GCE Examinations

Advanced Subsidiary / Advanced Level

Statistics

Module S1

Paper I

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.

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S1 Paper I – Marking Guide

1. *(a)* (i) normal — A1
(ii) e.g. producer must ensure that most bottles contain at least 75 cl — B1

(b) (i) discrete uniform — A1
(ii)

x	1	2	3	4
$P(X = x)$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

mean $= \frac{5}{2}$ (symmetry) — A1
$E(X^2) = \sum x^2 P(x) = \frac{1}{4} + 1 + \frac{9}{4} + 4 = \frac{15}{2}$ — M1 A1
$\text{Var}(X) = \frac{15}{2} - (\frac{5}{2})^2 = \frac{5}{4}$ — M1 A1 **(8)**

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2. *(a)* $P(A \cap B) = P(A) \times P(B) = 2P(B) \times P(B) = 2[P(B)]^2$ — M2
$\therefore 2[P(B)]^2 = \frac{1}{8}$; $\therefore [P(B)]^2 = \frac{1}{16}$; $\therefore P(B) = \frac{1}{4}$ — M2 A1

(b) $P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{1}{2} + \frac{1}{4} - \frac{1}{8} = \frac{5}{8}$ — M2 A1

(c) A and B independent $\therefore$ A and B' independent
$\therefore P(A \mid B') = P(A) = \frac{1}{2}$ — M1 A1 **(10)**

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3. *(a)* 12.7 + 5.8 = 18.5 minutes — A1

(b) $P(X < 12.7) = 0.25$; $P(Z < \frac{12.7 - \mu}{\sigma}) = 0.25$ — M1
$\frac{12.7 - \mu}{\sigma} = {}^{-}0.67$; $12.7 - \mu = {}^{-}0.67\sigma$ — M1 A1
$P(X < 18.5) = 0.75$; $P(Z < \frac{18.5 - \mu}{\sigma}) = 0.75$ — M1
$\frac{18.5 - \mu}{\sigma} = 0.67$; $18.5 - \mu = 0.67\sigma$ — M1 A1
solve simul. giving $\mu = 15.6$, $\sigma = 4.3284$; so $\mu = 15.6$, $\sigma^2 = 18.7$ — M1 A1

(c) e.g. would expect normal dist. and mean and variance seem close to actual values so seems a fairly suitable model — B2 **(11)**

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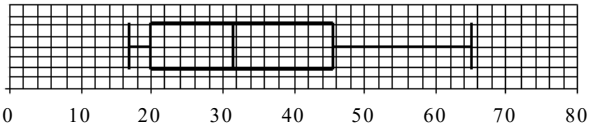
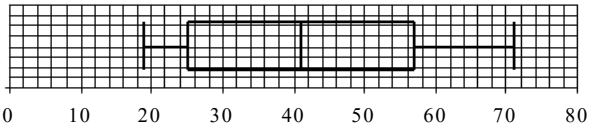
4. *(a)* median $= 15.5^{\text{th}} = \frac{31+32}{2} = 31.5$ — M1 A1
$Q_1 = 7.75^{\text{th}} = 20$ — A1
$Q_3 = 23.25^{\text{th}} = 45.5$ — A1

(b)



B3

(c)



B3

(d) e.g. similar range, youngest and oldest both a bit higher for E
median of M lower meaning younger students on average
IQR of M smaller meaning student ages more similar
E roughly symmetrical, M +vely skewed — B4 **(14)**

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5. *(a)* $(0.6 \times 0.5 \times 0.7) + (0.6 \times 0.5 \times 0.3) + (0.4 \times 0.5 \times 0.3) = 0.36$ M3 A1

(b) $P(W = 0) = 0.4 \times 0.5 \times 0.7 = 0.14$
$P(W = 3) = 0.6 \times 0.5 \times 0.3 = 0.09$
$P(W = 1) = 1 - (0.14 + 0.36 + 0.09) = 0.41$

w	0	1	2	3
$P(W = w)$	0.14	0.41	0.36	0.09

M2 A2

(c) $E(W) = \sum wP(w) = 0 + 0.41 + 0.72 + 0.27 = 1.4$ M1 A1
$E(W^2) = \sum w^2P(w) = 0 + 0.41 + 1.44 + 0.81 = 2.66$ M1 A1
$Var(W) = 2.66 - 1.4^2 = 0.7$ M1 A1

(d) e.g. unlikely to be valid as result of each match will probably raise or lower confidence changing probability of success in the next match B2 **(16)**

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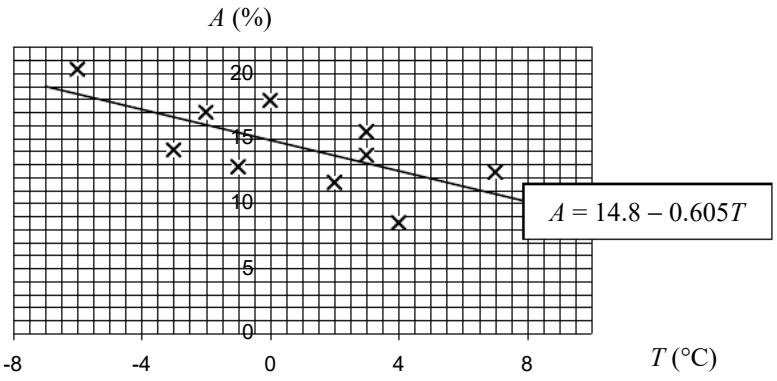
6. *(a)*



B4

(b) $S_{TT} = 137 - \frac{7^2}{10} = 132.1$ M1

$S_{AA} = 2172.66 - \frac{143.8^2}{10} = 104.816$ M1

$S_{TA} = 20.7 - \frac{7 \times 143.8}{10} = {}^{-}79.96$ M1

$r = \frac{-79.96}{\sqrt{132.1 \times 104.816}} = {}^{-}0.6795$ M1 A1

e.g. fairly strong –ve correlation so belief seems reasonable B1

(c) $q = \frac{-79.96}{132.1} = {}^{-}0.60530$ M1 A1

$p = \frac{143.8}{10} - ({}^{-}0.60530 \times \frac{7}{10}) = 14.804$ M1 A1

$A = 14.8 - 0.605T$

(d) line on graph above B2 **(16)**

Total **(75)**

Performance Record – S1 Paper I

Question no.	1	2	3	4	5	6	Total
Topic(s)	modelling, discrete uniform dist.	probability	normal dist.	stem & leaf, quartiles, boxplot	discrete r. v.	scatter diagram, pmcc, regression	
Marks	8	10	11	14	16	16	75
Student							