

QQQ – Further Statistics 2 – Chapter 4 – Combinations of Random Variables (Version 1)

Total Marks: 23

(23 = Platinum, 21 = Gold, 18 = Silver, 16 = Bronze)

1. The random variable A is defined as

$$A = B + 4C - 3D$$

where B , C and D are independent random variables with

$$B \sim N(6, 2^2) \quad C \sim N(7, 3^2) \quad D \sim N(4, 1.5^2)$$

Find $P(A < 45)$ (6)

(Total 6 marks)

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2. The weights of eggs, E grams, follow a normal distribution, $N(60, 3^2)$

The weights of empty small boxes, S grams, follow a normal distribution, $N(24, 1.8^2)$

The weights of empty large boxes, L grams, follow a normal distribution, $N(40, 2.1^2)$

Small boxes of eggs contain 6 randomly selected eggs.

Large boxes of eggs contain 12 randomly selected eggs.

(a) Find the probability that the total weight of a randomly selected small box of 6 eggs weighs less than 387 grams. (3)

(b) Find the probability that a randomly selected large box of 12 eggs weighs more than twice a randomly selected small box of 6 eggs. (5)

(Total 8 marks)

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3. Philip and James are racing car drivers. Philip's lap times, in seconds, are normally distributed with mean 90 and variance 9. James' lap times, in seconds, are normally distributed with mean 91 and variance 12. The lap times of Philip and James are independent. Before a race, they each take a qualifying lap.

(a) Find the probability that James' time for the qualifying lap is less than Philip's. **(4)**

The race is made up of 60 laps. Assuming that they both start from the same starting line and lap times are independent,

(b) find the probability that Philip beats James in the race by more than 2 minutes. **(5)**

(Total 9 marks)