

GCE

Edexcel GCE

Statistics S2 (6684)

Summer 2005

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Mark Scheme (Results)

June 2005
6684 Statistics S2
Mark Scheme

Question Number	Scheme	Marks
1(a)	$X \sim B(n, 0.04)$	Implied B1
	$E(X) = np$	Use of $np = 5$ M1
	$5 = 0.04n$	125 A1
	$n = 125$	(3)
(b)	$E(X) = 3$	$np = 3$ B1
	$np = 3$	Use of npq M1
	$sd = \sqrt{npq} = \sqrt{3(1-0.04)}$	$\sqrt{3(1-0.04)}$ A1
	$= \sqrt{2.88}$	awrt 1.70 A1
	$= 1.70$	(4)
		Total 7
2(a)	$f(x) = \frac{1}{4}, 2 \leq x \leq 6$	$\frac{1}{4}$ and range B1
	$= 0$, otherwise	0 and range B1
		(2)
(b)	$E(X) = 4$ by symmetry or formula	4 B1
		(1)
(c)	$\text{Var}(X) = \frac{(6-2)^2}{12}$	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
	$F(x) = \frac{1}{4}(x-2), 2 \leq x \leq 6$	$\frac{1}{4}(x-2)$ and range B1ft
	$= 1, x > 6$	ends and ranges B1
	$= 0, x < 2$	(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)
3(b)	$P(X = 0) = e^{-2.5}$ $= 0.08208\dots\dots = 0.0821$	Po (2.5) 0.0821 M1 A1 (2)
3(c)	$Y \sim \text{Po}(5) \text{ for 2 pages}$ $P(Y > 7) = 1 - P(X \leq 7)$ $= 1 - 0.8666 = 0.1334$	Implied Use of 1 – and correct inequality 0.1334 B1 M1 A1 (3)
3(d)	<p>For 20 pages, $Y \sim P_o(50)$ $Y \sim N(50, 50)$ approx</p> $P(Y < 40) = P(Y \leq 39.5)$ $= P\left(Z \leq \frac{39.5 - 50}{\sqrt{50}}\right)$ $= P(Z \leq -1.4849)$ $= 1 - 0.93 = 0.07$	$P_o(50)$ $N(50, 50)$ cc ± 0.5 standardise above all correct awrt – 1.48 0.07 B1 B1 M1 M1 A1 A1 A1 A1 (7) Total 14
4(a)	Individual member or element of the population or sampling frame	B1 (1)
4(b)	A <u>list</u> of <u>all</u> sampling units or <u>all</u> the population	B1 (1)
4(c)	<u>All</u> possible <u>samples</u> are chosen from a population; the <u>values</u> of a <u>statistic</u> and the associated <u>probabilities</u> is a sampling distribution	B1 B1 (2) Total 4

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

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