

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

Total Marks: 24

(24 = Platinum, 22 = Gold, 19 = Silver, 16 = Bronze)

1. An effect of a certain disease is that a small number of the red blood cells are deformed. Emily has this disease and the deformed blood cells occur randomly at a rate of 2.5 per ml of her blood. Following a course of treatment, a random sample of 2 ml of Emily's blood is found to contain only 1 deformed red blood cell.

Stating your hypotheses clearly and using a 5% level of significance, test whether or not there has been a decrease in the number of deformed red blood cells in Emily's blood. **(6)**

(Total 6 marks)

2. Asha, Davinda and Jerry each have a bag containing a large number of counters, some of which are white and the rest are red.

Each person draws counters from their bag one at a time, notes the colour of the counter and returns it to their bag.

The probability of Asha getting a red counter on any one draw is 0.07

(a) Find the probability that Asha will draw at least 3 white counters before a red counter is drawn. **(2)**

(b) Find the probability that Asha gets a red counter for the second time on her 9th draw. **(2)**

The probability of Davinda getting a red counter on any one draw is p .

Davinda draws counters until she gets n red counters. The random variable D is the number of counters Davinda draws.

Given that the mean and the standard deviation of D are 4400 and 660 respectively,

(c) find the value of p . **(4)**

Jerry believes that his bag contains a smaller proportion of red counters than Asha's bag. To test his belief, Jerry draws counters from his bag until he gets a red counter. Jerry defines the random variable J to be the number of counters drawn up to and including the first red counter.

(d) Stating your hypotheses clearly and using a 10% level of significance, find the critical region for this test. **(5)**

Jerry gets a red counter for the first time on his 34th draw.

(e) Giving a reason for your answer, state whether or not there is evidence that Jerry's bag contains a smaller proportion of red counters than Asha's bag. **(2)**

Given that the probability of Jerry getting a red counter on any one draw is 0.011

(f) show that the power of the test is 0.702 to 3 significant figures. **(3)**

(Total 18 marks)