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.

# 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

$S_{Tn} = 2583 - \frac{124 \times 384}{12} = {}^-1385$  M1

$r = \frac{-1385}{\sqrt{520.667 \times 6230}} = {}^-0.7690$  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)  $\frac{3}{4} \times P(B) = \frac{1}{2}$  $\therefore P(B) = \frac{2}{3}$  M2 A1

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

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**3.** (a)  $2E(X) + 3 = 2a + 3$  A1

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

(c)  $Var(X) = E(X^2) - [E(X)]^2$  B1
$b = E(X^2) - a^2$  M1
$E(X^2) = a^2 + b$  A1

(d)  $E[(X+1)^2] = E(X^2 + 2X + 1) = E(X^2) + 2E(X) + 1$  M1 A1
$= a^2 + b + 2a + 1 = (a+1)^2 + b$  M1 A1  **(10)**

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**4.** (a)  $S_{xy} = 11600 - \frac{100 \times 23}{8} = 11312.5$  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)  $n = {}^-14.83 + 0.05292 \times 900 = 32.8$  $\therefore 33$  M1 A1  **(11)**

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

$\sum fy = (^-3 \times 31) + (^-2 \times 6) + ... = ^-86$                     M1 A1

*(b)* $\sum f = 52$;   $\overline{y} = \frac{-86}{52} = ^-1.6538$                     M1

$\overline{x} = (200 \times ^-1.6538) + 699.5 = 368.73 = £369$ (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

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

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

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

*(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)**

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Total          **(75)**

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# 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 | | | | | | | | |
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