

Mock Paper Mark Scheme

Advanced Subsidiary/Advanced GCE General Certificate of Education

Subject **STATISTICS**Paper No. **Mock S3**

Question number	Scheme	Marks
1. (a)	$\bar{X} \sim N\left(100, \frac{14^2}{10}\right)$	<p style="text-align: right;">Normal</p> <p style="text-align: right;">B1</p> <p style="text-align: right;">$100, \frac{14^2}{10}$</p> <p style="text-align: right;">B1</p> <p style="text-align: right;">(2)</p>
(b)	$P(\bar{X} - 100 > 5) = P(\bar{X} > 105) + P(\bar{X} < 95)$ $= 2P(\bar{X} > 105)$ $= 2P\left(Z > \frac{105 - 100}{\sqrt{\frac{14^2}{10}}}\right)$ $= 2P(Z > 1.13)$ $= 0.2584$	<p style="text-align: right;">M1</p> <p style="text-align: right;">A1</p> <p style="text-align: right;">A1</p> <p style="text-align: right;">(3)</p> <p style="text-align: right;">(5 marks)</p>
2.	<p>H_0: No association between type and cover</p> <p>H_1: Association between type and cover</p> <p>$\alpha = 0.05$; $\nu = 2$;</p> <p>Critical value = 5.991</p> $\sum \frac{(O - E)^2}{E} = 11.09$ <p>Since 11.09 is in the critical region, there is evidence of association between type of book and type of cover</p>	<p style="text-align: right;">(both)</p> <p style="text-align: right;">B1</p> <p style="text-align: right;">M1 A1</p> <p style="text-align: right;">B1</p> <p style="text-align: right;">M1 A1</p> <p style="text-align: right;">(6)</p> <p style="text-align: right;">(6 marks)</p>

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<p>3. (a)</p>	<p>$H_0: \mu_{sp} = \mu_{st}; H_1: \mu_{sp} > \mu_{st};$ $\alpha = 0.05$; critical region: $z > 1.6449$</p> <p>standard error = $\sqrt{\frac{22^2}{100} + \frac{31^2}{80}} = 4.1051 \dots$</p> $z = \frac{75 - 64}{4.1051\dots} = 2.68$ <p>Since 2.68 is in the critical region there is evidence to reject H_0 and conclude that the special diet is more effective in reducing blood cholesterol.</p>	<p>B1 B1 B1 M1 A1 M1 A1 M1 A1[✓] (9)</p>
<p>(b)</p>	<p>Drop in blood cholesterol levels are normally distributed, or Central Limit Theorem can be applied, or standard deviations of the populations are 22 and 31</p>	<p>Any two B1 B1 (2) (11 marks)</p>
<p>4. (a)</p>	<p>H_0: Poisson distribution is a suitable model H_1: Poisson distribution is not a suitable model</p> <p>From these data $\lambda = \frac{52}{80} = 0.65$</p> <p>Expected frequencies 41.76, 27.15, $\underbrace{8.82, 2.27}_{11.09}$</p> <p>$\alpha = 0.05, \nu = 3 - 1 - 1 = 1$; critical value = 3.841</p> $\sum \frac{(O - E)^2}{E} = 1.312$ <p>Since 1.312 is not the critical region there is insufficient evidence to reject H_0 and we can conclude that the Poisson model is a suitable one.</p>	<p>both B1 M1 A1 M1 A2/1/0 Amalgamation M1 B1[✓]; B1[✓] M1 A1 M1 A1[✓] (13) (13 marks)</p>

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5. (a)	$E(R) = E(X) + 4E(Y) = 8 + (4 \times 14) = 64$	M1 A1 (2)
(b)	$\text{Var}(R) = \text{Var}(X) + 16 \text{Var}(Y) = 2^2 + (16 \times 3^2)$ $= 148$	M1 A1 A1 (3)
(c)	$P(R < 41) = P\left(Z < \frac{41 - 64}{\sqrt{148}}\right) = P(Z < -1.89)$ $= 0.0294$	M1 A1 ✓ A1 (3)
(d)	$\text{Var}(S) = 3 \text{Var}(Y) + \left(\frac{1}{2}\right)^2 \text{Var}(X)$ $= 27 + 1$ $= 28$	M1 M1 A1 A1 (4) (12 marks)
6. (a)	Stratified sampling	B1 (1)
(b)	Uses naturally occurring (strata) groupings e.g. variance of estimator of population mean is usually reduced, individual strata estimates available	B1 either B1 (2)
(c)	$\bar{x} = \frac{(12 \times 12.6) + (12 \times 14.1) + (8 \times 10.2)}{32}$ $= 12.56$	M1 A1 A1 (3)
(d)	Confidence interval is $12.56 \pm 1.96 \times \frac{2.48}{\sqrt{32}}$ i.e. $12.56 \pm 0.859276\dots$ i.e. (11.70, 13.42)	M1 1.96 B1 A1 A1 (4) accept (11.7, 13.4)
(e)	12 is within the confidence interval; so the time spent by these students is in agreement with the suggestion of the member of staff.	B1; B1 (2) (12 marks)

Question number	Scheme	Marks																				
7. (a)	$H_0: \rho = 0, H_1: \rho > 0$ $\alpha = 0.01$, critical value = 0.7887 Since 0.774 is not in the critical region there is insufficient evidence of positive correlation.	B1 B1 B1 M1 A1 (5)																				
(b)	e.g. <table style="display: inline-table; vertical-align: middle; margin-left: 20px;"> <tr> <td>R_T</td><td>3</td><td>4</td><td>8</td><td>2</td><td>1</td><td>5</td><td>7</td><td>6</td><td></td> </tr> <tr> <td>R_A</td><td>2</td><td>5</td><td>7</td><td>3</td><td>1</td><td>4</td><td>6</td><td>8</td><td></td> </tr> </table> $\sum d^2 = 10$ $r_s = 1 - \frac{6 \times 10}{8 \times 63} = 0.881$	R_T	3	4	8	2	1	5	7	6		R_A	2	5	7	3	1	4	6	8		Ranks All correct M1 A1 M1 A1 M1 A1 (6)
R_T	3	4	8	2	1	5	7	6														
R_A	2	5	7	3	1	4	6	8														
(c)	$H_0: \rho = 0, H_1: \rho > 0$ $\alpha = 0.01$; critical value: 0.8333 Since 0.881 is in the critical region there is evidence of positive correlation.	both B1 B1 A1 \checkmark (3)																				
(d)	Because it makes no distributional assumptions about the data or order is more important than the mark Product moment correlation assumes bivariate normality and it is very unlikely that these scores will be distributed this way.	B1 B1 (2) (16 marks)																				

