Question	Answer		Marks	Guidance
1	$\frac{40.5-31}{\sqrt{31}}$	(= 1.706)	M1	standn correct but allow with no or incorrect cc
	1 – ¢("1.706")		M1	indep correct area consistent with working
	= 0.0441 (3 sf) or 0.0440		A1	not 0.044
			3	

Question	Answer	Marks	Guidance
2	Poisson	B1	seen or implied
	$\lambda = 4.03$	B1	seen or implied
	$e^{-4.03}(1+4.03+\frac{4.03^2}{2!})$	M1	any λ ; e.g. allow $\lambda = 4$ no extra or missing terms
	= 0.234 (3 sf)	A1	
		4	

Question	Answer	Marks	Guidance
3	$\frac{\frac{153}{200} + z \times \sqrt{\frac{\frac{153}{200} \times \frac{200 - 153}{200}}{200}} = 0.835$ (Var(P _s) = 0.000898875) (s.d. 0.02998)	M1	
	z = 2.335	A1	allow 2.33 or 2.34
	$2\Phi(z)-1$	M1	or equivalent method indep
	$\alpha = 98$	A1	allow 98.0 but not e.g. 98.04
		4	

Question	Answer	Marks	Guidance
4(i)	$300.1 \pm z \times \frac{0.9}{\sqrt{75}}$	M1	allow any value of <i>z</i>
	<i>z</i> = 2.576	B1	allow 2.574 to 2.579
	299.83 to 300.37 (2 dps)	A1	answer must be seen to 2 dps need an interval
		3	
4(ii)	CI includes 300 so claim supported or justified or probably true	B1 FT	or equivalent FT from CI in (i)
		1	

Question	Answer	Marks	Guidance
5(i)	$\frac{1}{4}\int_{0}^{2} (x^{2} + x) dx \qquad (= \frac{1}{4} \left[\frac{x^{3}}{3} + \frac{x^{2}}{2} \right]_{0}^{2})$	M1	Attempt integ $xf(x)$, ignore limits
	$= \frac{1}{4} \left(\frac{8}{3} + 2\right) (-0)$	A1	Subst correct limits in correct integration
	$=\frac{7}{6}$ OE or 1.17 (3 sf)	A1	
		3	
5(ii)	$\frac{1}{4}\int_{0}^{m} (x+1) \mathrm{d}x = 0.5 \left(=\frac{1}{4}\left[\frac{x^{2}}{2} + x\right]_{0}^{m} = 0.5\right)$	M1	attempt integ $f(x)$, limits 0 to unknown (or unknown to 2) and = 0.5
	$\frac{1}{4}(\frac{m^2}{2} + m) = 0.5$	A1	a correct equation in <i>m</i> (any form)
	$m^{2} + 2m - 4 = 0$ $m = \frac{-2\pm\sqrt{4+16}}{2} \text{ OE}$		or $\sqrt{5} - 1$
	m = 1.24	A1	must reject the negative value if there
		3	

Question	Answer	Marks	Guidance
6(i)	Mean = $3.2 \times 90 = 288$	B1	
	Variance = $0.4^2 \times 90^2$	M1	
	= 1296	A1	
		3	
6(ii)	Mean = $288' + 4.3 \times 95 = 696.5$	B1 FT	
	Variance = $(1296) + 0.6^2 \times 95^2 = 4545$	B1 FT	FT their (i)
	$\frac{670-696.5}{\sqrt{4545}} \qquad (= -0.393)$	M1	FT Var provided both given Vars used standardising (ignore cc) no sd / Var mix
	$1 - \phi(`-0.393') = \phi(`0.393)$	M1	correct area consistent with their working (i.e. their mean)
	= 0.653 (3 sf)	A1	
		5	

Question	Answer	Marks	Guidance
7(i)	H_0 : mean no. sales = 3.5	B1	or " = 0.7 (per day)"
	H_1 : mean no. sales > 3.5	M1	allow ' λ ' or ' μ ' but not just 'mean'
	$P(X \ge 5) = 1 - e^{-3.5}(1 + 3.5 + \frac{3.5^2}{2!} + \frac{3.5^3}{3!} + \frac{3.5^4}{4!})$	M1	
	= 0.275	A1	allow 0.274
	Comp with 0.10	M1	valid comparison using Poisson
	No evidence (at 10%) to believe that sales per day have increased	A1 FT	correct conclusion FT no contradictions
		6	

Question	Answer	Marks	Guidance
7(ii)	$\lambda = 3.9$	B1	
	$e^{-3.9} \times \frac{3.9^2}{2!}$	M1	any $\lambda \neq 0.7$ or 0.6), single term
	= 0.154 (3 sf)	A1	
		3	

Question	Answer	Marks	Guidance
8(i)	$\overline{x} = 27/150 \ (= 0.18)$	B1	
	$s = \sqrt{\frac{150}{149}} \times \sqrt{\frac{5.01}{150}} - 0.18^2 \text{ or variance}$ (= 0.031729) (var = 3/2980 = 0.0010067)	M1	or var = $1/149(5.01 - 27.0^2/150)$
	H ₀ : Pop mean = 0.185 H ₁ : Pop mean < 0.185	B1	allow just 'µ'
	$\frac{0.18 - 0.185}{\frac{'0.031729'}{\sqrt{150}}}$	M1	standardising, need $\sqrt{150}$
	= (-) 1.930 (3 sfs) or 1.93	A1	
	Comp with $z = (-) 2.326$	M1	$\begin{array}{l} \mbox{consistent signs} \\ \mbox{or using probs } 0.0268 > 0.01 \mbox{ or } 0.9732 \\ < 0.99 \\ \mbox{or using } x_{crit} \ 0.18 > 0.17897 \end{array}$
	There is no evidence (at 1% level) that concentration with drug is less than without drug	A1 FT	conclusion FT no contradictions
		7	

Question	Answer	Marks	Guidance
8(ii)	$\frac{cv - 0.185}{\frac{0.031729'}{\sqrt{150}}} \ (= -2.326)$	M1	must use 0.185 and $\sqrt{150}$
	= 0.17897 or 0.179	A1	acceptance region (for H_0) is > 0.179
	$\frac{"0.17897" - 0.175}{\frac{'0.031729'}{\sqrt{150}}} $ (=1.534)	M1	must use 0.175 and $\sqrt{150}$
	1 – φ("1.534")	M1	indep mark
	= 0.0625 (3 sf)	A1	Accept 0.0610 to 0.0628
		5	