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ASSESSMENT and QUALIFICATIONS ALLIANCE

Free-Standing Mathematics Qualification

Using and Applying Statistics 6990/2

Mark Scheme

2007 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.

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.

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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.

June 07

Free-Standing Mathematics Qualification

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

Answers and Marking Scheme

Question 1

(a)	Mean height = $\frac{520}{9}$ = 57.8 inches AWRT Mean weight = $\frac{726}{9}$ = 80.7 pounds Mean ideal wt = $\frac{1037}{9}$ = 115.2 pounds	**B1** **B1** **B1**	Allow 58 inches Allow 81 pounds Allow 115 pounds
(b)	Mean height for those patients with cystic fibrosis is 3 inches below that for healthy children. Mean ideal weight for children with cystic fibrosis is just 5 pounds lower that that for healthy children. Mean weight is far lower for those patients with cystic fibrosis at a massive 33 pounds below that for healthy children.	**E1** **E1**	Examples of acceptable comments. Either – no need to quote actual values Mean higher for healthy E1 only Just numbers E0 Must mention that this is the bigger difference
(c)(i)	Healthy children are, on average, closer to their ideal weight (actual mean 114, ideal mean 120; 6 pounds)	**E1**	Examples of acceptable comments E1 'lower' **SC2** 5.26% and 49.5%
(c)(ii)	Those children with cystic fibrosis are, on average, way below their ideal weight (actual mean 81, ideal mean 115) (34 pounds) All cystic fibrosis children are below their ideal weight.	**E1**	Any other sensible comment
	TOTAL	**7**	

Question 2

(a)	$z = \frac{96-84.4}{22.9} = 0.507$ P($z > 0.507$) = 1 – P($z < 0.507$) = 1 – 0.6950 = 0.306 3SF = 0.305	**M1A1** **M1M1** **A1**	 Use of 0.6915, 0.7123 M1M1A0 0.304 -0.307 Percentages condoned
(b)	$z = \frac{96-112.6}{24.8} = -0.669$ or – 0.670 P($z > -0.669$) = P($z < 0.669$) = 0.748 (3SF) 0.7486	**M1A1** **M1** **A1**	Ignore sign + / – 0.747 – 0.749 Percentages condoned 3SF or A0 ISW
(c)	Although 96 pounds is well below the mean weight for healthy children, only 30% of children suffering from cystic fibrosis would be expected to weigh more than 96 pounds. 75% of healthy children would be expected to weigh more than 96 pounds.	**E1** **E1**	Any two sensible comments **FT** E1 only Examples of comments given
	TOTAL	**11**	

Question 3

(a)	width 10 10 5 5 5 10 10 height 0.5 1.4 4.8 3.8 2.8 0.9 0.5 Histogram	**M1** **M1** **B1** **A1ft**	Widths Condone small slips Height = freq/width Plotted ok No gaps & correct by eye
(b)	$9 + 5 + \frac{4}{5} \times 14 = 25.2$ Expect about 25 of the 90 children to weigh over 96 pounds (allow 25.2).	**M1A1**	
	TOTAL	**6**	

Question 4

(a)(i)	0.895	**B2**	0.9, 0.89 B1
(a)(ii)	Strong (positive) correlation between groove and weight Example of comment: This indicates that when the weight method predicts a high level of miles of tyre wear, the groove method also predicts a high level.	**B1** **E1**	In context and positive Also acceptable: There is strong evidence of a linear relationship between weight method and groove method
(b)(i)	$y = 0.815x + 4.62$ $a = 0.815 \quad b = 4.62$	**B1** **B1**	Allow 0.842 Allow 4.6 B0 B0 if reversed and not in equation
(b)(ii)	a=0.815 gives the rate of change of y with x / gradient. In this case, it means that for every 1 mile of wear given by the weight method, 0.815 miles of wear are given by the groove method.	**B1ft** **E1ft**	 In context
(b)(iii)	$y = 0.815 \times 400 + 4.62 = 330.6$ Estimate is 33 100 miles AWRT	**M1ft** **A1**	Substitute 329 or 332 Not 32 600
(b)(iv)	x = 500 is beyond the range of the data used to obtain the regression equation and therefore any predictions made using the line would be extrapolation and may lead to unreliable results.	**E1**	
	TOTAL	**11**	

Question 5

(a)	Only adults with a telephone can be included. Time period (holiday)	**B1**	Other sensible comments acceptable Not more males, not 18+
	Interviewer bias might occur.	**B1**	Any two for B2
(b)(i)	A stratified sample involves identification of 'strata' into which a population can be divided.	**E1**	Strata
	Random samples are then taken from each stratum, usually in proportion to the size of each of the strata.	**E1 dep**	Random
(b)(ii)	ICM conducted interviews across the country and 'results have been weighted to fit the profile of all adults'.	**E1**	Allow that 'results have been weighted to fit the profile of all adults' implies original survey was not stratified.
	This implies that the sampling was stratified.	**E1**	
	TOTAL	**6**	

Question 6

(a)	$0.30 \times 44.7 = 13.4$ (million)	**M1A1**	
(b)	$22 \div 13.4 = 1.64$ (injuries per person)	**M1A1**	M1 13.4 (**FT** 'their' 13.4)
	TOTAL	**4**	

Question 7

(a)	See answer sheet	**M1**	Cumulative freqs
	Cf females 20, 48, 88, 124, 180	**M1A1**	Plots at end of interval A0 if extends Allow polygon
(b)(i)	Males median = 29 years	**B1**	28/30 years
	Females median = 41 years	**B1**	40/42 years
(b)(ii)	Males tended to be younger (when they over–exerted themselves).	**E1**	**FT** (b)(i)
	TOTAL	**6**	

Question 8

(a)	Inwards UK $\frac{318.1-306}{306}\times 100 = 3.95\% \approx 4.0\%$ Outwards UK $\frac{231.4-249.6}{249.6}\times 100 = -7.29\% \approx -7.3\%$	 **M1A1** **M1A1**	 **OE** $\frac{318.1}{306} = 1.039$ etc. **NOT** $\frac{306}{318.1}$ etc. **SC1** $\frac{306-318.1}{306}$
(b)	UK had a very small increase for Inwards but almost double this amount as a decrease for Outwards. Finland had increases for both Inwards and Outwards but the Outwards increase was much lower. Finland had a far greater increase in Maritime trade.	**E1** **E1**	Other sensible comments acceptable any two for E2
(c)	 $\frac{1881.8}{100.8}\times 100 = 1866.9$ million tonnes 1870 (million tonnes)	 **B1** **M1** **A1 dep**	 For 100.8 Division by "100.8" or 1.008 or 1.08 and multiply by 100 AWRT
	TOTAL	**9**	
	TOTAL MARK FOR PAPER	**60**	