GCE MARKING SCHEME

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

SUMMER 2014

Ques	Solution	Mark	Notes
1	$\bar{x} = \frac{405.6}{8}$ (= 50.7)	**B1**	
	SE of $\bar{X} = \frac{4}{\sqrt{8}}$ (= 1.4142…)	**M1A1**	
	90% conf limits are 50.7 ± 1.645 × 1.4142… giving [48.4, 53.0] cao	**M1A1** **A1**	M1 correct form, A1 correct z. Award M0 if no working seen
2(a)	Upper quartile = mean + 0.6745 × SD = 86.0	**M1** **A1**	
(b)	Let X=weight of an orange, Y=weight of a lemon		
	$E(\Sigma X)$ = 1984	**B1**	
	Var(ΣX) = 512	**B1**	
	$z = \frac{2000-1984}{\sqrt{512}} = 0.71$	**M1A1**	Award M0 if no working seen
	Prob = 0.7611 cao	**A1**	
(c)	Let $U = X - 3Y$	**M1**	
	E(U) = – 7	**A1**	
	Var(U) = 64 + 9 × 2.25 = 84.25	**M1A1**	
	We require P(U >0) $z = \frac{0+7}{\sqrt{84.25}} = 0.76$	**m1A1**	Award m0 if no working seen
	Prob = 0.2236	**A1**	
3(a)	$H_0 : \mu_M = \mu_F ; H_1 : \mu_M \neq \mu_F$	**B1**	
(b)	Let X= male weight, Y=female weight ($\sum x = 39.2; \sum y = 46.6$) $\bar{x} = 4.9; \bar{y} = 4.66$	**B1B1**	
	SE of diff of means= $\sqrt{\frac{0.5^2}{8} + \frac{0.5^2}{10}}$ (0.237…)	**M1A1**	
	Test statistic = $\frac{4.9-4.66}{0.237...}$	**m1**	Award m0 if no working seen
	= 1.01	**A1**	
	Prob from tables = 0.1562	**A1**	
	p-value = 0.3124	**B1**	FT line above
	Insufficient evidence to conclude that there is a difference in mean weight between males and females.	**B1**	FT their p-value

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4(a)(i)	$H_0: p = 0.6; H_1: p < 0.6$	B1	
(ii)	Let X = Number of games won Under H_0, X is B(20,0.6) si Let Y = Number of games lost Under H_0, Y is B(20,0.4) p-value = $P(X \le 7 \mid (X \text{ is } B(20,0.6)))$ = $P(Y \ge 13 \mid Y \text{ is } B(20,0.4)$ = 0.021 Strong evidence to reject Gwilym's claim (or to accept Huw's claim).	B1 B1 M1 A1 A1 B1	 Award M0 if no working seen FT on p-value
(b)	X is now B(80,0.6) (under H_0) $\approx$ N(48,19.2) p-value = $P(X \le 37 \mid X \text{ is } N(48,19.2))$ $z = \frac{37.5 - 48}{\sqrt{19.2}}$ $= -2.40$ p-value = 0.0082 Very strong evidence to reject Gwilym's claim (or to accept Huw's claim).	B1B1 M1 A1 A1 A1 B1	 Award M0 if no working seen Award M1A0A1 for incorrect or no continuity correction No cc ; $z = -2.51$, $p = 0.00604$ 36.5 ; $z = -2.62$, $p = 0.0044$ FT on p-value only if less than 0.01
5(a)	$E(X) = E(Y) = 1.2$ E(U) = E(X)E(Y) = 1.44 cao	B1 B1	
(b)	Var(X) = Var(Y) = 0.96 $E(X^2)(= E(Y^2)) = \text{Var}(X) + [E(X)]^2 = 2.4$ Var(U) = $E(X^2Y^2) - [E(XY)]^2$ = $E(X^2)E(Y^2) - [E(X)E(Y)]^2$ = 3.69 cao	B1 M1A1 M1 A1 A1	 FT their values from (a)
6(a)(i)	Under H_0, X is Po(15) si $P(X \le 10) = 0.1185; P(X \ge 20) = 0.1248$ Significance level = 0.2433	B1 B1 B1	 Award B1 for either correct
(ii)	X is now Poi(10) P(accept H_0) = $P(11 \le X \le 19)$ = $0.9965 - 0.5830$ or $0.4170 - 0.0035$ = 0.4135 cao	B1 M1 A1 A1	 Award M0 if no working seen
(b)	Under H_0, X is now Po(75) $\approx$ N(75,75) $z = \frac{91.5 - 75}{\sqrt{75}} = 1.91$ Prob from tables = 0.0281 p-value = 0.056 Insufficient evidence to reject H_0	B1 M1A1 A1 A1 B1	 Award M1A0 for incorrect or no continuity correction but FT further work. FT from line above FT from line above No cc gives $z = 1.96$, $p = .05$ 92.5 gives $z = 2.02$, $p = 0.0434$

Ques	Solution	Mark	Notes
7(a)	$P(L \le 4) = P(A \le 4^2)$	**M1**	
	$= \frac{16-15}{20-15}$	**A1**	
	$= 0.2$	**A1**	
(b)	$E(L) = E(A^{1/2})$		
	$= \int_{15}^{20} a^{1/2} \times \frac{1}{5}\,\mathrm{d}a$	**M1A1**	Limits can be left until next line
	$= \frac{2}{15}\left[a^{3/2}\right]_{15}^{20}$	**A1**	
	$= 4.18$	**A1**	Do not accept $\sqrt{17.5} = 4.18$
(c)	$\mathrm{Var}(L) = E(L^2) - [E(L)]^2$	**M1**	
	$= 17.5 - 4.18^2$	**A1**	FT their E(L)
	$= 0.03$	**A1**	