



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Free-Standing Mathematics Qualification

Using and Applying Statistics
6990/2

Advanced Level

Mark Scheme

2008 examination – June series

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.

Free-Standing Mathematics Qualification
Advanced Level – Using and Applying Statistics (6990/2)
Answers and Marking Scheme June 2008

Question 1

(a)	$\frac{(59321.7 - 59113.5)}{59113.5} \times 100$	M1	-0.352% \Rightarrow MIAO
	0.352% or better	A1	accept 0.35% or better
(b)	1.0766 (1.08) accept for B1M1	B1	from 55925599 Allow 55900(000) to 3sf (Not 55600)
	$x \times 1.0766 = 60209.5$	M1	
	$x = 55926(000)$	A1	
(c)	1 The natural change was greater than the Net migration and other changes from 1991 to 1998 OR The natural change was less than the Net migration and other changes from 1998 (allow 1997) to 2005	B1	Or other sensible comparisons, e.g. they were equal in 97 (-98); but not individual comparisons other than this
	2 The natural change was fairly stable throughout this period whereas the net migration and other changes was generally growing from 1991 to 2005	B1	
TOTAL		7	

Question 2

(a)	Any one correct fd calculation seen or implied	M1	May be implied from (correct) diagram $(\pm \frac{1}{2}$ sq for heights only)
	6 correct fds 2, 9, 19, 33, 14.5, 0.5 seen or implied	A1	
	Upper boundaries at 14, 16, etc	M1	
	Fully correct histogram	A1	
(b)	$4 + \frac{3}{4} \times 58$	M1	$(14.5 \times 3) + 4$
	47	A1	Accept 48 also (integer)
TOTAL		6	

Question 3

(a)(i)	$\bar{h} = 173.83\dot{3} = 174$ (to 3sf) $\bar{f} = 26.16\dot{6} = 26$ (to 2sf)	B1	Allow 174 or correct decimals
(a)(ii)	$r = 0.751$ (seen)	B1	Allow 0.75 also (not 0.8 NMS)
(a)(iii)	$f = 0.13h + 3.57$ condone y, x used	B1 B1	From 0.129997815 From 3.5687...allow 3.56 Coefficients to 2sf or better (allow truncation)
(b)	Line through their mean point (174, 26) Passing through another calculated value <u>shown</u> or correct check (165, 25) if mean correct	B2ft B2ft (dep mean)	$\left. \begin{array}{l} 173-174 \\ 26-26.5 \end{array} \right\}$ $\pm \frac{1}{2}$ sq; value must be shown or (165, 25)
(c)	As a boy's height increases by 1 cm his foot length on average increases by "0.13" cm	B2 (use figures)	positive gradient (in context) B1 accept increasing B1 The gradient is the rate of change between foot length and height in boys \Rightarrow B1
(d)	The boys scatter diagram exhibits strong positive correlation because the points are close to the line of best fit whereas for the females scatter diagram the points are much more varied (spread out) about a line of best fit and consequently they will have a smaller correlation coefficient.	B2 (good)	B1 for weak explanation e.g. anomalies or outliers
	TOTAL	13	

Question 4

(a)(i)	Mean = 139.08 Standard deviation = 26.9 or 28.1	B1 B2	Accept 139 or better (28.092)
(a)(ii)	The males' wrist circumferences are on average much larger than the females. The standard deviation of the females' wrist circumferences is almost twice as large as the males' standard deviation suggesting the females wrist circumferences are much more spread out.	B1ft B1ft	strict ft penalise heights once 'is larger' OK
(b)(i)	69	B1	69 or 180
(b)(ii)	The mean of the females' wrist circumferences will increase. The standard deviation of the females' wrist circumferences will decrease.	B1ft B1	decrease ft 180 only, any other value do not give max b (ii) not range
(c)(i)	$P(F < 185) = P\left(Z < \frac{185-170}{9.6}\right)$ $= P(Z < 1.56(25))$ $= \Phi(1.56(25))$ $= 0.941$	M1 M1 A1	accept 0.94 or better
(c)(ii)	$P(F < 146) = P\left(Z < \frac{146-170}{9.6}\right)$ $= P(Z < -2.5)$ 0.9938 seen $= 1 - 0.9938$ $= 0.0062$	M1 A1 M1 M1 A1	ans 0.62% without further work \Rightarrow 4 marks (lose 1 mark)
	TOTAL	16	

Question 5

(a)	Assistant Professor (ave age 39)	B1	
(b)(i)	Cumulative frequencies 2, 15, 46, 65, 66	B1	must be an increasing function throughout
(b)(ii)	Plotting their heights at ucb's (40, 50, 60, 70, 75) Smooth curve or polygon passing through their heights	B1ft B1ft	boundaries $\pm \frac{1}{2}$ sq
(c)	Median Senior Lecturer = 51 Median Professor = "57" On average the Professors are older than Senior Lecturers.	B1 B1ft B1ft	accept 50-51 Follow their curve if increasing their "correct" values from their CFC's (dep method)
	TOTAL	7	

Question 6

(a)(i)	$\frac{42}{297}(\times 100 = 14.1\%)$	M1	Either correct method seen accept 14% or better															
(a)(ii)	$\frac{422}{1166} \times (100 = 36.2\%)$	A1	Both answers correct (may not be %'s) accept 36% or better															
(a)(iii)	The proportion of male Professors is more than (twice that of) the female Professors.	B1dep	must be the "correct" method comparison – dep(a)															
(b)	<p>Any correct method seen or implied by two correct answers</p> <table border="1" data-bbox="359 909 957 1173"> <thead> <tr> <th>All UTOs</th> <th>Female</th> <th>Male</th> </tr> </thead> <tbody> <tr> <td>Univ. Lecturer</td> <td>(10.46) 10</td> <td>(24.74) 25</td> </tr> <tr> <td>Senior Lecturer</td> <td>(3.90) 4</td> <td>(12.92) 13</td> </tr> <tr> <td>Reader</td> <td>(3.08) 3</td> <td>(13.19) 13</td> </tr> <tr> <td>Professor</td> <td>(2.87) 3</td> <td>(28.84) 29</td> </tr> </tbody> </table>	All UTOs	Female	Male	Univ. Lecturer	(10.46) 10	(24.74) 25	Senior Lecturer	(3.90) 4	(12.92) 13	Reader	(3.08) 3	(13.19) 13	Professor	(2.87) 3	(28.84) 29	M1 A1 A1 A1	e.g. $\frac{100}{1463} \times 153$ All decimals for females or males correct to at least 1d.p. if shown – mark whole numbers first All female integers correct All male integers correct sc3 1 compensating row
All UTOs	Female	Male																
Univ. Lecturer	(10.46) 10	(24.74) 25																
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Professor	(2.87) 3	(28.84) 29																
(c)	$(297 \times 0.148) + (1166 \times 0.074) = 130(.24)$ $W = 20\%$ $M = 80\%$ $\frac{14.8}{5} = 2.96$ $7.4 \times \frac{4}{5} = 5.92$ $\left. \begin{array}{l} \frac{14.8}{5} = 2.96 \\ 7.4 \times \frac{4}{5} = 5.92 \end{array} \right\} 8.88\%$ $\frac{130}{1463} \times 100 = 0.0888\dots$	M1 A1 M1 A1	44 + 86 130 8.9% of 1463 = 130															
	TOTAL	11																
	TOTAL MARK FOR PAPER	60																