Version : 1.0. 0610

Free-Standing Mathematics Qualification
June 2010

Using and Applying Statistics 6990/2

Advanced Level

Final

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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

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.

Free-Standing Mathematics Qualification

Advanced Level – Using and Applying Statistics (6990/2)

Answers and Marking Scheme June 2010

Question 1

(a)	Germany	**B1**	
(b)	$\frac{(61185981-60816701)}{60816701}\times 100$	**M1**	oe
	0.607%	**A1**	accept 0.61% or better
(c)	$\frac{(38125479-38115641)}{38125479}\times 100$	**M1**	
	$(\pm)0.0258...\%$	**A1**	$(\pm)0.026\%$ or better
(d)	obtain 0.9979	**B1**	oe
	$\frac{10045000}{their\ 0.9979}$	**M1**	Their attempt at (100 – 0.21)(%)
	10066138 or 10066139	**A1**	accept 10100000 (3SF)
	TOTAL	**8**	

Question 2

(a)	obtaining cumulative frequencies 5, 27, 71, 152, 192, 200	**B1**	seen or implied, even from cum. block diagram
	plotting cumulative frequencies at upper class boundaries	**M1**	must be an increasing non-linear function for (a) and (b). No marks for a polygon
	joined by curve or straight lines	**A1**	fully correct (condone not joined to (30, 0))
(b)(i)	their 67	**B1 ft**	From C.F.C.
(b)(ii)	their 79 – their 55 within $\pm\frac{1}{2}$ sq.	**M1**	locating and subtracting quartiles from C.F.C. From $\frac{3}{4}$n and $\frac{1}{4}$n
	their 24	**A1 ft**	
(c)	72×200 (= 14 400)	**M1**	
	$\frac{\text{their total mileage}}{43}\times 5.50$	**M1**	
	£1841.86	**A1**	£1840 or better (3SF)
	TOTAL	**9**	

Question 3

(a)	$12\times(8-5)$ 36	**M1** **A1**	or 12×3
(b)	$(1\times10)+(2\times7)+(1\times5)+(36)+(2\times4)+(1\times2)$ 75	**M1** **A1**	accept at least 3 correct products or values seen
(c)	their frequencies $\times$ midpoints eg $(10\times1.5)+(14\times3)+(5\times4.5)+...$ their total $\div$ their 75 $\left(\text{eg } \frac{419.5}{75}\right)$ 5.59(333333...)	**M1** **m1** **A1**	accept at least 3 correct products or values summed Dep on M1 in (b) accept 5.6 or better
(d)	their frequencies $\times$ upper class boundaries $(10\times2)+(14\times4)+(5\times5)+...$ 513	**M1** **A1**	Accept at least 3 correct products or values summed
(e)	no (because $600-90=510$ and) it is very unlikely that all of the parcels will be near their upper class boundaries	**E1 ft**	Compare with their (d) M1 earned
	TOTAL	**10**	

Question 4

(a)	$\bar{x}=91.22$ $\sigma_n=34.2(677049)$ or 34.3	**B1** **B2**	91.2 or better accept $\sigma_{n-1}=36.1(213325)$
(b)	the average rainfall has only very slightly increased the spreads of the data sets are the same overall Stef's belief is not justified by these figures	**B1** **B1** **B1**	Accept 'has increased' or 'increasing' the standard deviations are not different
	TOTAL	**6**	

Question 5

(a)(i)	$0.72(3)$	**B1**	
(a)(ii)	this suggests the strongest correlation is between Armagh and Durham	**B1ft**	
(b)(i)	$a = 0.88$ $b = 22.75$	**B1** **B1**	from $0.88(00963)$ from $22.75(366)$
(b)(ii)	$(\bar{x}, \bar{y}) = (52.0, 68.5)$ one other point calculated in given range 2 sf or better straight line passing through these two points	**B1** **B2ft** **B1ft**	Or other correctly calculated point from correct equation ft their equation over the horizontal range of the data 11-110 Depends on at least 1 point correct. Do not allow a line with a negative gradient.
(b)(iii)	a is the gradient of the regression line it suggests that if the Durham rainfall increases by 1 mm the Armagh rainfall will increase by 0.88 mm	**B2ft**	B1 positive gradient
(b)(iv)	b is the y - intercept value it suggests that when there is no rain per month in Durham there will (on average) 22.75 mm of rain per month in Armagh	**B2ft**	B1 y -intercept value
(b)(v)	the rainfall value of 150 mm is outside the range of the data so it is not sensible to use the regression line for this value	**E1**	
	TOTAL	**13**	

Question 6

(a)(i)	median $= 50.5^{th}$ or 50^{th} value 164.5 or 164	**M1** **A1**	
(a)(ii)	73	**B1**	
(b)	fairly symmetrical, unimodal, modal class is 160-170, mean is ~160 range = 49 Inter Quartile Range = 14	**B2**	Accept normally distributed any two, B1 each
(c)	$P(H > 190) \equiv P\left(Z > \frac{190-178}{7}\right)$ or $P(Z > 1.7143)$ $1-\Phi(1.7143)$ $1-0.9568$ 4.32 %	**M1** **M1** **M1** **A1**	1.71 or better 0.9568 or 0.9564 seen also accept $1-0.9564$ and 4.36%
(d)	$P(147 < W < 203) = P\left(\frac{147-162}{6.4} < Z < \frac{203-162}{6.4}\right)$ P(-2.344 < Z < 6.406) $\Phi(2.344)$ 99.04 %	**M1** **A1A1** **m1** **A1**	Standardising both sides -2.34 3 sf or better, allow 6.4… Do not allow $1-\Phi(2.34)$ if follows after correct answer seems to be given accept 99.0% (3sf)
	TOTAL	**14**	
	TOTAL MARK FOR PAPER	**60**	