the probability that the total weight of the box and its contents is more than 500 grams. [5]

(b) Find the probability that the weight of seeds in the box is less than 1.4 times the weight of raisins in the box. [5]