



**General Certificate of Education
June 2010**

Statistics

SS02

Statistics 2

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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Key to mark scheme and abbreviations used in marking

M	mark is for method		
m or dM	mark is dependent on one or more M marks and is for method		
A	mark is dependent on M or m marks and is for accuracy		
B	mark is independent of M or m marks and is for method and accuracy		
E	mark is for explanation		
✓ or ft or F	follow through from previous incorrect result	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	or equivalent	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
-x EE	deduct x marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded. However, there are situations in some units where part marks would be appropriate, particularly when similar techniques are involved. Your Principal Examiner will alert you to these and details will be provided on the mark scheme.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

SS02

Q	Solution	Marks	Total	Comments
1(a)	$E(X) = 40 \times 0.37 + 70 \times 0.18 + 100 \times 0.14$	M1		M1 method for $E(X)$
(i)	$+140 \times 0.12 + 190 \times 0.19$ $= 94.3$			
(ii)	$E(X^2) = 40^2 \times 0.37 + 70^2 \times 0.18$ $+100^2 \times 0.14 + 140^2 \times 0.12 + 190^2 \times 0.19$ $= 12085$	M1		M1 method for $E(X^2)$ ag
(iii)	$V(X) = 12085 - 94.3^2 = 3192.51$ s.d. $= \sqrt{3192.51} = 56.5$	M1 m1A1	5	M1 method for variance m1 method for s.d. A1 56.5 (56.4 – 56.6)
(b)(i)	0.31	B1		B1 0.31 CAO
(ii)	0	B1	2	B1 0
(c)	Smaller, 0 is less than the mean of fare-paying passengers.	B1 B1	2	B1 smaller B1 $0 < 94.3$ or equivalent
	Total		9	
2(a)	2007 2008 J-A M-A S-D J-A M-A S-D 121.3 114 109.7 103 101.3 2009 J-A M-A S-D 98.3 89.3	M1 B1		M1 method for m.a. B1 3-point m.a. used
(b)	On insert	A1 M1 A1 B1	3 3	A1 all correct nearest whole number M1 their m.a. in correct position A1 accurate plot - allow one small slip B1 trend line - generous
(c)(i)	Estimated J-A seasonal effect $(13.3 + 19.7)/2 = 16.5$	M1 A1		M1 method for seasonal effect - allow inclusion of 2007. Attempt to find mean deviation from their trend/regression line A1 16.5 (16 ~ 19) Needs all previous M marks
	Forecast $83 + 16.5 = 100$	M1M1	5	M1 attempt to find estimate of J-A 2010 moving average from their trend line. M1 method for forecast – their forecast moving average + their seasonal effect A1 100 (95 ~ 105) – needs all previous M's. Allow non-integer SC Correct answer, no working or using May-August only B2
(ii)	110 allow '110 or more'	M1A1	2	M1 their (c)(i)+ 10% A1 110 (104~116)
(d)	82 does not allow for seasonal variation. 130 does not allow for downward trend. Fairest target would be 110 which allows for both seasonal variation and trend.	E1 E1 B1	3	B1 their answer to (c)(ii) E1 82 omits seasonal variation E1 130 omits trend.
	Total		16	

6

SS02 (cont)

Q	Solution	Marks	Total	Comments
6(a)(i)	$1 - 0.8946 = 0.105$	M1		M1 $P(6 \text{ or more}) = 1 - P(5 \text{ or fewer})$
(ii)	0.0408	A1 M1 A1	4	A1 0.105 (0.105 ~ 0.106) M1 Attempt to find $P(0)$ A1 0.0408 (0.0407 ~ 0.041)
(b)(i)	0.2689	B1		B1 0.269 (0.2688 ~ 0.269)
(ii)	Poisson mean $3.2 + 3.8 = 7$ $P(<2) = P(1 \text{ or fewer}) = 0.0073$	M1 m1 A1	4	M1 attempt to use Poisson mean 3.2 + 3.8 or equivalent m1 completely correct method A1 0.0073 (0.007 ~ 0.0073)
(iii)	In this week the total of the number who did not attend on Tuesday and the number who did not attend on Thursday was 1. As shown in part (b) this was an extremely unlikely occurrence prior to the change of policy. Hence it is likely that the change of policy has improved attendance.	E1 E1 E1	3	E1 Policy effective E1 Attempt at reference to relevant probability E1 complete answer
(c)(i)	Poisson has no upper limit. Number of absentees cannot exceed size of squad (probably about 16)	E1		E1 no upper limit
(ii)	Same member may miss both sessions due to illness/holiday	E1	2	E1 reason
	Total		13	
7(a)	Number shops 000 to 419 Select 3-digit random numbers Ignore repeats and > 419 Select corresponding shops	E1 E1 E1 E1	4	E1 number 000 to 419 or equivalent E1 3-digit random numbers E1 ignore > 419 - consistent with their numbering E1 ignore repeats
(b)(i)	(A) stratified (random) (B) equally likely (C) not all subsets possible	E1 E1 E1	3	E1 stratified E1 equally likely Allow 'yes,' disallow 'likely' E1 reason
(ii)	(A) systematic (B) equally likely (C) not all subsets possible	E1 E1 E1	3	E1 systematic E1 equally likely. E1 reason
(iii)	Shops with largest electricity consumption are likely to have the largest potential savings. Therefore sensible to audit these first	E1	2	E1 shops with largest consumption selected E1 largest potential saving
	Total		12	
	TOTAL		75	