GCE Examinations

Advanced Subsidiary / Advanced Level

Statistics

Module S2

Sample Paper from Solomon Press

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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Sample Paper from Solomon Press – Marking Guide

1. *(a)* e.g. quicker; may not be able to get data from all of pop^{n} — B2

(b) frame – list of all local newspapers in Britain — B1
units – individual local newspapers — B1 **(4)**

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2. *(a)* let X = no. out of 30 who visit advertiser's site $\therefore X \sim \text{B}(30, \frac{1}{40})$ — M1

$\text{P}(X \le 1) = (\frac{39}{40})^{30} + 30(\frac{1}{40})(\frac{39}{40})^{29}$ — M1 A1

$= 0.8278$ (4sf) — A1

(b) let Y = no. out of 200 who visit advertiser's site $\therefore Y \sim \text{B}(200, \frac{1}{40})$ — M1

Using Po approx. $Y \approx \sim \text{Po}(5)$ — M1

$\text{P}(Y > 10) = 1 - \text{P}(Y \le 10)$ — M1

$\approx 1 - 0.9863 = 0.0137$ — A1 **(8)**

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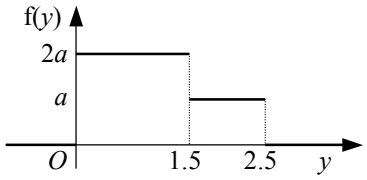
3. *(a)* continuous uniform — B1

(b) $\text{f}(x) = \begin{cases} \frac{1}{2}, & 0 \le x \le 2, \\ 0, & \text{otherwise.} \end{cases}$ — A2

(c) $\text{P}(X > 1.3) = 0.7 \times \frac{1}{2} = 0.35$ — M1 A1

(d) (i) $\text{f}(y)$



B2

(ii) $(2a \times 1.5) + (a \times 1) = 1$ — M1

$\therefore 4a = 1,\ a = \frac{1}{4}$ — A1

$\text{f}(y) = \begin{cases} \frac{1}{2} & 0 \le y \le 1.5, \\ \frac{1}{4} & 1.5 \le y \le 2.5, \\ 0 & \text{otherwise.} \end{cases}$ — A1 **(10)**

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4. *(a)* e.g. incoming emails likely to occur singly, at random and at a constant rate — B3

(b) let X = no. of emails per day $\therefore X \sim \text{Po}(8)$ — M1

$\text{P}(X \ge 6) = 1 - \text{P}(X \le 5)$ — M1

$= 1 - 0.1912 = 0.8088$ — A1

(c) let Y = no. of emails per 5-days $\therefore Y \sim \text{Po}(40)$ — M1

N approx. $E \sim \text{N}(40, 40)$ — M1

$\text{P}(Y > 50) \approx \text{P}(E > 50.5)$ — M1

$= \text{P}(Z > \frac{50.5 - 40}{\sqrt{40}}) = \text{P}(Z > 1.66)$ — A1

$= 1 - 0.9515 = 0.0485$ — A1 **(11)**

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5. *(a)* let X = no. of sales per hour $\therefore X \sim \text{Po}(1.5)$ M1
$\text{P}(X = 0) = 0.2231$ A1

(b) let Y = no. of sales per half-hour $\therefore Y \sim \text{Po}(0.75)$ M1
$\text{P}(Y > 2) = 1 - \text{P}(Y \leq 2)$ M1
$= 1 - \text{e}^{-0.75}(1 + 0.75 + \frac{0.75^2}{2})$ M1 A1
$= 1 - 0.9595 = 0.0405$ (4sf) A1

(c) let S = no. of sales per two-hours $\therefore S \sim \text{Po}(3)$ M1
$\text{H}_0 : \lambda = 3 \quad \text{H}_1 : \lambda > 3$ B1
$\text{P}(S \geq 7) = 1 - \text{P}(S \leq 6) = 1 - 0.9665 = 0.0335$ M1 A1
less than 5% $\therefore$ significant, evidence of increase A1 **(12)**

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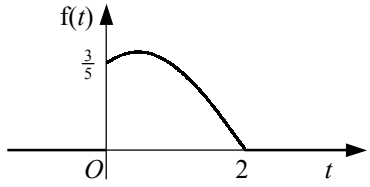
6. *(a)* $\int_0^2 k(2 + t - t^2)\ \text{d}t = 1$ M1
$\therefore\ k[2t + \frac{1}{2}t^2 - \frac{1}{3}t^3]_0^2 = 1$ A1
$\therefore\ k[(4 + 2 - \frac{8}{3}) - (0)] = 1;\ \frac{10}{3}k = 1;\ k = \frac{3}{10}$ M1 A1

(b) $2 + t - t^2 = (2 - t)(1 + t)$



B3

(c) e.g. $\text{f}'(t) = \frac{3}{10}(1 - 2t)$, $\therefore$ mode when $t = \frac{1}{2}$ M1 A1

(d) $\text{E}(T) = \int_0^2 t \times \frac{3}{10}(2 + t - t^2)\ \text{d}t = \frac{3}{10}\int_0^2 2t + t^2 - t^3\ \text{d}t$ M1
$= \frac{3}{10}[t^2 + \frac{1}{3}t^3 - \frac{1}{4}t^4]_0^2$ A1
$= \frac{3}{10}[(4 + \frac{8}{3} - 4) - (0)] = \frac{4}{5}$ M1 A1 **(13)**

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7. *(a)* e.g. may "get eye in" so p may vary but only a little so reasonable model B2

(b) let X = no. of scores in 10 shots $\therefore X \sim \text{B}(10, 0.7)$ M1
$\text{P}(X < 6) = \text{P}(Y \geq 5)$ where $Y \sim \text{B}(10, 0.3)$ M1
$= 1 - \text{P}(Y \leq 4)$ M1
$= 1 - 0.8497 = 0.1503$ A1

(c) let S = no. of sets in which she scores < 6 $\therefore S \sim \text{B}(5, 0.1503)$ M1
$\text{P}(S \leq 1) = 0.8497^5 + 5(0.1503)(0.8497)^4$ M1 A1
$= 0.835$ (3sf) A1

(d) let T = no. of scores in 50 shots $\therefore T \sim \text{B}(50, 0.7)$ M1
$\text{H}_0 : p = 0.7 \quad \text{H}_1 : p \neq 0.7$ B1
for $U \sim \text{B}(50, 0.3)$, $\text{P}(U \leq 9) = 0.0402$
$\text{P}(U \leq 20) = 0.9522$ M1 A1
$\therefore$ C.R. is $T \leq 29$ or $T \geq 41$ M1 A1

(e) $0.0402 + (1 - 0.9522) = 0.0880$ A1 **(17)**

Total **(75)**

Performance Record - Sample Paper from Solomon Press

Question no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Total
Topic(s)	sampling	binomial, Po approx.	rect. dist., p.d.f.	Poisson, N approx.	Poisson, hyp. test	p.d.f., mode, mean	binomial, hyp. test	
Marks	4	8	10	11	12	13	17	75
Student								