Edexcel GCE

Mathematics

Statistics S2 6684

Summer 2005

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Final Mark Scheme

Edexcel GCE
Mathematics

General Instructions

1. The total number of marks for the paper is 75.

2. Method (M) marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.

3. Accuracy (A) marks can only be awarded if the relevant method (M) marks have been earned.

4. (B) marks are independent of method marks.

5. Method marks should not be subdivided.

6. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected. Indicate this action by 'MR' in the body of the script (but see also note 10).

7. If a candidate makes more than one attempt at any question:

   (a) If all but one attempt is crossed out, mark the attempt which is NOT crossed out.

   (b) If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

8. Marks for each question, or part of a question, must appear in the right-hand margin and, in addition, total marks for each question, even where zero, must be ringed and appear in the right-hand margin and on the grid on the front of the answer book. It is important that a check is made to ensure that the totals in the right-hand margin of the ringed marks and of the unringed marks are equal. The total mark for the paper must be put on the top right-hand corner of the front cover of the answer book.

9. For methods of solution not in the mark scheme, allocate the available M and A marks in as closely equivalent a way as possible, and indicate this by the letters 'OS' (outside scheme) put alongside in the body of the script.

10. All A marks are 'correct answer only' (c.a.o.) unless shown, for example, as A1 f.t. to indicate that previous wrong working is to be followed through. In the body of the script the symbol $\surd$ should be used for correct f.t. and $\not\surd$ for incorrect f.t. After a misread, however, the subsequent A marks affected are treated as A f.t., but manifestly absurd answers should never be awarded A marks.

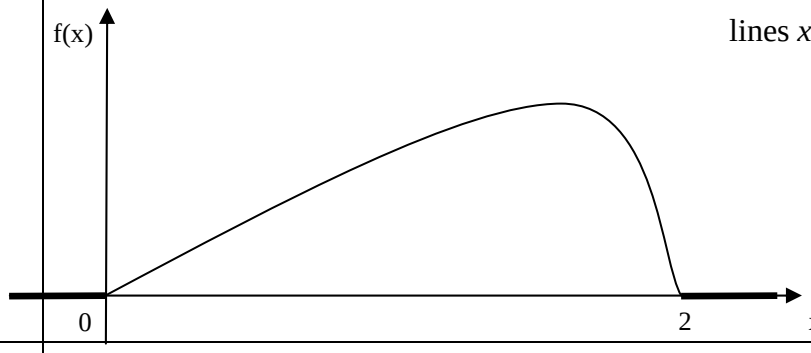
11. Ignore wrong working or incorrect statements following a correct answer.

June 2005
6684 Statistics S2
Mark Scheme

Question Number	Scheme		Marks
1(a)	X ~ B(n, 0.04)	Implied	B1
	E(X) = np		M1
		Use of np = 5	
	5 = 0.04n		
	n = 125	125	A1
			(3)
(b)	E(X) = 3		
	np = 3	np = 3	B1
	sd = $\sqrt{npq}$ = $\sqrt{3(1-0.04)}$	Use of npq	M1
	= $\sqrt{2.88}$	$\sqrt{3(1-0.04)}$	A1
	= 1.70	awrt 1.70	A1
			(4)
			Total 7
2(a)	f(x) = $\frac{1}{4}$, $2 \le x \le 6$	$\frac{1}{4}$ and range	B1
	= 0 , otherwise	0 and range	B1
			(2)
(b)	E(X) = 4 by symmetry or formula	4	B1
			(1)
(c)	Var (X) = $\frac{(6-2)^2}{12}$	Use of formula	M1
	= $\frac{4}{3}$	$1.\dot{3}$ or $1\frac{1}{3}$ or $\frac{4}{3}$ or 1.33	A1
			(2)
(d)	F(x) = $\int_2^x \frac{1}{4}\,dt$ = $\left[\frac{1}{4}t\right]_2^x$	Use of $\int f(x)\,dx$	M1
	= $\frac{1}{4}(x-2)$	$\frac{1}{4}(x-2)$ or equiv.	A1
	F(x) = $\frac{1}{4}(x-2)$, $2 \le x \le 6$	$\frac{1}{4}(x-2)$ and range	B1ft
	= 1 , x > 6		
	= 0 , x < 2	ends and ranges	B1
			(4)
(e)	P(2.3 < X < 3.4) = $\frac{1}{4}(3.4-2.3)$	Use of area or F(x)	M1
	= 0.275		
		0.275 or $\frac{11}{40}$	A1
			(2)
			Total 11

Question Number	Scheme		Marks
3(a)	Misprints are random / independent, occur singly in space and at a constant rate	Context, any 2	B1, B1 (2)
(b)	$P(X = 0) = e^{-2.5}$ $= 0.08208\ldots\ldots = 0.0821$	Po (2.5) 0.0821	M1 A1 (2)
(c)	Y ~ Po (5) for 2 pages $P(Y > 7) = 1 - P(X \leq 7)$ $= 1 - 0.8666 = 0.1334$	Implied Use of 1 – and correct inequality 0.1334	B1 M1 A1 (3)
(d)	For 20 pages, $Y \sim P_o(50)$ $Y \sim N(50, 50)$ approx	$P_o(50)$ N(50, 50)	B1 B1
	$P(Y < 40) = P(Y \leq 39.5)$ $= P\left(Z \leq \frac{39.5 - 50}{\sqrt{50}}\right)$	cc ± 0.5 standardise above all correct	M1 M1 A1
	$= P(Z \leq -1.4849)$ $= 1 - 0.93 = 0.07$	awrt – 1.48 0.07	A1 A1 (7)
			Total 14
4(a)	Individual member or element of the population or sampling frame		B1 (1)
(b)	A list of all sampling units or all the population		B1 (1)
(c)	All possible samples are chosen from a population; the values of a statistic and the associated probabilities is a sampling distribution		B1 B1 (2)
			Total 4

Question Number	Scheme		Marks
5(a)	X ~ B(200 , 0.02) n large, P small so X ~ Po (np) = Po (4)	Implied conditions, $P_0(4)$	B1 B1, B1
	P(X = 5) = $\frac{e^{-4}4^5}{5!}$ = 0.1563	$P(X \le 5) - P(X \le 4)$ 0.1563	M1 A1 (5)
(b)	P (X < 5) = P(X ≤ 4) = 0.6288	P(X ≤ 4) 0.6288	M1 A1 (2) **Total 7**
6(a)	$\int_0^2 k(4x - x^3)\,dx = 1$	$\int f(x)dx = 1$, all correct	M1 A1
	$k\left[2x^2 - \frac{1}{4}x^4\right]_0^2 = 1$	[*]	A1
	k(8 – 4) = 1	cso	A1
	k = $\frac{1}{4}$		(4)
(b)	E(X) = $\int_0^2 x.\frac{1}{4}(4x - x^3)\,dx$	$\int xf(x)dx$	M1
	= $\left[\frac{1}{3}x^3 - \frac{1}{20}x^5\right]_0^2$	[*]	A1
	= $\frac{16}{15}$	1.07 or $1\frac{1}{15}$ or $\frac{16}{15}$ or $1.0\dot{6}$	A1 (3)
(c)	At mode, $f'(x) = 0$	Implied	M1
	$4 - 3x^2 = 0$	Attempt to differentiate	M1
	$x = \frac{2}{\sqrt{3}}$	$\sqrt{\frac{4}{3}}$ or 1.15 or $\frac{2}{\sqrt{3}}$ or $\frac{2\sqrt{3}}{3}$	A1 (3)
(d)	At median, $\int_0^x \frac{1}{4}(4t - t^3)\,dt = \frac{1}{2}$	$F(x) = \frac{1}{2}$ or $\int f(x)dx = \frac{1}{2}$	M1
	$\frac{1}{4}\left(2x^2 - \frac{1}{4}x^4\right) = \frac{1}{2}$	Attempt to integrate	M1
	$x^4 - 8x^2 + 8 = 0$		
	$x^2 = 4 \pm 2\sqrt{2}$	Attempt to solve quadratic	M1
	x = 1.08	Awrt 1.08	A1 (4)

(e)	mean (1.07) < median (1.08) < mode (1.15) $\Rightarrow$ negative skew	any pair cao	M1 A1 (2)
(f)		lines $x<0$ and $x>2$, labels, 0 and 2 negative skew between 0 and 2	B1 B1 (2) **Total 18**
7 (a)	X ~ B(10, p)	Binomial (10, 0.75)	B1, B1 (2)
(b)	P(X = 6) = 0.9219 – 0.7759 = 0.1460	$P(X \le 6) - P(X \le 5)$ 0.1460	M1 A1 (2)
(c)	H_0: $p = 0.75$ (or $p = 0.25$) H_1: $p < 0.75$ (or $p > 0.25$) Under H_0, X ~ B(20, 0.75) (or Y ~ B(20,0.25)) $P(X \le 13) = 1 - 0.7858 = 0.2142$ (or $P(Y \ge 7)$) Insufficient evidence to reject H_0 as $0.2412 > 0.05$ Doctor's belief is not supported by the sample *(OR CR $P(X \le 12) = 1 - 0.8982 = 0.1018$* *(or $P(Y \ge 8)$)* *$P(X \le 11) = 1 - 0.9591 = 0.0409$* *(or $P(Y \ge 9)$)* *13 outside critical region* *(or 7))*	Correct H_0 One tailed H_1 Implied $P(X \le 13)$ and 1 - , 0.2142 Context *either*	B1 B1 B1 M1, A1 A1 (6) (*M1 A1*)
(d)	$P(X \le c) \le 0.01$ for p=0.75 (or $P(Y \ge 20\text{-}c) \le 0.01$ for p=0.25) $P(X \le 9) = 1 - 0.9961 = 0.0039$ (or $P(Y \ge 11)$ $P(X \le 10) = 1 - 0.9861 = 0.0139$ (or $P(Y \ge 10)$ C. R. is [0,9], so greatest no. of patients is 9.	 0.9961 or 0.9981 9	M1 A1 B1 B1 (4) **Total 14**