

Mark Scheme (Results) Summer 2009

GCE

GCE Mathematics (6683/01)

June 2009
6683 Statistics S1
Mark Scheme

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

Question Number	Scheme	Marks
<p>Q2 (a)</p> <p>(b)(i)</p> <p>(ii)</p> <p>(c)</p>	<div style="text-align: center;"> </div> <p>Correct tree All labels Probabilities on correct branches</p> <p>$\frac{1}{3} \times \frac{1}{10} = \frac{1}{30}$ or equivalent</p> <p>$CNL + BNL + FNL = \frac{1}{2} \times \frac{4}{5} + \frac{1}{6} \times \frac{3}{5} + \frac{1}{3} \times \frac{9}{10}$ $= \frac{4}{5}$ or equivalent</p> <p>$P(F' / L) = \frac{P(F' \cap L)}{P(L)}$ $= \frac{\frac{1}{6} \times \frac{2}{5} + \frac{1}{2} \times \frac{1}{5}}{1 - (ii)}$ $= \frac{5}{30} = \frac{5}{6}$ or equivalent</p> <p>Attempt correct conditional probability but see notes</p> <p>numerator / denominator</p> <p>cao</p>	<p>B1 B1 B1</p> <p>(3)</p> <p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>M1 A1 A1ft A1 (4) [11]</p>
<p>Notes</p>	<p>Exact decimal equivalents required throughout if fractions not used e.g. 2(b)(i) 0.03 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.</p>	

Question Number	Scheme	Marks
Q3 (a) (b)	<p>1(cm) cao</p> <p>10 cm² represents 15 10/15 cm² represents 1</p> <p>Therefore frequency of 9 is $\frac{10}{15} \times 9$ or $\frac{9}{1.5}$</p> <p>height = 6(cm)</p> <p style="text-align: right;">or 1cm² represents 1.5</p> <p style="text-align: right;">Require $\times \frac{2}{3}$ or $\div 1.5$</p>	B1 M1 A1 [3]
Notes	<p>If 3(a) and 3(b) incorrect, but their (a) x their (b)=6 then award B0M1A0</p> <p>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.</p>	

Question Number	Scheme	Marks								
Q6 (a) <table border="1" data-bbox="220 315 437 389" style="margin-left: 20px;"> <tr> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>$3a$</td> <td>$2a$</td> <td>a</td> <td>b</td> </tr> </table> (b) $3a + 2a + a + b = 1$ $2a + 2a + 3b = 1.6$ $14a = 1.4$ $a = 0.1$ $b = 0.4$ (c) $P(0.5 < x < 3) = P(1) + P(2)$ $= 0.2 + 0.1$ $= 0.3$ (d) $E(3X - 2) = 3E(X) - 2$ $= 3 \times 1.6 - 2$ $= 2.8$ (e) $E(X^2) = 1 \times 0.2 + 4 \times 0.1 + 9 \times 0.4 (= 4.2)$ $\text{Var}(X) = "4.2" - 1.6^2$ $= 1.64 \quad \text{**given answer**}$ (f) $\text{Var}(3X - 2) = 9 \text{Var}(X)$ $= 14.76$	0	1	2	3	$3a$	$2a$	a	b	 or equivalent, using Sum of probabilities =1 or equivalent, using $E(X)=1.6$ Attempt to solve cao cao $3a$ or their $2a$ +their a Require $0 < 3a < 1$ to award follow through cao cso awrt 14.8	B1 (1) M1 M1 M1dep B1 B1 (5) M1 A1 ft (2) M1 cao A1 (2) M1 M1 A1 (3) M1 A1 (2) [15]
0	1	2	3							
$3a$	$2a$	a	b							
Notes	<p>6(a) Condone a clearly stated in text but not put in table.</p> <p>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.</p> <p>6(d) 2.8 only award M1A1</p> <p>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.</p> <p>6(f) 14.76 only award M1A1</p>									

Question Number	Scheme	Marks
Q7(a) (i) (ii) (b) (c) (d)	$P(A \cup B) = a + b$ $P(A \cup B) = a + b - ab$ $P(R \cup Q) = 0.15 + 0.35$ $= 0.5$ $P(R \cap Q) = P(R Q) \times P(Q)$ $= 0.1 \times 0.35$ $= 0.035$ $P(R \cup Q) = P(R) + P(Q) - P(R \cap Q) \quad \text{OR} \quad P(R) = P(R \cap Q') + P(R \cap Q)$ $= 0.15 + \text{their (c)}$ $= 0.15 + 0.035$ $= 0.185$ $0.5 = P(R) + 0.35 - 0.035$ $P(R) = 0.185$	 cao B1 or equivalent B1 (2) 0.5 B1 (1) M1 A1 0.035 (2) M1 A1 0.185 (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)	<p>Let the random variable X be the lifetime in hours of bulb</p> $P(X < 830) = P\left(Z < \frac{\pm(830 - 850)}{50}\right)$ <p style="text-align: right;">Standardising with 850 and 50</p> $= P(Z < -0.4)$ <p style="text-align: right;">Using 1-(probability>0.5)</p> $= 1 - P(Z < 0.4)$ $= 1 - 0.6554$ $= 0.3446 \text{ or } 0.344578 \text{ by calculator}$ <p style="text-align: right;">awrt 0.345</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>(3)</p>
(b)	0.3446×500 $= 172.3$ <p style="text-align: right;">Their (a) x 500</p> <p style="text-align: right;">Accept 172.3 or 172 or 173</p>	<p>M1</p> <p>A1</p> <p>(2)</p>
(c)	<p>Standardise with 860 and σ and equate to z value $\frac{\pm(818 - 860)}{\sigma} = z$ value</p> $\frac{818 - 860}{\sigma} = -0.84(16) \text{ or } \frac{860 - 818}{\sigma} = 0.84(16) \text{ or } \frac{902 - 860}{\sigma} = 0.84(16) \text{ or equiv.}$ <p style="text-align: right;">$\pm 0.8416(2)$</p> $\sigma = 49.9$ <p style="text-align: right;">50 or awrt 49.9</p>	<p>M1</p> <p>A1</p> <p>B1</p> <p>A1</p> <p>(4)</p>
(d)	<p>Company Y as the <u>mean</u> is greater for Y.</p> <p>They have (approximately) the same <u>standard deviation</u> or <u>sd</u></p> <p style="text-align: right;">both</p>	<p>B1</p> <p>B1</p> <p>(2)</p> <p>[11]</p>
Notes	<p>8(a) If 1-z used e.g. 1-0.4=0.6 then award second M0</p> <p>8(c) M1 can be implied by correct line 2</p> <p>A1 for completely correct statement or equivalent.</p> <p>Award B1 if 0.8416(2) seen</p> <p>Do not award final A1 if any errors in solution e.g. negative sign lost.</p> <p>8(d) Must use statistical terms as underlined.</p>	