GCE MARKING SCHEME

MATHEMATICS - C1-C4 & FP1-FP3 AS/Advanced

SUMMER 2013

Ques	Solution	Mark	Notes
1(a)(i)	$z = \frac{10.5-10}{2} = 0.25$	M1A1	M0 for 2^2 or $\sqrt{2}$ M1A0 for – 0.25 if final answer incorrect
	P($X \le 10.5$) = 0.5987	A1	M0 no working
(ii)	$x = \frac{x-\mu}{\sigma} = 1.282$	M1	M1 for 2.326, 1.645, 2.576
	= 12.564	A1	Accept 12.6
(b)(i)	E(X + 2Y) = 34	B1	
	Var(X + 2Y) = Var(X) + 4Var(Y) = 40	B1	
	We require P(X + 2Y < 36) $z = \frac{36-34}{\sqrt{40}} = 0.32$	M1A1	FT their mean and variance M0 no working
	Prob = 0.6255	A1	
(ii)	Consider $U = X_1 + X_2 + X_3 - Y_1 - Y_2$ E(U) = 3 × 10 – 2 × 12 = 6	B1	
	Var(U) = 3 × 4 + 2 × 9 = 30	M1A1	
	We require P(U < 0) $z = \frac{0-6}{\sqrt{30}} = -1.10$	m1A1	Do not FT their mean and variance
	Prob = 0.136	A1	
2(a)	$\bar{x} = \frac{9980}{50}$ (= 199.6)	B1	
	SE of $\bar{X} = \frac{4}{\sqrt{50}}$ (= 0.5656…)	B1	
	95% conf limits are 199.6 ± 1.96 × 0.5656…	M1A1	M1 correct form, A1 correct z.
	giving [198.5, 200.7] cao	A1	M0 no working
(b)	Width of 95% CI = $3.92 \times \frac{4}{\sqrt{n}}$ si	B1	FT their z from (a)
	We require $3.92 \times \frac{4}{\sqrt{n}} < 1$	M1	Award M1A0A0 for 1.96 instead of 3.92
	$n >$ 245.86…	A1	
	Minimum n = 246	A1	FT from line above if n > 50

3(a)	$H_0 : \mu_B = \mu_G ; H_1 : \mu_B \neq \mu_G$	**B1**	
(b)	$\bar{x}_B = \frac{482}{8} = 60.25; \bar{x}_G = \frac{430}{8} = 53.75$	**B1B1**	
	SE of diff of means= $\sqrt{\frac{7.5^2}{8} + \frac{7.5^2}{8}}$ (3.75)	**M1A1**	
	Test statistic (z) = $\frac{60.25 - 53.75}{3.75}$	**m1A1**	
	= 1.73	**A1**	
	Prob from tables = 0.0418	**A1**	FT their z if M marks gained
	p-value = 0.0836	**B1**	FT on line above
	Insufficient evidence to conclude that there is a difference in performance between boys and girls.	**B1**	FT their p-value
4(a)	$H_0 : p = 0.4; H_1 : p > 0.4$	**B1**	
(b)	Let X = No. supporting politician so that		
	X is B(50,0.4) (under H_0) si	**B1**	
	p-value = $P(X \geq 25 \mid X \text{ is } B(50,0.4))$	**M1**	M0 for $P(X = 25)$ or $P(X > 25)$
	= 0.0978	**A1**	M0 normal or Poisson approx
	Insufficient evidence to conclude that the support is greater than 40%.	**B1**	FT on p-value
(c)	X is now B(400,0.4) (under H_0) $\approx$ N(160,96)	**B1**	
	p-value = $P(X \geq 181 \mid X \text{ is } N(160,96))$	**M1**	
	$z = \frac{180.5 - 160}{\sqrt{96}}$	**m1A1**	Award m1A0A1A1 for incorrect or no continuity correction
	= 2.09	**A1**	$181.5 \to z = 2.19 \to p = 0.01426$
	p-value = 0.0183	**A1**	$181 \to z = 2.14 \to p = 0.01618$
	Strong evidence to conclude that the support is greater than 40%.	**B1**	FT on p-value
5(a)	$H_0 : \mu = 1.2 : H_1 : \mu < 1.2$	**B1**	Must be μ
(b)(i)	Let X = number of accidents in 60 days		
	Then X is Poi(72) (under H_0) $\approx$ N(72,72) si	**B1**	
	Sig level = $P(X \leq 58 \mid H_0)$	**M1**	
	$z = \frac{58.5 - 72}{\sqrt{72}}$	**m1A1**	Award m1A0A1A1 for incorrect or no continuity correction
	$= -1.59$	**A1**	$57.5 \to z = -1.71 \to p = 0.0436$
	Sig level = 0.0559	**A1**	$58 \to z = -1.65 \to p = 0.0495$
(ii)	X is now Poi(48) which is approx N(48,48) si	**B1**	
	P(wrong conclusion) = $P(X \geq 59 \mid \mu = 0.8)$	**M1**	
	$z = \frac{58.5 - 48}{\sqrt{48}}$	**m1A1**	Award m1A0A1A1 for incorrect or no continuity correction
	= 1.52	**A1**	$59.5 \to z = 1.66 \to p = 0.0485$
	P(wrong conclusion) = 0.0643	**A1**	$59 \to z = 1.59 \to p = 0.0559$

6(a)(i)	$E(C) = 2\pi E(R)$ $= 2\pi \times 7 = 14\pi$ (43.98) $\text{Var}(C) = 4\pi^2 \text{Var}(R)$ $= \dfrac{4\pi^2}{3}$ (13.16)	**M1** **A1** **M1** **A1**	Accept the use of integration, M1 for a correct integral and A1 for the correct answer
(ii)	$P(C \le 45) = P(R \le 45/2\pi)$ $= \dfrac{(45/2\pi - 6)}{8-6}$ $= 0.581$	**M1** **A1** **A1**	
(b)(i)	$A = \pi R^2$ $P(A \ge 150) = P\left(R \ge \sqrt{150/\pi}\right)$ $= \dfrac{8-\sqrt{150/\pi}}{8-6}$ $= 0.545$	 **M1A1** **A1** **A1**	
(ii)	EITHER $E(A) = \displaystyle\int_6^8 \pi r^2 \times \frac{1}{2}\,dr$ $= \dfrac{\pi}{6}\left[r^3\right]_6^8$ $= \dfrac{148\pi}{3}$ (155) OR $E(A) = \pi E(R^2) = \pi\left(\text{var}(R) + (E(R))^2\right)$ $= \pi\left(\dfrac{1}{3} + 7^2\right)$ $= \dfrac{148\pi}{3}$ (155)	 **M1** **A1** **A1** **M1** **A1** **A1**	