Edexcel

Success through qualifications

Mock Paper Mark Scheme

Advanced Subsidiary/Advanced GCE
General Certificate of Education

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

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

Question number	Scheme		Marks	
3. (*a*)	$H_0: \mu_{sp} = \mu_{st}$; $H_1: \mu_{sp} > \mu_{st}$;		B1 B1	
	$\alpha = 0.05$; critical region: $z > 1.6449$	1.6449	B1	
	standard error $= \sqrt{\dfrac{22^2}{100} + \dfrac{31^2}{80}} = 4.1051\ldots.$		M1 A1	
	$z = \dfrac{75 - 64}{4.1051\ldots} = 2.68$		M1 A1	
	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.		M1 A1$\surd$	(9)
(*b*)	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	Any two	B1 B1	(2)
				(11 marks)
4. (*a*)	H_0: Poisson distribution is a suitable model H_1: Poisson distribution is not a suitable model	both	B1	
	From these data $\lambda = \dfrac{52}{80} = 0.65$		M1 A1	
	Expected frequencies 41.76, 27.15, $\underbrace{8.82, 2.27}_{11.09}$	$80 \times P(X = x)$	M1 A2/1/0	
		Amalgamation	M1	
	$\alpha = 0.05$, $\nu = 3 - 1 - 1 = 1$; critical value = 3.841		B1$\surd$; B1$\surd$	
	$\sum \dfrac{(O - E)^2}{E} = 1.312$		M1 A1	
	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.		M1 A1$\surd$	(13)
				(13 marks)

Question number	Scheme	Marks
5. (*a*)	$E(R) = E(X) + 4E(Y) = 8 + (4 \times 14) = 64$	M1 A1 (2)
(*b*)	$\text{Var}(R) = \text{Var}(X) + 16\,\text{Var}(Y) = 2^2 + (16 \times 3^2)$	M1 A1
	$= 148$	A1 (3)
(*c*)	$P(R < 41) = P\left(Z < \dfrac{41-64}{\sqrt{148}}\right) = P(Z < -1.89)$	M1 A1√
	$= 0.0294$	A1 (3)
(*d*)	$\text{Var}(S) = 3\,\text{Var}(Y) + (\tfrac{1}{2})^2\,\text{Var}(X)$	M1 M1
	$= 27 + 1$	A1
	$= 28$	A1 (4)
		(12 marks)
6. (*a*)	Stratified sampling	B1 (1)
(*b*)	Uses naturally occurring (strata) groupings	B1
	e.g. variance of estimator of population mean is usually reduced, individual strata estimates available — either	B1 (2)
(*c*)	$\bar{x} = \dfrac{(12 \times 12.6) + (12 \times 14.1) + (8 \times 10.2)}{32}$	M1 A1
	$= 12.56$	A1 (3)
(*d*)	Confidence interval is	M1
	$12.56 \pm 1.96 \times \dfrac{2.48}{\sqrt{32}}$ — 1.96	B1
		A1
	i.e. $12.56 \pm 0.859276\ldots$	
	i.e. (11.70, 13.42) — accept (11.7, 13.4)	A1 (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*)	$H_0: \rho = 0$, $H_1: \rho > 0$	B1 B1
	$\alpha = 0.01$, critical value = 0.7887	B1
	Since 0.774 is not in the critical region there is insufficient evidence of positive correlation.	M1 A1 (5)
(*b*)	e.g. R_T: 3 4 8 2 1 5 7 6 — Ranks	M1
	R_A: 2 5 7 3 1 4 6 8 — All correct	A1
	$\sum d^2 = 10$	M1 A1
	$r_s = 1 - \dfrac{6 \times 10}{8 \times 63} = 0.881$	M1 A1 (6)
(*c*)	$H_0: \rho = 0$, $H_1: \rho > 0$ both	B1
	$\alpha = 0.01$; critical value: 0.8333	B1
	Since 0.881 is in the critical region there is evidence of positive correlation.	A1 √ (3)
(*d*)	Because it makes no distributional assumptions about the data or order is more important than the mark	B1
	Product moment correlation assumes bivariate normality and it is very unlikely that these scores will be distributed this way.	B1 (2)
		(16 marks)