

## **GCE MARKING SCHEME**

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

**SUMMER 2015** 

Ques	Solution	Mark	Notes
1(a)	$H_0: \mu = 120; H_1: \mu \neq 120$	<b>B1</b>	
(b)	$\bar{x} = \frac{\sum x}{10}$	M1	
	= 119.2	<b>A1</b>	
	Test statistic = $\frac{119.2 - 120}{\sqrt{1.2^2/10}}$	M1A1	Award M0 if 10 omitted
	= -2.11 Value from tables = 0.01743 $p-value = 0.03486$ Strong evidence that the mean speed has changed.	A1 A1 A1 B1	FT from line above Accept 'mean speed has decreased'
			FT the <i>p</i> -value if less than 0.05
(b)	$95^{\text{th}}$ percentile = $82 + 1.645 \times 2.5$ = $86.1$ Let X=weight of a man, Y=weight of a woman	M1 A1	
	$z_1 = \frac{68 - 65}{2} = 1.5$	M1A1	M0 if no working
	$z_2 = \frac{64 - 65}{2} = -0.5$	A1	
	P(Y < 1.5) = 0.9332 or $P(Y > -0.5) = 0.6915$	A1	
	P(Y < -0.5) = 0.3085  or  P(Y > 1.5) = 0.0668	A1 A1	
	P(64 < Y < 68) = 0.6247	AI	
(c)	Let $U = \sum_{i=1}^{3} X_i + \sum_{i=1}^{4} Y_i$		
	$E(U) = 3 \times 82 + 4 \times 65 = 506$	B1	
	$Var(U) = 3 \times 2.5^2 + 4 \times 2^2 = 34.75$	M1A1	
	$z = \frac{500 - 506}{\sqrt{34.75}} = -1.02$	M1A1	
	Prob = 0.8461	A1	
3(a)	Let $X$ , $Y$ = measured sugar contents of A,B ( $\sum x = 1612; \sum y = 1584$ ) $\bar{x} = 201.5; \bar{y} = 198$	B1B1	
	SE of diff of means= $\sqrt{\frac{1.5^2}{8} + \frac{1.5^2}{8}}$ (0.75)	M1A1	M0 if 8 omitted or only one term
	99% confidence limits for the difference are $201.5-198\pm2.5758\times0.75$	m1A1	Award this A1 for z if m1 given
( <b>L</b> )	[1.57, 5.43]	A1	ET from (a)
<b>(b)</b>	$4.81 - 2.19 = 2z \times 0.75$ $z = 1.75$	M1A1 A1	FT from (a)
	Confidence level = 92%	A1	

4(a)	Under $H_0$ , <i>X</i> is $B(20,0.4)$ si	B1	
	$(P(X \ge 13) = 0.0210)$	M1	Award M1 for valid attempt at
	$ \begin{pmatrix} P(X \ge 13) = 0.0210 \\ P(X \ge 14) = 0.0065 \end{pmatrix} $		using tables
	$X \ge 14$ has significance level closest to 1%	<b>A1</b>	Award M1A0 for 13 or 15
(b)	Let $Y =$ number of hits Under H <sub>0</sub> , $Y$ is B(120, 0.4) $\approx N(48, 28.8)$ si	B1 B1	
	Test statistic = $\frac{54.5 - 48}{\sqrt{28.8}}$	M1A1	Award M1A0 for incorrect or no continuity correction but FT for following marks
	= 1.21 $p-value = 0.1131$ Legging to the state of t	A1 A1	No cc gives $z = 1.30$ , $p = 0.0968$ Wrong cc $z = 1.40$ , $p = 0.0808$
	Insufficient evidence to conclude that his shooting has improved	B1	FT the p-value
5	Let $X =$ score on a single die. Then $E(X) = 3.5$ and	B1	
	$Var(X) = \frac{91}{6} - 3.5^2 = \frac{35}{12}$	M1A1	
	Let $Y =$ mean of scores on 100 dice. Then by the Central Limit Theorem, $Y \approx N(3.5, 35/1200)$ .	M1A1	FT their mean and variance
	$z = \frac{3.75 - 3.5}{\sqrt{35/1200}}$	m1A1	Use of continuity correction gives $z = 1.43$ , $p = 0.0764$
	$= (\pm)1.46$ Prob = 0.0721	A1 A1	gives $z = 1.43$ , $p = 0.0704$
6(a)(i)	$H_0: \mu = 1.2; H_1: \mu < 1.2$	B1	Accept 12 in place of 1.2
(ii)	Under $H_0$ , $X$ is Po(12) si	<b>B</b> 1	1 1
	$P(X \le 9)$ $= 0.2424$	M1 A1	
	Insufficient evidence to conclude that the (mean) number of breakdowns has decreased.	B1	FT the <i>p</i> -value
<b>(b)</b>	Under $H_0$ , Y is Po(120) $\approx$ N(120,120)	<b>B</b> 1	
	$z = \frac{101.5 - 120}{\sqrt{120}}$	M1A1	Award M1A0 for incorrect or no continuity correction but FT for following marks
	= -1.69	<b>A1</b>	No cc gives $z = -1.73$ , $p=0.0418$
	p-value = 0.0455	<b>A1</b>	Wrong cc, $z = -1.78$ , $p = 0.0375$
	Strong evidence to conclude that the (mean) number of breakdowns has decreased.	B1	FT the <i>p</i> -value if less than 0.05

7(a)(i)	$P(Y \le y) = P(\sqrt{X} \le y)$	M1	
	$=P(X\leq y^2)$	<b>A1</b>	
	$=\frac{y^2-a}{b-a}$	<b>A1</b>	
(ii)	Attempting to differentiate,	M1	
	giving $\frac{2y}{b-a}$	<b>A1</b>	
<b>(b)</b>	$f(y) = \frac{2y}{b-a}$ for $\sqrt{a} \le y \le \sqrt{b}$	<b>A1</b>	
	= 0 otherwise		
	We are given that		
	$\frac{a+b}{2} = 5.5$ and $\frac{(b-a)^2}{12} = 3$	B1B1	
	Solving, $a = 2.5, b = 8.5$	M1 A1A1	