Question	Answer	Marks	Guidance
1	$0.6 \pm z\sqrt{\frac{0.4\times0.6}{100}}$	M1	Recognisable value of z
	$z = 2.326$	B1	2.326 to 2.329
	0.486 to 0.714 (3 sf)	A1	Must be an interval
		3	

Question	Answer	Marks	Guidance
2	$\frac{50}{49}\left(\frac{4361}{50}-\bar{x}^2\right) = 9.62$	M1	or $\left(\frac{4361}{49}-\frac{(\Sigma x)^2}{50\times49}\right) = 9.62$ BOD regarding symbols used
	$\bar{x}^2 = \frac{4361}{50}$ - $9.62\times\frac{49}{50} = 77.7924$	A1	$(\Sigma x)^2 = 4361 \times 50 - 9.62 \times 50 \times 49 = 194481$or $\Sigma x = 441$ (Σx) or $(\bar{x})$ must be correctly identified
	$\bar{x} = 8.82$ (3 sf)	A1	SC use of 'biased' leading to 8.81 B1
		3	

Question	Answer	Marks	Guidance
3(i)	*D* more likely to be chosen	B1	oe, e.g. P(*D*) > P(*A*) e.g. P(A)=P(B)=P(C)=1/6 P(D)=1/2 no contradictions
		1	
3(ii)	Reject scores of 5 or 6	B1	or other correct: choose D when the score is 4
		1	

Question	Answer	Marks	Guidance
3(iii)	AB AC AD BC BD CD	B1	
	Allocate as follows: 1: AB; 2: AC; 3: AD; 4: BC; 5: BD 6: CD	B1	or similar
		2	

Question	Answer	Marks	Guidance
4	Total ~ N(1208, ...)	B1	
	Var(total) (= 10×1.2 + 20×0.7 (+ 0)) = 26	B1	May be implied by next line
	$\pm \frac{1200-\text{"}1208\text{"}}{\sqrt{\text{"}26\text{"}}}$ (= –1.569)	M1	**FT** their mean and var of total mass, e.g. allow 1200 and 11.24 (from $10 \times 1.2^2 + 20 \times 0.7^2$)
	1 – Φ(“1.569”)	M1	Correct area consistent with their working
	= 0.0583 (3 sf)	A1	
		5	

Question	Answer	Marks	Guidance
5	H_0: Pop mean = 20 H_1: Pop mean ≠ 20	**B1**	 Accept μ
	$\frac{\Sigma x}{6}$ $\left(= \frac{126.9}{6} = 21.15\right)$	**M1**	Attempted or 126.9 and 11.64 attempted
	$\frac{'21.15'-20}{\sqrt{\frac{1.94}{6}}}$	**M1**	Must have $\sqrt{6}$ or $\frac{120-126.9}{\sqrt{11.64}}$ no mixed method
	= 2.022	**A1**	
	2(1 - ϕ(‘2.022’)) 2 (1 – '0.9784)' = 0.0432)	**M1**	**FT** $2\times\left(1-'.9784'\right)$
	α = 4.32 (3 sf)	**A1**	**FT** Allow 4.3 or 4, if correct working seen, or clearly implied, as far as 0.0216 **FT** their z, no error seen One-tail test scores maximum 3/6
		6	

Question	Answer	Marks	Guidance
6(i)	$\frac{3}{a^3}\int_0^a x^2 dx$ $(= \frac{3}{a^3}\left[\frac{x^3}{3}\right]_0^a)$	**M1**	Attempt to integrate f(x) with limits 0 and a (condone missing $\frac{3}{a^3}$)
	$= \frac{3a^3}{3a^3}$	**A1**	$\frac{3a^3}{3a^3} - 0$ or better seen
	= 1 Hence f is pdf for all *a*	**A1**	Answer = 1 and comment
		3	
6(ii)	$\frac{3}{a^3}\int_0^2 x^2 dx = 0.5$ $\frac{3}{a^3}\left[\frac{x^3}{3}\right]_0^2 = 0.5$	**M1**	Attempt to integrate f(x)=0.5, limits 0 and 2 oe, condone missing $\frac{3}{a^3}$
	$\frac{3}{a^3} \times \frac{8}{3} = 0.5$ oe	**A1**	$\frac{2^3}{3} - 0$ or better, condone missing $\frac{3}{a^3}$
	$a^3 = 16$ or $a = \sqrt[3]{16}$ (= 2.52 **AG**)	**A1**	Convincingly obtained Note: Attempt to verify 2.52, M1 as stated except not equated to 0.5.A1 as stated, A1 for evaluation to 0.499..apprx 0.5
		3	

Question	Answer	Marks	Guidance
6(iii)	$\frac{3}{16}\int_0^{2.52} x^3 dx$ or $\frac{3}{16}\int_0^{a} x^3 dx$ $= \frac{3}{16}\left[\frac{x^4}{4}\right]_0^{2.52}$ or $\frac{3}{16}\left[\frac{x^4}{4}\right]_0^{a}$	M1	Attempt integ $xf(x)$, correct limits, condone missing $\frac{3}{a^3}$
	$= \frac{3}{16} \times \frac{40.317}{4}$	A1	$\frac{2.52^4}{4} - 0$ or better, condone missing $\frac{3}{a^3}$
	$= 1.89$ (3 sf)	A1	
		3	

Question	Answer	Marks	Guidance
7(i)	Use of Po(2.8)	M1	May be implied
	$1 - e^{-2.8}(1 + 2.8 + \frac{2.8^2}{2}))$	M1	Any λ allowing one end error
	= 0.531or 0.53(0) (3 sf)	A1	SC Binomial 0.534 B1
		3	
7(ii)	Use of Po(5.8)	M1	May be implied
	$e^{-5.8} \times \frac{5.8^6}{6!}$	M1	Any λ
	= 0.16(0) (3 sf)	A1	
		3	

Question	Answer	Marks	Guidance
7(iii)	Use of N(58, 58)	**M1**	May be implied or N(58, 55.38)
	$\frac{50.5-'58'}{\sqrt{'58'}}$ (= -0.985)	**M1**	Standardised with their values, allow wrong or incorrect cc
	$\Phi('0.985')$	**M1**	Correct area consistent with their working or $\Phi("1.008)$
	= 0.838 (3 sf)	**A1**	or 0.843
		4	

Question	Answer	Marks	Guidance
8(i)	$H_0: p = \frac{1}{4}$ $H_1: p > \frac{1}{4}$	B1	
	${}^{10}C_6 (\frac{1}{4})^6 (\frac{3}{4})^4 + {}^{10}C_7 (\frac{1}{4})^7 (\frac{3}{4})^3 + {}^{10}C_8 (\frac{1}{4})^8 (\frac{3}{4})^2 +$ $10 (\frac{1}{4})^9 (\frac{3}{4}) + (\frac{1}{4})^{10}$	M1	Correct terms, allow one term incorrect or omitted or extra or summing all correct terms from 0 to 5 allow one term incorrect or omitted or extra
	= 0.0197	A1	or 0.9803
	comp '0.0197' with 0.01	M1	Valid comparison with 0.01 or valid comparison with 0.99
	No evidence to conclude $p > \frac{1}{4}$	A1	**FT** No contradictions Use of two-tail test can score BOM1A1M1(comparison with 0.005) A0
		5	
8(ii)	${}^{10}C_7 (\frac{1}{4})^7 (\frac{3}{4})^3 + {}^{10}C_8 (\frac{1}{4})^8 (\frac{3}{4})^2 + 10 (\frac{1}{4})^9 (\frac{3}{4}) + (\frac{1}{4})^{10}$	M1	Their P(X $\geqslant$ 6) – ${}^{10}C_6 (0.25)^6 (0.75)^4$
	P(Type I) = 0.00351 (3 sf)	A1	Accept 0.00348 to 0.00351
		2	
8(iii)	C.R is $X \geqslant 7$ P(Type II) = 1 – P($X \geqslant 7 \mid p = \frac{3}{5}$) =	M1	May be implied
	$1 - ({}^{10}C_7 (\frac{3}{5})^7 (\frac{2}{5})^3 + {}^{10}C_8 (\frac{3}{5})^8 (\frac{2}{5})^2 + 10 (\frac{3}{5})^9 (\frac{2}{5}) + (\frac{3}{5})^{10})$	M1	Accept 1 – P($X \geqslant 8 \mid p = \frac{3}{5}$) or 1 – P($X \geqslant 6 \mid p = \frac{3}{5}$)
	= 0.618	A1	
		3	