

ST ANDREW'S JUNIOR COLLEGE

JC2 H1 MATHEMATICS (8865)

Term 3 Weekend Assignment 1

Topic: Binomial Distribution

Name: _____

Marks: _____/11

C.G.: _____

1. TJC Promo 8865/2021/Q9

CheapnGood is an online shop that sells solar powered lights. CheapnGood is not very reliable and it is known that $p\%$ of their solar powered lights **do not work**. A shopper bought 12 solar powered lights for his garden from CheapnGood. The 12 lights were randomly chosen by CheapnGood and delivered to the shopper.

For **part (i) to part (iv)**, take $p = 15$.

- (i) Find the probability that exactly 7 lights bought by the shopper work. [1]
- (ii) Find the probability that at least 3 lights bought by the shopper do not work. [2]
- (iii) Find the probability that exactly 7 lights work given that at least 3 lights bought by the shopper do not work. [3]
- (iv) Find the least value of r such that the probability that less than r lights bought by the shopper do not work is greater than 0.9. [3]

In a random sample of size 12, find in terms of p , the mean and variance of the number of lights that do not work. [2]

Solutions

1 (i)	Let F be the number of lights out of 12 that do not work $F \sim B(12, 0.15)$ $P(F = 5) = 0.019280$ (5 sf) $= 0.0193$ (3 sf)							
(ii)	0 1 2 3 4 12 $P(F \geq 3)$ $= 1 - P(F \leq 2)$ $= 0.26418$ (5 sf) $= 0.264$ (3 sf)							
(iii)	$P(F = 5 \mid F \geq 3)$ $= \frac{P(F = 5 \text{ and } F \geq 3)}{P(F \geq 3)}$ $= \frac{P(F = 5)}{P(F \geq 3)}$ $= \frac{0.019280}{0.26418} = 0.072981$ (5 sf) $= 0.0730$ (3 sf) Intersection of $F = 5$ and $F \geq 3$ is 5.							
(iv)	0 1 . . . r-1 r . . . 12 $P(F < r) > 0.9$ $P(F \leq r-1) > 0.9$ <table><tr><td>r</td><td>$P(F \leq r-1)$</td></tr><tr><td>3</td><td>$0.73582 < 0.9$</td></tr><tr><td>4</td><td>$0.90779 > 0.9$</td></tr></table> From GC, Least value of $r = 4$	r	$P(F \leq r-1)$	3	$0.73582 < 0.9$	4	$0.90779 > 0.9$	
r	$P(F \leq r-1)$							
3	$0.73582 < 0.9$							
4	$0.90779 > 0.9$							
	Mean $= 12 \times \frac{p}{100} = \frac{3}{25} p$ Variance $= 12 \times \frac{p}{100} \times \left(1 - \frac{p}{100}\right) = \frac{3}{25} p \left(1 - \frac{p}{100}\right)$							