Applied Year 1 Chapter 7 – Hypothesis Testing Exam Questions (Answers)

1. (a) $X \sim B(20, 0.3)$ M1

$P(X \leq 1) = 0.00763$

$P(X \geq 11) = 1 - 0.9829 = 0.0171$

Critical region is $(0 \leq X \leq 1)$ and $(11 \leq X \leq 20)$ A1 A1 3

(b) Insufficient evidence to reject H_0 B1 ft

$x = 3$ is not in the critical region **or** $0.1071 > 0.025$ B1 ft 2

(c) Significance level = 0.00763 + 0.0171, = 0.02473 or 2.473% M1 A1 2

2. <u>One tail test</u>

<u>Method 1</u>

H_0: p = 0.2 B1

H_1: p > 0.2 B1

$X \sim B(5, 0.2)$ may be implied M1

$P(X \geq 3) = 1 - P(X \leq 2)$

$= 1 - 0.9421$

$= 0.0579$ M1

$0.0579 > 0.05$ M1

Do not reject H_0. A1

There is insufficient evidence that there is an increase in the number of times the taxi/driver is late. B1

3. (a) $X \sim B(20, 0.3)$ M1

$P(X \leq 2) = 0.0355$ A1

$P(X \leq 9) = 0.9520$ so $P(X \geq 10) = 0.0480$ A1

Therefore the critical region is

$\{X \leq 2\} \cup \{X \geq 10\}$ A1A1

(b) 11 is in the critical region B1ft

there is evidence of a <u>change/ increase</u> in the <u>proportion/number</u> of <u>customers buying single tins</u> B1ft

(c) 0.0355 + 0.0480 = 0.0835 B1

4.	(a)	The set of values of the test statistic for which	B1	
		the null hypothesis is rejected in a hypothesis test.	B1	
	(b)	$X \sim B(30,0.3)$	M1	
		$P(X \leq 3) = 0.0093$		
		$P(X \leq 2) = 0.0021$	A1	
		$P(X \geq 16) = 1 - 0.9936 = 0.0064$		
		$P(X \geq 17) = 1 - 0.9979 = 0.0021$	A1	
		Critical region is $x \leq 2$ or $17 \leq x$	A1A1	
	(c)	15 (it) is not in the critical region	Bft 2, 1, 0	
		not significant		
		No significant evidence of a change in $P = 0.3$ accept H_0, (reject H_1)		
		$P(x \geq 15) = 0.0169$		
	(d)	Actual significance level 0.0021 + 0.0021 = 0.0042	B1	1
5.	(a)	X~ B; (25, 0.20)	B1; B1	
		P $(X \leq l) = 0.0274$ or $P(X = 0) =0.0038$	M1A1	
		P $(X \leq 9) = 0.9827; \Rightarrow P(X \geq 10) = 0.0173$	A1	
		CR is $X \leq 1$ and $X \geq 10$	A1	
	(b)	Significance level = 0.0274 + 0.0173		
		= 0.0447 or 4.477%	B1	
	(c)	H_0: $p = 0.20$; H_1 : $p < 0.20$;	B1 B1	
		Under H_0 $Y \sim B$ (20, 0.20)	B1	
		$P(Y \leq 2) = 0.2061$	M1	
		$P(Y \leq 1) = 0.0692$		
		= 0.2061 CR $Y \leq 1$	A1	
		0.2061 > 0.10 or 0.7939 < 0.9 or 2 > 1	M1	
		Insufficient evidence to suggest that the proportion of defective bowls has decreased.	Blft	

6.	(a)	2 outcomes/faulty or not faulty/success or fail	B1
		A constant probability	B1
		Independence	
		Fixed number of trials (fixed n)	
	(b)	$X \sim B(50, 0.25)$	M1
		$P(X \leq 6) = 0.0194$	
		$P(X \leq 7) = 0.0453$	
		$P(X \geq 18) = 0.0551$	
		$P(X \geq 19) = 0.0287$	
		$P(X \geq 20) = 0.0139$	
		CR $X \leq 6$ and $X \geq 20$	A1 A1
	(c)	$0.0194 + 0.0139 = 0.0333$	M1 A1
	(d)	8(It) is not in the Critical region	
		or 8(It) is not significant	M1
		or $0.0916 > 0.025$;	
		There is evidence that the probability of a faulty bolt is 0.25	A1ft
		or the company's claim is correct	
	(e)	$H_0 : p = 0.25$ $H_1 : p < 0.25$	B1 B1
		$P(X \leq 5) = 0.0070$ or CR $X \leq 5$	M1 A1
		$0.007 < 0.01$,	
		5 is in the critical region, reject H_0, significant.	M1
		There is evidence that the probability of faulty bolts has decreased	A1ft