Linear combinations of random variables– 2023 Nov CIE Mathematics

1. Nov/2023/Paper_9709/61/No.4

The masses, in kilograms, of chemicals A and B produced per day by a factory are modelled by the independent random variables X and Y respectively, where $X \sim \text{N}(10.3, 5.76)$ and $Y \sim \text{N}(11.4, 9.61)$. The income generated by the chemicals is \$2.50 per kilogram for A and \$3.25 per kilogram for B.

(a) Find the mean and variance of the daily income generated by chemical A. [2]

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(b) Find the probability that, on a randomly chosen day, the income generated by chemical A is greater than the income generated by chemical B. [6]

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2. Nov/2023/Paper_9709/62/No.6

A factory makes loaves of bread in batches. One batch of loaves contains X kilograms of dried yeast and Y kilograms of flour, where X and Y have the independent distributions $N(0.7, 0.02^2)$ and $N(100.0, 3.0^2)$ respectively.

Dried yeast costs \$13.50 per kilogram and flour costs \$0.90 per kilogram. For making one batch of bread the total of all other costs is \$55. The factory sells each batch of bread for \$200.

Find the probability that the profit made on one randomly chosen batch of bread is greater than \$40. [7]