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

© Solomon Press

These sheets may be copied for use solely by the purchaser's institute.

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)**

---

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

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

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

---

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

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

(c) $\text{Var}(X) = E(X^2) - [E(X)]^2$ 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
$\quad = a^2 + b + 2a + 1 = (a+1)^2 + b$ M1 A1   **(10)**

---

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

---

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

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

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

---

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

   (b)   P(more F) = P(3F) + P(2F)   M1

            $= \left(\frac{6}{10} \times \frac{5}{9} \times \frac{4}{8}\right) + \left(3 \times \frac{4}{10} \times \frac{6}{9} \times \frac{5}{8}\right) = \frac{2}{3}$ 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)**

---

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

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

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

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

   (b)   median = mean = 72 minutes   A1

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

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

            $P\left(Z < \frac{Q_3 - 72}{48}\right) = 0.75$ 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)**

© *Solomon Press*

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								

© Solomon Press