Question	Scheme	Marks
2. (a)	$\dfrac{n^3}{(n+1)^3} = 0.729 \Rightarrow \dfrac{n}{n+1} = \sqrt[3]{0.729} \Rightarrow n = 9$	M1A1cso
		(2)
(b)	$P(T = 24) = 0.9^2(1-0.9) \times 3$	
	$P(T = 30) = 0.9(1-0.9)^2 \times 3$	M1
	$P(T = 36) = (1-0.9)^3$	M1

T	[18]	24	30	36
$P(T = t)$	[0.729]	0.243	0.027	0.001

		Marks
		A1 A1
		(4)
(c)	$P(R = 0) = P(T = 18) + P(T = 36) = 0.73$	M1 A1
	$P(R = 6) = P(T = 24) + P(T = 30) = 0.27$	
		(2)
		Total 8

Notes

(a) M1 for a correct equation in n, $n + 1$ and 0.729
A1 cso M1 must be scored and no errors seen

Alternative (verification):
M1 for $\dfrac{9^3}{(9+1)^3} = 0.729$
A1 cso for stating $n = 9$ from correct working

(b) 1st M1 for either $p^2(1-p) \times 3$ or $p(1-p)^2 \times 3$
2nd M1 for $(1-p)^3$ or use of $1 - P(T \neq 36)$
1st A1 for at least 1 correct probability
2nd A1 dependent on both M marks. Must have t values of 24, 30 and 36
    associated with correct probabilities. (Need not be in a table).

(c) M1 for correct calculation for either $P(R = 0)$ or $P(R = 6)$
A1 both probabilities correct and associated with correct r values and no other (non-zero) probabilities

Question	Scheme	Marks
4.(a)	$np = 4.2$ $np(1 - p) = 3.57$	M1
	leading to $(1 - p) = 0.85$	M1
	$p = 0.15$ $n = 28$	A1 A1
		(4)
(b)	$X \sim B(25, 0.35)$	
	$E(X) = 8.75$	B1
	$[P(X > 8.75) = P(X \geq 9) =]$	
	$1 - P(X \leq 8) = 1 - 0.4668 = 0.5332$ **awrt 0.533**	M1 A1
		(3)
(c)	$H_0 : p = 0.1$ $H_1 : p < 0.1$	B1
	$Y \sim B(40, 0.1)$	
	$P(Y \leq 1) = 0.080473\ldots$	M1
	Do not reject H_0 / Not significant	dM1
	The <u>proportion</u> of customers buying more than 2 bags of sweets is <u>not less than 10%/not less than the shop's claim</u>	A1cso
	or	
	The <u>shop's claim</u> is not rejected	
		(4)
		Total 11
	Notes	
(a)	1st M1 for correct expressions for mean and variance	
	2nd M1 for attempting to solve simultaneously by eliminating n or p	
	1st A1 for $p = 0.15$	
	2nd A1 for $n = 28$	
(b)	B1 for $E(X) = 8.75$ (may be implied by the M1)	
	M1 for using $1 - P(X \leq 8)$ with binomial $(25, 0.35)$ (allow ft for a correct probability statement consistent with their $E(X)$ with binomial $(25, 0.35)$)	
(c)	B1 both hypotheses correct (must use p or π)	
	1st M1 for awrt 0.0805 **or** for stating critical region is $Y = 0$ from $B(40, 0.1)$	
	2nd dM1 Dependent on previous M being awarded. A correct statement (do not allow if there are contradicting non-contextual statements). This mark may be implied by a correct contextual statement.	
	A1cso A correct contextual statement. All previous marks must be awarded for this mark to be awarded. Must include proportion/number/percentage/probability (condone rate) oe <u>and</u> 10%/shop's claim **or** The shop's claim is not rejected. Allow The shop's claim is supported/accepted	

Question	Scheme	Marks
6. (a)	$X \sim B(80, 0.6) \approx N(48, 19.2)$	M1 A1
	$P(X \geq n) < 0.05$ $\qquad\qquad$ $P(X \leq n-1) > 0.95$	
	$P\left(Z > \dfrac{(n-0.5)-48}{\sqrt{19.2}} \right) < 0.05$ $\qquad$ $P\left(Z < \dfrac{((n-1)+0.5)-48}{\sqrt{19.2}} \right) > 0.95$	M1
	$\dfrac{(n-0.5)-48}{\sqrt{19.2}} > 1.6449$	M1 B1
	$n > 55.7$ $\qquad\qquad\qquad$ $n = 56$	A1cao
		(6)
(b)	$[H_0 : \lambda = 9 \qquad\qquad H_1 : \lambda > 9]$	
	$[B \sim Po(9)]$	
	$P(B \leq 14) = 0.9585 / P(B \geq 15) = 0.0415 \, (< 0.05)$	M1
	$B \geq 15$	A1
		(2)
		Total 8

	Notes	
(a)	1st M1 for writing or using a normal approximation	
	1st A1 correct mean and variance (may be implied by the standardisation expression)	
	2nd M1 for attempting a continuity correction $(n \pm 0.5)$ or $((n-1) \pm 0.5)$ (allow $n - 48.5$ or $n - 47.5$ or $n - 46.5$ as numerator in a standardisation attempt)	
	3rd M1 for standardising n or $(n \pm 0.5)$ or $(n-1)$ or $((n-1) \pm 0.5)$ with their mean and their standard deviation and comparing to z-value, $|z| > 1$	
	B1 for use of 1.6449 or better compatible with their standardisation	
	A1 56 cao dependent upon all M marks (from correct working- can score A1 from z-value $1.64 \leq z \leq 1.65$)	
	NB: Use of binomial score 0 out of 6	
(b)	M1 for either $P(B \leq 14) = 0.9585$ or $P(B \geq 15) = 0.0415$ (may be implied by correct CR)	
	A1 allow use of any letter but must be a CR not a probability statement	