

QQQ – Further Statistics 1 – Chapter 4 – Hypothesis Testing (Version 2)

Total Marks: 25

(25 = Platinum, 23 = Gold, 20 = Silver, 17 = Bronze)

1. Every morning Geethaka repeatedly rolls a fair, six-sided die until he rolls a 3 and then he stops. The random variable X represents the number of times he rolls the die each morning.

(a) Suggest a suitable model for the random variable X (1)

(b) Show that $P(X \leq 3) = \frac{91}{216}$ (2)

After 64 mornings Geethaka will calculate the mean number of times he rolled the die.

(c) Estimate the probability that the mean number of rolls is between 5.6 and 7.2 (5)

Nira wants to check Geethaka's die to decide whether or not the probability of rolling a 3 with his die is less than $\frac{1}{6}$

Nira rolls the die repeatedly until she rolls a 3

She obtains $x = 16$

(d) By carrying out a suitable test, determine what Nira's conclusion should be. You should state your hypotheses clearly and use a 5% level of significance. (4)

(Total 12 marks)

2. Andreia's secretary makes random errors in his work at an average rate of 1.7 errors every 100 words.

- (a)** Find the probability that the secretary makes fewer than 2 errors in the next 100-word piece of work. **(2)**

Andreia asks the secretary to produce a 250-word article for a magazine.

- (b)** Find the probability that there are exactly 5 errors in this article. **(2)**

Andreia offers the secretary a choice of one of two bonus schemes, based on a random sample of 40 pieces of work each consisting of 100 words.

In scheme **A** the secretary will receive the bonus if more than 10 of the 40 pieces of work contain no errors.

In scheme **B** the bonus is awarded if the total number of errors in all 40 pieces of work is fewer than 56

- (c)** Showing your calculations clearly, explain which bonus scheme you would advise the secretary to choose. **(5)**

Following the bonus scheme, Andreia randomly selects a single 500-word piece of work from the secretary to test if there is any evidence that the secretary's rate of errors has decreased.

- (d)** Stating your hypotheses clearly and using a 5% level of significance, find the critical region for this test. **(4)**

(Total 13 marks)