

Mark Scheme 4733 June 2006

4733

Mark Scheme

June 2006

<p>1</p>	$\mu = \frac{3}{37} \int_3^4 x^3 dx = \frac{3}{37} \left[\frac{x^4}{4} \right]_3^4 = 3 \frac{81}{148}$ $\frac{3}{37} \int_3^4 x^4 dx = \frac{3}{37} \left[\frac{x^5}{5} \right]_3^4$ $= 12 \frac{123}{185} \text{ or } 12.665$ $\sigma^2 = 12 \frac{123}{185} - 3 \frac{81}{148}^2 = \mathbf{0.0815}$	<p>M1 M1 A1 A1 M1 A1</p> <p>6</p>	<p>Integrate $xf(x)$, limits 3 & 4 <i>[can be implied]</i> $\left[\frac{525}{148} \text{ or } 3.547 \right]$ Attempt to integrate $x^2f(x)$, limits 3 & 4 Correct indefinite integral, any form $\frac{2343}{185}$ or in range [12.6, 12.7] <i>[can be implied]</i> Subtract their μ^2 Answer, in range [0.0575, 0.084]</p>
<p>2</p>	<p>(i) Find $P(R \geq 6)$ or $P(R < 6)$ $= 0.0083$ or 0.9917</p> <p>Compare with 0.025 [can be from N] [0.05 if "empty LH tail stated] Reject H_0</p>	<p>M1 A1 B1 A1√</p> <p>4</p>	<p>Find $P(= 6)$ from tables/calc, OR RH critical region $P(\geq 6)$ in range [0.008, 0.0083] or $P(< 6) = 0.9917$ OR CR is 6 with probability 0.0083/0.9917 Explicitly compare with 0.025 [or 0.975 if consistent] OR state that result is in critical region Correct comparison and conclusion, √ on their p</p>
	<p>(ii) $n = 9, P(\leq 1) = 0.0385$ [> 0.025] $n = 10, P(\leq 1) = 0.0233$ [< 0.025] Therefore $n = 9$</p>	<p>M1 A1 B1</p> <p>3</p>	<p>At least one, or $n = 8, P(\leq 1) = 0.0632$ Both of these probabilities seen, don't need 0.025 Answer $n = 9$ only, indep't of M1A1, <i>not</i> from $P(= 1)$</p>
<p>3</p>	<p>(i) $(140 - \mu)/\sigma = -2.326$ $(300 - \mu)/\sigma = 0.842$</p> <p>Solve to obtain: $\mu = \mathbf{257.49}$ $\sigma = \mathbf{50.51}$</p>	<p>M1 B1 A1√ M1 A1 A1</p> <p>6</p>	<p>One standardisation equated to Φ^{-1}, allow "1-", σ^2 Both 2.33 and 0.84 at least, ignore signs Both equations completely correct, √ on their z Solve two simultaneous equations to find one variable μ value, in range [257, 258] σ in range [50.4, 50.55]</p>
<p>4</p>	<p>(ii) Higher as there is positive skew</p>	<p>B1 B1</p> <p>2</p>	<p>"Higher" or equivalent stated Plausible reason, allow from normal calculations</p>
<p>4</p>	<p>(i) Each element equally likely to be selected (and all selections independent) OR each possible sample equally likely</p>	<p>B1</p> <p>1</p>	<p>One of these two. "Selections independent" alone is insufficient, but don't need this. An example is insufficient.</p>
<p>4</p>	<p>(ii) $B(6, 5/8)$ ${}^6C_4 p^4 (1 - p)^2$ $= \mathbf{0.32187}$</p>	<p>M1 M1 A1√</p> <p>3</p>	<p>$B(6, 5/8)$ stated or implied, allow e.g. 499/799 Correct formula, any p Answer, a.r.t. 0.322, can allow from wrong p</p>
<p>4</p>	<p>(iii) $N(37.5, 225/16)$ $\frac{39.5 - 37.5}{3.75} = 0.5333$</p> <p>$1 - \Phi(0.5333)$ $= \mathbf{0.297}$</p>	<p>B1 B1 M1 dep A1 dep M1 A1</p> <p>6</p>	<p>Normal, mean 37.5, or 37.47 from 499/799, 499/800 14.0625 or 3.75 seen, allow 14.07/14.1 or 3.75 Standardise, wrong or no cc, np, npq, no \sqrt{n} Correct cc, \sqrt{npq}, signs can be reversed Tables used, answer $< 0.5, p = 5/8$ Answer, a.r.t. 0.297 SR: $np < 5$: $Po(np)$ stated or implied, B1</p>

4733

Mark Scheme

June 2006

5	(i)	B(303, 0.01) $\approx \text{Po}(3.03)$	B1 B1	2	B(303, 0.01) stated, allow $p = 0.99$ or 0.1 Allow Bin implied clearly by parameters Po(3.03) stated or implied, can be recovered from (ii)
	(ii)	$e^{-3.03} (1 + 3.03 + \frac{3.03^2}{2}) = 0.4165$ AG	M1 A1	2	Correct formula, ± 1 term or "1 -" or both Convincingly obtain 0.4165(02542) [Exact: 0.41535]
	(iii)	302 seats $\Rightarrow \mu = 3.02$ $e^{-3.02} (1 + 3.02) = 0.1962$ 0.196 < 0.2 So 302 seats.	M1 M1 A1 A1 A1	5	Try smaller value of μ Formula, at least one correct term Correct number of terms for their μ 0.1962 [or 0.1947 from exact] Answer 302 only
SR: B(303, 0.99): B1B0; M0; M1 then N(298.98, 2.9898) or equiv, standardise: M1A1 total 4/9 SR: $p = 0.1$: B(303, 0.1), N(30.3, 27.27) B1B0; Standardise 2 with np & \sqrt{npq} , M1A0; N(0.1n, 0.09n); standardise with np & \sqrt{npq} ; solve quadratic for \sqrt{n} ; $n = 339$: M1M1M1A1, total 6/9 B(303, 0.01) \approx N(3.03, 2.9997): B1B0; M0A0; M1A0					
6	(i)	Customers arrive independently	B1	1	Valid reason in context, allow "random"
	(ii)	$1 - 0.9921$ = 0.0079	M1 A1	2	Poisson tables, "1 -", or correct formula ± 1 term Answer, a.r.t. 0.008 [1 - 0.9384 = 0.0606: M1A0]
	(iii)	N(48, 48) $z = \frac{55.5 - 48}{\sqrt{48}}$ $= 1.0825$ $1 - \Phi(1.0825)$ = 0.1394	B1 B1√ M1 dep A1 dep M1 A1	6	Normal, mean 48 Variance or SD same as mean√ Standardise, wrong or no cc, $\mu = \lambda$ Correct cc, $\sqrt{\lambda}$ Use tables, answer < 0.5 Answer in range [0.139, 0.14]
	(iv)	$e^{-\lambda} < 0.02$ $\lambda > -\ln 0.02$ $= 3.912$ $0.4t = 3.912$: $t = 9.78$ minutes $t = 9$ minutes 47 seconds	M1 M1 A1 M1 A1	5	Correct formula for P(0), OR P(0 $\lambda = 4$) at least ln used OR $\lambda = 3.9$ at least by T & I 3.91(2) seen OR $\lambda = 3.91$ at least by T & I Divide λ by 0.4 or multiply by 150, any distribution 587 seconds ± 1 sec [inequalities not needed]

4733

Mark Scheme

June 2006

7	<p>(i) $\frac{c - 4000}{60 / \sqrt{50}} = 1.645$</p> <p>Solve $c = 4014$ [4013.958] Critical region is > 4014</p>	<p>M1 B1 A1√ M1 A1 A1√ 6</p>	<p>Standardise unknown with $\sqrt{50}$ or 50 [ignore RHS] $z = 1.645$ or -1.645 seen Wholly correct eqn, $\sqrt{}$ on their z [$1 - 1.645$: M1B1A0] Solve to find c Value of c, a.r.t. 4014 Answer "> 4014", allow \geq, $\sqrt{}$ on their c, needs M1M1</p>
	<p>(ii) Use "Type II is: accept when H_0 false" $\frac{4020 - 4014}{60 / \sqrt{50}}$ $= 0.7071$ [0.712 from 4013.958] $1 - \Phi(0.7071)$ $= \mathbf{0.240}$ [0.238 from 4013.958]</p>	<p>M1dep depM1 A1√ A1 M1 A1 6</p>	<p>Standardise 4020 and $4014\sqrt{}$, allow 60^2, cc With $\sqrt{50}$ or 50 Completely correct LHS, $\sqrt{}$ on their c z-value in range [0.707, 0.712] Normal tables, answer < 0.5 Answer in range [0.2375, 0.2405]</p>
	<p>(iii) Smaller Smaller cv, better test etc</p>	<p>B1 B1 2</p>	<p>"Smaller" stated, no invalidating reason Plausible reason</p>
	<p>(iv) Smaller Smaller cv, larger prob of Type I etc</p>	<p>B1 B1 2</p>	<p>"Smaller" stated, no invalidating reason Plausible reason</p>
	<p>(v) No, parent distribution known to be normal</p>	<p>B2 2</p>	<p>"No" stated, convincing reason SR: If B0, "No", reason that is not invalidating: B1</p>