

QQQ – Further Statistics 1 – Chapter 3 – Geometric and Negative Binomial Distributions (Version 1)

Total Marks: 22

(22 = Platinum, 20 = Gold, 18 = Silver, 15 = Bronze)

1. A chocolate manufacturer places special tokens in 2% of the bars it produces so that each bar contains at most one token. Anyone who collects 3 of these tokens can claim a prize.

Andreia buys a box of 40 bars of the chocolate.

(a) Find the probability that Andreia can claim a prize. (2)

Barney intends to buy bars of the chocolate, one at a time, until he can claim a prize.

(b) Find the probability that Barney can claim a prize when he buys his 40th bar of chocolate. (3)

(c) Find the expected number of bars that Barney must buy to claim a prize. (1)

(Total 6 marks)

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2. Irina is practising her serves in badminton and counts the number of her serves that are faults. She finds that 15% of her serves are faults.

Assuming that each serve is independent,

(a) find the probability that

(i) Irina's 4th fault comes on her 20th serve, (2)

(ii) in 18 serves, Irina has 4 faults. (2)

With practice, Irina reduces her proportion of faults, p , so that the mean number of serves until her 4th fault is at least 32

(b) Find the maximum value of p (3)

(Total 7 marks)

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3. Suzanne and Jon are playing a game.

They put 4 red counters and 1 blue counter in a bag.

Suzanne reaches into the bag and selects one of the counters at random. If the counter she selects is blue, she wins the game. Otherwise she puts it back in the bag and Jon selects one at random.

If the counter he selects is blue, he wins the game. Otherwise he puts it back in the bag and they repeat this process until one of them selects the blue counter.

- (a)** Find the probability that Suzanne selects the blue counter on her 4th selection. **(2)**
- (b)** Find the probability that the blue counter is first selected on or after Jon's third selection. **(2)**
- (c)** Find the mean and standard deviation of the number of selections made until the blue counter is selected. **(2)**
- (d)** Find the probability that Suzanne wins the game. **(3)**

(Total 9 marks)