GCE Examinations

Advanced Subsidiary / Advanced Level

Statistics

Module S1

Paper L

MARKING GUIDE

This guide is intended to be as helpful as possible to teachers by providing concise solutions and indicating how marks should be awarded. There are obviously alternative methods that would also gain full marks.

Method marks (M) are awarded for knowing and using a method.

Accuracy marks (A) can only be awarded when a correct method has been used.

(B) marks are independent of method marks.

Written by Shaun Armstrong & Chris Huffer

S1 Paper L – Marking Guide

1. *(a)* $S_{TT} = 1802 - \frac{124^2}{12} = 520.667$ M1

$S_{nn} = 18518 - \frac{384^2}{12} = 6230$ M1

$S_{Tn} = 2583 - \frac{124\times384}{12} = {}^{-}1385$ M1

$r = \frac{-1385}{\sqrt{520.667\times6230}} = {}^{-}0.7690$ M1 A1

(b) it shows –ve correlation meaning less glove sales in higher temperatures B1

e.g. people mainly buy gloves when their hands are cold B1 **(7)**

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2. *(a)* $\frac{3}{4} - \frac{1}{4} = \frac{1}{2}$ M1 A1

(b) $\frac{3}{4} \times \mathrm{P}(B) = \frac{1}{2} \quad \therefore \mathrm{P}(B) = \frac{2}{3}$ M2 A1

(c) $1 - [\mathrm{P}(B) + \mathrm{P}(A \cap B')] = 1 - (\frac{2}{3} + \frac{1}{4}) = \frac{1}{12}$ M2 A1 **(8)**

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3. *(a)* $2\mathrm{E}(X) + 3 = 2a + 3$ A1

(b) $2^2 \times \mathrm{Var}(X) = 4b$ M1 A1

(c) $\mathrm{Var}(X) = \mathrm{E}(X^2) - [\mathrm{E}(X)]^2$ B1

$b = \mathrm{E}(X^2) - a^2$ M1

$\mathrm{E}(X^2) = a^2 + b$ A1

(d) $\mathrm{E}[(X+1)^2] = \mathrm{E}(X^2 + 2X + 1) = \mathrm{E}(X^2) + 2\mathrm{E}(X) + 1$ M1 A1

$= a^2 + b + 2a + 1 = (a+1)^2 + b$ M1 A1 **(10)**

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4. *(a)* $S_{xy} = 11600 - \frac{100\times23}{8} = 11312.5$ M1

$S_{xx} = 215000 - \frac{100^2}{8} = 213750$ M1

$b = \frac{11312.5}{213750} = 0.0529240$ M1 A1

$a = \frac{23}{8} - (0.0529240 \times \frac{100}{8}) = 2.21345$ M1 A1

$y = 2.21 + 0.0529x$ A1

(b) $n - 20 = 2.21345 + 0.0529240(v - 700)$ M1

$n = {}^{-}14.8 + 0.0529v$ A1

(c) $n = {}^{-}14.83 + 0.05292 \times 900 = 32.8 \quad \therefore 33$ M1 A1 **(11)**

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5. *(a)* y values = $^-3,\ ^-2,\ ^-1,\ 0,\ 1,\ 4,\ 9$ — M1

$\Sigma fy = (^-3 \times 31) + (^-2 \times 6) + \ldots = {}^-86$ — M1 A1

(b) $\Sigma f = 52$; $\bar{y} = \frac{-86}{52} = {}^-1.6538$ — M1

$\bar{x} = (200 \times {}^-1.6538) + 699.5 = 368.73 = £369$ (nearest £) — M1 A1

std. dev. of $y = \sqrt{\frac{424}{52} - (-1.6538)^2} = 2.3278$ — M1

std. dev. of $x = 200 \times 2.3278 = 465.56 = £466$ (nearest £) — M1 A1

(c) e.g. mean is raised by a few very large values, most weeks a lot less is stolen; median is more typical but would suggest that the amount stolen is much less of a problem than it really is — B3 **(12)**

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6. *(a)* $\frac{4}{10} \times \frac{3}{9} = \frac{2}{15}$ — M2 A1

(b) P(more F) = P(3F) + P(2F) — M1

$= (\frac{6}{10} \times \frac{5}{9} \times \frac{4}{8}) + (3 \times \frac{4}{10} \times \frac{6}{9} \times \frac{5}{8}) = \frac{2}{3}$ — M3 A2

(c) after M goes, left with 6F and 3M — M1

P(next 2 F) = $\frac{6}{9} \times \frac{5}{8} = \frac{5}{12}$ — M1 A1 **(12)**

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7. *(a)* cum. freqs: 15, 46, 78, 101, 118, 120 — M1

$Q_1 = 30.25^{th} = 30 + 30(\frac{15.25}{31}) = 44.8$ $[30^{th} \rightarrow 44.5]$

$Q_2 = 60.5^{th} = 60 + 30(\frac{14.5}{32}) = 73.6$ $[60^{th} \rightarrow 73.1]$ — M2 A3

$Q_3 = 90.75^{th} = 90 + 30(\frac{12.75}{23}) = 106.6$ $[90^{th} \rightarrow 105.7]$

(b) median = mean = 72 minutes — A1

P($Z < \frac{Q_1 - 72}{48}$) = 0.25 — M1

$\therefore \frac{Q_1 - 72}{48} = {}^-0.67$; $Q_1 = 39.8$ (1dp) — M1 A1

P($Z < \frac{Q_3 - 72}{48}$) = 0.75 — M1

$\therefore \frac{Q_3 - 72}{48} = 0.67$; $Q_3 = 104.2$ (1dp) — M1 A1

(c) e.g. median and quartiles from model all slightly lower than in new results but reasonably close so fairly suitable model — B2 **(15)**

Total **(75)**

Performance Record – S1 Paper L

Question no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Total
Topic(s)	pmcc	probability	discrete r. v.	regression	mean and std. dev. with coding	probability	interplo'n, normal dist.	
Marks	7	8	10	11	12	12	15	75
Student								