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Mark Scheme (Results)
June 2008

GCE

GCE Mathematics (6683/01)

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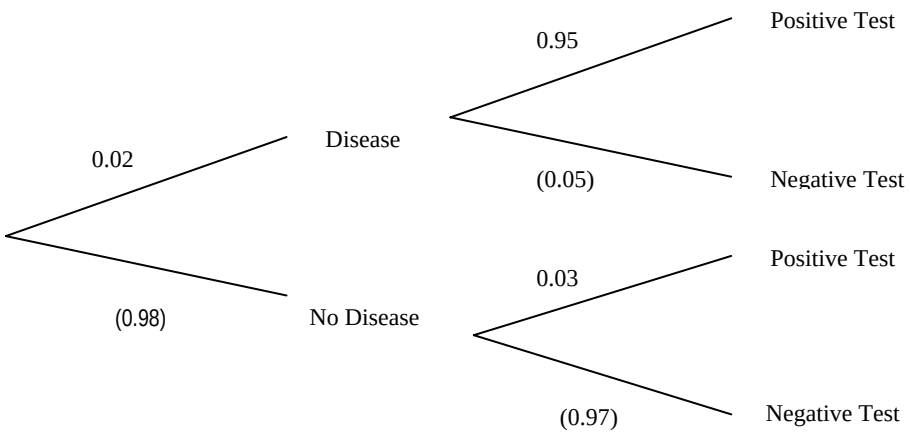
June 2008
6683 Statistics S1
Mark Scheme

Question Number	Scheme	Marks
Q1 (a)		
	Tree without probabilities or labels	**M1**
	0.02(Disease), 0.95(Positive) on correct branches	**A1**
	0.03(Positive) on correct branch.	**A1**
		[3]
(b)	P(Positive Test) $=0.02\times0.95+0.98\times0.03$	**M1A1ft**
	$=0.0484$	**A1**
		[3]
(c)	$P(\text{Do not have disease}\mid\text{Postive test}) = \dfrac{0.98\times0.03}{0.0484}$	**M1**
	$=0.607438..$ awrt 0.607	**A1**
		[2]
(d)	Test not very useful OR High probability of not having the disease for a person with a positive test	**B1**
		[1]
		Total 9
	Notes: (a) M1:All 6 branches. Bracketed probabilities not required. (b) M1 for sum of two products, at least one correct from their diagram A1ft follows from the probabilities on their tree A1 for correct answer only or $\dfrac{121}{2500}$ (c) M1 for conditional probability with numerator following from their tree and denominator their answer to part (b). A1 also for $\dfrac{147}{242}$.	

Question Number	Scheme	Marks
Q2 (a)	50	**B1** **[1]**
(b)	$Q_1 = 45$	**B1**
	$Q_2 = 50.5$ ONLY	**B1**
	$Q_3 = 63$	**B1** **[3]**
(c)	Mean $= \frac{1469}{28} = 52.464286..$ awrt 52.5	**M1A1**
	Sd $= \sqrt{\frac{81213}{28} - \left(\frac{1469}{28}\right)^2}$	**M1**
	$=12.164\ldots$ or $12.387216\ldots$ for divisor n-1 awrt 12.2 or 12.4	**A1** **[4]**
(d)	$\frac{52.46.. - 50}{sd} =$ awrt 0.20 or 0.21	**M1A1** **[2]**
(e)	1. mode/median/mean Balmoral>mode/median/mean Abbey 2. Balmoral sd < Abbey sd or similar sd or correct comment from their values, Balmoral range<Abbey range, Balmoral IQR>Abbey IQR or similar IQR 3. Balmoral positive skew or almost symmetrical AND Abbey negative skew, Balmoral is less skew than Abbey or correct comment from their value in (d) 4. Balmoral residents generally older than Abbey residents or equivalent. Only one comment of each type max 3 marks	**B1B1B1** **[3]** **Total 13**
	Notes: (c) M1for their 1469 between 1300 and 1600, divided by 28, A1 for awrt 52.5 .. Please note this is B1B1 on Epen M1 use of correct formula including sq root A1 awrt 12.2 or 12.4 Correct answers with no working award full marks. (d) M1 for their values correctly substituted A1 Accept 0.2 as a special case of awrt 0.20 with 0 missing (e) Technical terms required in correct context in lines 1 to 3 e.g. 'average' and 'spread' B0 1 correct comment B1B0B0 2 correct comments B1B1B0 3 correct comments B1B1B1	

Question Number	Scheme	Marks
Q3 (a)	$-1\times p+1\times 0.2+2\times 0.15+3\times 0.15 \quad =0.55$ $p=0.4$ $p+q+0.2+0.15+0.15 \quad =1$ $q=0.1$	**M1dM1** **A1** **M1** **A1** **[5]**
(b)	$\text{Var}(X)=(-1)^2\times p+1^2\times 0.2+2^2\times 0.15+3^2\times 0.15,-0.55^2$ $=2.55-0.3025=2.2475$ awrt 2.25	**M1A1,M1** **A1** **[4]**
(c)	E(2*X*-4) =2E(*X*)-4 = –2.9	**M1** **A1** **[2]** **Total 11**
	Notes: (a) M1 for at least 2 correct terms on LHS Division by constant e.g. 5 then M0 dM1 dependent on first M1 for equate to 0.55 and attempt to solve. Award M1M1A1 for p=0.4 with no working M1 for adding probabilities and equating to 1. All terms or equivalent required e.g. $p+q$=0.5 Award M1A1 for q=0.1 with no working (b) M1 attempting E(X^2) with at least 2 correct terms A1 for fully correct expression or 2.55 Division by constant at any point e.g. 5 then M0 M1 for subtracting their mean squared A1 for awrt 2.25 Award awrt 2.25 only with no working then 4 marks (c) M1 for 2x(their mean) -4 Award 2 marks for -2.9 with no working	

Question Number	Scheme	Marks
Q4 (a)	$S_{tt} = 10922.81 - \frac{401.3^2}{15} = 186.6973$ awrt 187	**M1A1**
	$S_{vv} = 42.3356 - \frac{25.08^2}{15} = 0.40184$ awrt 0.402	**A1**
	$S_{tv} = 677.971 - \frac{401.3 \times 25.08}{15} = 6.9974$ awrt 7.00	**A1** **[4]**
(b)	$r = \frac{6.9974}{\sqrt{186.6973 \times 0.40184}}$	**M1A1ft**
	$= 0.807869$ awrt 0.808	**A1** **[3]**
(c)	*t* is the explanatory variable as we can control temperature but not frequency of noise or equivalent comment	**B1** **B1** **[2]**
(d)	High value of *r* or *r* close to 1 or Strong correlation	**B1** **[1]**
(e)	$b = \frac{6.9974}{186.6973} = 0.03748$ awrt 0.0375	**M1A1**
	$a = \frac{25.08}{15} - b \times \frac{401.3}{15} = 0.6692874$ awrt 0.669	**M1A1** **[4]**
(f)	*t*= 19, *v*=0.6692874+0.03748x19=1.381406 awrt 1.4	**B1** **[1]**
		Total 15
	Notes: (a) M1 any one attempt at a correct use of a formula. Award full marks for correct answers with no working. Epen order of awarding marks as above. (b) M1 for correct formula and attempt to use A1ft for their values from part (a) NB Special Case for $\frac{677.971}{\sqrt{10922.81 \times 42.3356}}$ M1A0 A1 awrt 0.808 Award 3 marks for awrt 0.808 with no working (c) Marks are independent. Second mark requires some interpretation in context and can be statements such as 'temperature effects / influences pitch or noise' B1 'temperature is being changed' BUT B0 for 'temperature is changing' (e) M1 their values the right way up A1 for awrt 0.0375 M1 attempt to use correct formula with their value of *b* A1 awrt 0.669 (f) awrt 1.4	

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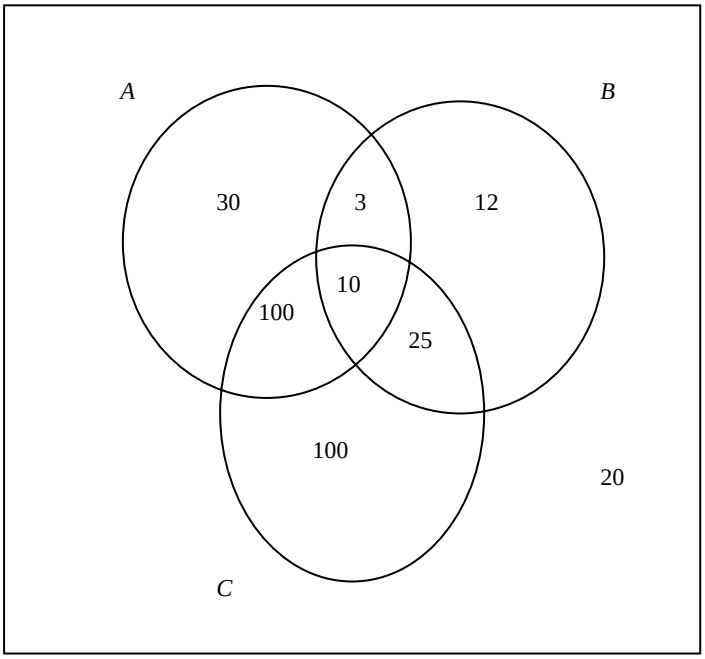
Question Number	Scheme	Marks
Q5 (a)	 3 closed intersecting curves with labels 100 100,30 12,10,3,25 Box	**M1** **A1** **A1** **B1** **[4]**
(b)	P(Substance C) $= \frac{100+100+10+25}{300} = \frac{235}{300} = \frac{47}{60}$ or exact equivalent	**M1A1ft** **[2]**
(c)	P(All 3 $\mid A$) $= \frac{10}{30+3+10+100} = \frac{10}{143}$ or exact equivalent	**M1A1ft** **[2]**
(d)	P(Universal donor) $= \frac{20}{300} = \frac{1}{15}$ or exact equivalent	**M1A1 cao** **[2]** **Total 10**
	Notes: (a) 20 not required. Fractions and exact equivalent decimals or percentages. (b) M1 For adding their positive values in C and finding a probability A1ft for correct answer or answer from their working (c) M1 their 10 divided by their sum of values in A A1ft for correct answer or answer from their working (d) M1 for 'their 20' divided by 300 A1 correct answer only	

Question Number	Scheme	Marks
Q6 (a)	F(4)=1 $(4+k)^2 = 25$ $k = 1$ as $k > 0$	**M1** **A1** **[2]**
(b)	x: 2 | 3 | 4 P(X=x): $\frac{9}{25}$ | $\frac{7}{25}$ | $\frac{9}{25}$	**B1ftB1B1** **[3]** **Total 5**
	Notes: (a) M1 for use of F(4) = 1 only If F(2)=1 and / or F(3)=1 seen then M0. F(2)+F(3)+F(4)=1 M0 A1 for k=1 and ignore k= -9 (b) B1ft follow through their k for P(X=2) either exact or 3sf between 0 and 1 inclusive. B1 correct answer only or exact equivalent B1 correct answer only or exact equivalent	

Question Number	Scheme	Marks
Q7 (a)	$z = \frac{53-50}{2}$ Attempt to standardise	**M1**
	P(X>53)=1-P(Z<1.5) 1-probability required can be implied	**B1**
	=1-0.9332	
	=0.0668	**A1**
		[3]
(b)	$P(X \le x_0) = 0.01$	**M1**
	$\frac{x_0 - 50}{2} = -2.3263$	**M1B1**
	$x_0 = 45.3474$ awrt 45.3 or 45.4	**M1A1**
		[5]
(c)	P(2 weigh more than 53kg and 1 less) $= 3 \times 0.0668^2 (1 - 0.0668)$	**B1M1A1ft**
	$= 0.012492487..$ awrt 0.012	**A1**
		[4]
		Total 12

Notes:
(a) M1 for using 53,50 and 2, either way around on numerator
B1 1- any probability for mark
A1 0.0668 cao
(b) M1 can be implied or seen in a diagram
or equivalent with correct use of 0.01 or 0.99
M1 for attempt to standardise with 50 and 2 numerator either way around
B1 for ± 2.3263
M1 Equate expression with 50 and 2 to a z value to form an equation with consistent signs and attempt to solve
A1 awrt 45.3 or 45.4
(c) B1 for 3,
M1 $p^2(1-p)$ for any value of p
A1ft for p is their answer to part (a) without 3
A1 awrt 0.012 or 0.0125