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Mark Scheme (Results)
Summer 2009

GCE

GCE Mathematics (6683/01)

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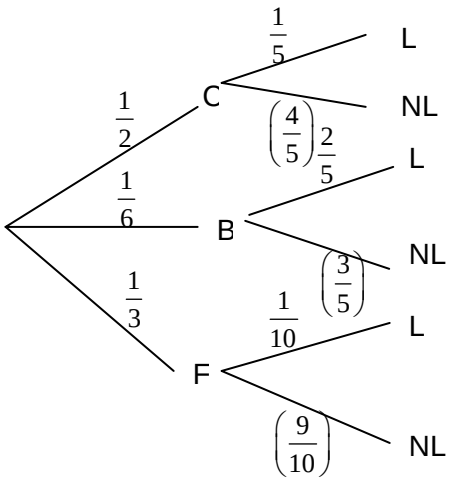
June 2009
6683 Statistics S1
Mark Scheme

Question Number	Scheme	Marks
Q1 (a)	$(S_{pp} =)\ 38125 - \frac{445^2}{10}$	M1
	$= 18322.5$ awrt 18300	A1
	$(S_{pt} =)\ 26830 - \frac{445 \times 240}{10}$	
	$= 16150$ awrt 16200	A1 (3)
(b)	$r = \frac{"16150"}{\sqrt{"18322.5" \times 21760}}$ Using their values for method	M1
	$= 0.8088...$ awrt 0.809	A1 (2)
(c)	As the temperature increases the pressure increases.	B1 (1) **[6]**
Notes	1(a) M1 for seeing a correct expression $38125 - \frac{445^2}{10}$ or $26830 - \frac{445 \times 240}{10}$ If no working seen, at least one answer must be exact to score M1 by implication. 1(b) Square root and their values with 21760 all in the right places required for method. Anything which rounds to (awrt) 0.809 for A1. 1(c) Require a correct statement in **context** using temperature/heat and pressure for B1. Don't allow " as *t* increases *p* increases". Don't allow proportionality. Positive correlation only is B0 since there is no interpretation.	

Question Number	Scheme	Marks
Q2 (a)	 Correct tree All labels Probabilities on correct branches	B1 B1 B1 (3)
(b)(i)	$\frac{1}{3}\times\frac{1}{10}=\frac{1}{30}$ or equivalent	M1 A1 (2)
(ii)	CNL + BNL + FNL $=\frac{1}{2}\times\frac{4}{5}+\frac{1}{6}\times\frac{3}{5}+\frac{1}{3}\times\frac{9}{10}$	M1
	$=\frac{4}{5}$ or equivalent	A1 (2)
(c)	$P(F'/L)=\frac{P(F'\cap L)}{P(L)}$ Attempt correct conditional probability **but see notes**	M1
	$=\frac{\frac{1}{6}\times\frac{2}{5}+\frac{1}{2}\times\frac{1}{5}}{1-(ii)}$ $\frac{\text{numerator}}{\text{denominator}}$	$\frac{\text{A1}}{\text{A1ft}}$
	$=\frac{\frac{5}{30}}{\frac{1}{5}}=\frac{5}{6}$ or equivalent cao	A1 (4) **[11]**
Notes	Exact decimal equivalents required throughout if fractions not used e.g. 2(b)(i) $0.0\dot{3}$ Correct path through their tree given in their probabilities award Ms 2(a) All branches required for first B1. Labels can be words rather than symbols for second B1. Probabilities from question enough for third B1 i.e. bracketed probabilities not required. Probabilities and labels swapped i.e. labels on branches and probabilities at end can be awarded the marks if correct. 2(b)(i) Correct answer only award both marks. 2(b)(ii) At least one correct path identified and attempt at adding all three multiplied pairs award M1 2(c) Require probability on numerator and division by probability for M1.Require numerator correct for their tree for M1. Correct formula seen and used, accept denominator as attempt and award M1 No formula, denominator must be correct for their tree or 1-(ii) for M1 1/30 on numerator only is M0, P(L/F') is M0.	

Question Number	Scheme	Marks
Q3 (a)	1(cm) cao	B1
(b)	10 cm^2 represents 15 10/15 cm^2 represents 1 or $1cm^2$ represents 1.5 Therefore frequency of 9 is $\frac{10}{15}\times 9$ or $\frac{9}{1.5}$ Require $x\frac{2}{3}$ or $\div 1.5$ height = 6(cm)	M1 A1 **[3]**
Notes	If 3(a) and 3(b) incorrect, but their (a) x their (b)=6 then award B0M1A0 3(b) Alternative method: f/cw=15/6=2.5 represented by 5 so factor x2 award M1 So f/cw=9/3=3 represented by 3x2=6. Award A1.	

Question Number	Scheme	Marks
Q4 (a)	$Q_2 = 17 + \left(\frac{60-58}{29}\right)\times 2$	M1
	= 17.1 (17.2 if use 60.5) awrt 17.1 (or17.2)	A1 (2)
(b)	$\sum fx = 2055.5$ $\sum fx^2 = 36500.25$ Exact answers can be seen below or implied by correct answers.	B1 B1
	Evidence of attempt to use midpoints with at least one correct	M1
	Mean = 17.129… awrt 17.1	B1
	$\sigma = \sqrt{\frac{36500.25}{120} - \left(\frac{2055.5}{120}\right)^2}$	M1
	= 3.28 (s= 3.294) awrt 3.3	A1 (6)
(c)	$\frac{3(17.129 - 17.1379...)}{3.28}$ = -0.00802 Accept 0 or awrt 0.0	M1 A1
	No skew/ slight skew	B1 (3)
(d)	The skewness is very small. Possible.	B1 B1dep (2) **[13]**

Notes
4(a) Statement of $17+\frac{\text{freq into class}}{\text{class freq}}\times \text{cw}$ and attempt to sub or $\frac{m-17}{19-17} = \frac{60(.5)-58}{87-58}$ or equivalent award M1 cw=2 or 3 required for M1. 17.2 from cw=3 award A0. 4(b) Correct $\sum fx$ and $\sum fx^2$ can be seen in working for both B1s Midpoints seen in table and used in calculation award M1 Require complete correct formula including use of square root and attempt to sub for M1. No formula stated then numbers as above or follow from (b) for M1 $(\sum fx)^2, \sum (fx)^2 or \sum f^2 x$ used instead of $\sum fx^2$ in sd award M0 Correct answers only with no working award 2/2 and 6/6 4(c) Sub in their values into given formula for M1 4(d) No skew / slight skew / 'Distribution is almost symmetrical' / 'Mean approximately equal to median' or equivalent award first B1. Don't award second B1 if this is not the case. Second statement should imply 'Greg's suggestion that a normal distribution is suitable is possible' for second B1 dep. If B0 awarded for comment in (c).and (d) incorrect, allow follow through from the **comment** in (c).

Question Number	Scheme	Marks
Q5 (a)	$b = \dfrac{59.99}{33.381}$	M1
	$= 1.79713\ldots..$ 1.8 or awrt 1.80	A1
	$a = 32.7 - 1.79713\ldots \times 51.83$	M1
	$= -60.44525\ldots$ awrt -60	A1
	$w = -60.445251\ldots + 1.79713\ldots l$ l and w required and awrt 2sf	A1ft (5)
(b)	$w = -60.445251\ldots + 1.79713\ldots \times 60$	M1
	$= 47.3825\ldots$ In range 47.3 – 47.6 inclusive	A1 (2)
(c)	It is extrapolating so (may be) unreliable.	B1, B1dep (2) **[9]**
Notes	5(a) Special case $b = \dfrac{59.99}{120.1} = 0.4995$ M0A0 $a = 32.7 - 0.4995 \times 51.83$ M1A1 $w = 6.8 + 0.50l$ at least 2 sf required for A1 5(b) Substitute into their answer for (a) for M1 5(c) 'Outside the range on the table' or equivalent award first B1	

Question Number	Scheme	Marks
Q6 (a)	$\begin{array}{\|c\|c\|c\|c\|}\hline 0 & 1 & 2 & 3 \\ \hline 3a & 2a & a & b \\ \hline \end{array}$	B1 (1)
(b)	$3a + 2a + a + b = 1$ or equivalent, using Sum of probabilities =1 $2a + 2a + 3b = 1.6$ or equivalent, using E(X)=1.6 $14a = 1.4$ Attempt to solve $a = 0.1$ cao $b = 0.4$ cao	M1 M1 M1dep B1 B1 (5)
(c)	$P(0.5 < x < 3) = P(1) + P(2)$ 3a or their $2a$+their a $= 0.2 + 0.1$ $= 0.3$ Require $0<3a<1$ to award follow through	M1 A1 ft (2)
(d)	$E(3X - 2) = 3E(X) - 2$ $= 3 \times 1.6 - 2$ $= 2.8$ cao	M1 A1 (2)
(e)	$E(X^2) = 1\times0.2 + 4 \times0.1 + 9 \times0.4$ (= 4.2) Var (X) = "4.2" – 1.6^2 = 1.64 **given answer** cso	M1 M1 A1 (3)
(f)	$Var(3X - 2) = 9$ Var (X) = 14.76 awrt 14.8	M1 A1 (2) **[15]**
Notes	6(a) Condone *a* clearly stated in text but not put in table. 6(b) Must be attempting to solve 2 different equations so third M dependent upon first two Ms being awarded. Correct answers seen with no working B1B1 only, 2/5 Correctly verified values can be awarded M1 for correctly verifying sum of probabilities =1, M1 for using E(X)=1.6 M0 as no attempt to solve and B1B1 if answers correct. 6(d) 2.8 only award M1A1 6(e) Award first M for at least two non-zero terms correct. Allow first M for correct expression with *a* and *b* e.g. $E(X^2) = 6a+9b$ Given answer so award final A1 for correct solution. 6(f) 14.76 only award M1A1	

Question Number	Scheme	Marks
Q7(a) (i)	$P(A \cup B) = a + b$ cao	B1
(ii)	$P(A \cup B) = a + b - ab$ or equivalent	B1 (2)
(b)	$P(R \cup Q) = 0.15 + 0.35$ $= 0.5$ 0.5	B1 (1)
(c)	$P(R \cap Q) = P(R\|Q) \times P(Q)$ $= 0.1 \times 0.35$ M1 $= 0.035$ **0.035** A1 (2)
(d)	$P(R \cup Q) = P(R) + P(Q) - P(R \cap Q)$ OR $P(R) = P(R \cap Q') + P(R \cap Q)$ M1 $0.5 = P(R) + 0.35 - 0.035$ $= 0.15 + 0.035$ $P(R) = 0.185$ $= 0.185$ 0.185 A1 (2) **[7]**
Notes	7(a) (i) Accept $a + b$ - 0 for B1 **Special Case** If answers to (i) and (ii) are (i) $P(A)+P(B)$ and (ii) $P(A)+P(B)-P(A)P(B)$ award B0B1 7(a)(i) and (ii) answers must be clearly labelled or in correct order for marks to be awarded.

Question Number	Scheme	Marks
Q8 (a)	Let the random variable X be the lifetime in hours of bulb	
	$P(X < 830) = P(Z < \frac{\pm(830-850)}{50})$ Standardising with 850 and 50	M1
	$= P(Z < -0.4)$	
	$= 1 - P(Z < 0.4)$ Using 1-(probability>0.5)	M1
	$= 1 - 0.6554$	
	$= 0.3446$ or 0.344578 by calculator awrt 0.345	A1
		(3)
(b)	0.3446×500 Their (a) x 500	M1
	$= 172.3$ Accept 172.3 or 172 or 173	A1
		(2)
(c)	Standardise with 860 and σ and equate to z value $\frac{\pm(818-860)}{\sigma} = z$ value	M1
	$\frac{818-860}{\sigma} = -0.84(16)$ or $\frac{860-818}{\sigma} = 0.84(16)$ or $\frac{902-860}{\sigma} = 0.84(16)$ or equiv.	A1
	$\pm 0.8416(2)$	B1
	$\sigma = 49.9$ 50 or awrt 49.9	A1
		(4)
(d)	Company Y as the ***mean*** is greater for Y. both	B1
	They have (approximately) the same ***standard deviation*** or ***sd***	B1
		(2)
		[11]

Notes
8(a) If 1-z used e.g. 1-0.4=0.6 then award second M0
8(c) M1 can be implied by correct line 2
A1 for completely correct statement or equivalent.
Award B1 if 0.8416(2) seen
Do not award final A1 if any errors in solution e.g. negative sign lost.
8(d) Must use statistical terms as underlined.