UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

9709 MATHEMATICS

9709/62 Paper 6, maximum raw mark 50

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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Mark Scheme Notes

Marks are of the following three types:

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.

- The symbol √ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously "correct" answers or results obtained from incorrect working.

- Note: B2 or A2 means that the candidate can earn 2 or 0.
  B2/1/0 means that the candidate can earn anything from 0 to 2.

  The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored.

- Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.

- For a numerical answer, allow the A or B mark if a value is obtained which is correct to 3 s.f., or which would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated above, an A or B mark is not given if a correct numerical answer arises fortuitously from incorrect working. For Mechanics questions, allow A or B marks for correct answers which arise from taking *g* equal to 9.8 or 9.81 instead of 10.

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The following abbreviations may be used in a mark scheme or used on the scripts:

AEF Any Equivalent Form (of answer is equally acceptable)

AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)

BOD Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)

CAO Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)

CWO Correct Working Only – often written by a 'fortuitous' answer

ISW Ignore Subsequent Working

MR Misread

PA Premature Approximation (resulting in basically correct work that is insufficiently accurate)

SOS See Other Solution (the candidate makes a better attempt at the same question)

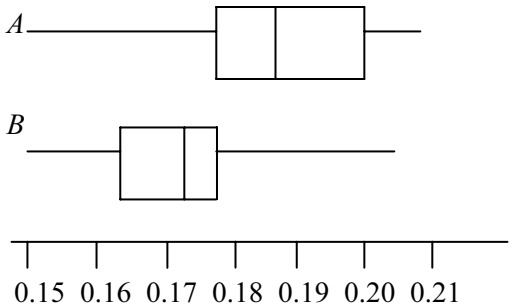
SR Special Ruling (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)

Penalties

MR –1 A penalty of MR –1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become "follow through √" marks. MR is not applied when the candidate misreads his own figures – this is regarded as an error in accuracy. An MR –2 penalty may be applied in particular cases if agreed at the coordination meeting.

PA –1 This is deducted from A or B marks in the case of premature approximation. The PA –1 penalty is usually discussed at the meeting.

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1	$\bar{x} = 4.3$	B1		4.3 or 645/150 or 18.49 seen
	$\text{sd} = \sqrt{\left(\frac{8287.5}{150} - 4.3^2\right)} = \sqrt{36.76} = 6.063$	M1		Subst in correct formula to find sd or var or expand $\Sigma(x-\bar{x})^2$ correctly and substitute
	$\Sigma(x-\bar{x})^2 = 150 \times 6.063^2$	M1		Mult by 150
	$= 5514$ (5510)	A1	[4]	Answer rounding to 5510
2	**(i)**	B1		0, 2, 4 only seen for Y no probs needed. Accept other vals if P(value) = 0 seen in table, allow 0002244 with probs
		M1		Summing two or more 2-factor probs (can be implied)
		A1		One correct prob
		A1	[4]	Correct table or list
	(ii) 0.96 + 0.4 = 1.36	B1ft	[1]	Ft their table for Y or X $\Sigma p = 1$
3	**(i)** $\text{P}(2 < X < 12) = 1 - \text{P}(0, 1, 2, 12)$	M1		Using binomial with ${}_{12}\text{C}_{\text{something}}$ and powers summing to 12, $\Sigma p = 1$
	$= 1 - (0.35)^{12} - (0.65)(0.35)^{11}{}_{12}\text{C}_1 - (0.65)^2(0.35)^{10}{}_{12}\text{C}_2 - (0.65)^{12}$	A1		Correct unsimplified answer
	$= 1 - 0.0065359$			
	$= 0.993$	A1	[3]	Accept 0.994 from correct working only
	(ii) $1 - (0.87)^n > 0.95$	M1		Equality or inequality in (0.87 or 0.78 or 0.35), power n or $n-1$, 0.95 or 0.05
	$0.05 > (0.87)^n$	M1		Attempt to solve an equation with a power in (can be implied)
	$n = 22$	A1	[3]	Correct answer
4	**(i)** A: median = 0.186,	B1		
	IQ range = 0.198 – 0.179	M1		Subt LQ from their UQ
	$= 0.019$	A1ft	[3]	Correct IQ range ft dp in wrong place
	(ii) 	B1ft		2 correct boxes ft **(i)** OK if superimposed
		B1		2 pairs correct whiskers lines up to box not inside
		B1	[3]	Correct uniform scale from at least 0.15 to 0.21 seen. No scale no marks **(ii)** unless perfect A and B with all 10 values shown

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5	**(i)**	$_{11}C_6 = 462$	B1		
		OR A3 B3 or A4 B2 or A5 B1 or A6			
		$= {}_8C_3 + {}_8C_4 \times {}_3C_2 + {}_8C_5 \times {}_3C_1 + {}_8C_6$	B1		
		$= 56 + 210 + 168 + 28$			
		$= 462$		[1]	
	(ii)	${}_8C_4 \times {}_3C_2 + {}_8C_5 \times {}_3C_1 + {}_8C_6$	M1		$\sum$ 2 or more two-factor terms, *P* or *C* any numbers
		$= 210 + 168 + 28$	B1		Any correct option unsimplified
		$= 406$	A1	[3]	Correct answer
	(iii)	${}_9C_4 + {}_9C_6 = 126 + 84$	M1		Summing ${}_9C_x + {}_9C_y$ can be mult by 2 no other terms
			B1		126 or 84 seen or unsimplified ${}_9C_4$, ${}_9C_6$
		$= 210$	A1		Correct answer
		OR			
		1,2 in A tog with : A1B3 + A2B2 + A3B1 + A4B0 + 1,2 out of A : A3B3 + A4B2 + A5B1 + A6B0	M1		$\sum$ 5 or more 2-factor ${}_6P_x$ or ${}_6C_x$ with ${}_3C_x$ or ${}_3P_x$ only (can be mult by 2)
		$= {}_6C_1 + {}_6C_2 \times {}_3C_2 + {}_6C_3 \times {}_3C_1 + {}_6C_4 + {}_6C_3 \times {}_3C_3 + {}_6C_4 \times {}_3C_2 + {}_6C_5 \times {}_3C_1 + {}_6C_6$	B1		3 or more correct unsimplified options
		$= 6 + 45 + 60 + 15 + 20 + 45 + 18 + 1 = 210$	A1		Correct answer
		OR			
		$462 - {}_9C_5 - {}_9C_5$	M1 B1		subt two ${}_9C_x$ options from their **(i)** ${}_9C_5$ seen oe if using this method
		$= 210$	A1	[3]	Correct answer
6	**(i)**				
			B1		One correct row or column numbers
			B1	[2]	All correct including labels
	(ii)	12/30 (0.4)	B1ft	[1]	Ft their table
	(iii)	10/18 (5/9) (0.556)	B1ft	[1]	Ft their table
	(iv)	10/17 (0.588)	B1ft	[1]	Ft their table
	(v)	P(2 wrapped)			
		$= 12/30 \times 11/29 \times 18/28 \times 17/27 \times {}_4C_2$	M1 M1 M1		Mult by ${}_4C_2$ $12 \times 11 \times 18 \times 17$ seen in num $30 \times 29 \times 28 \times 27$ seen in denom
		$= 0.368$ (374/1015)	A1		Correct answer
		OR			
		$({}_{12}C_2 \times {}_{18}C_2)/{}_{30}C_4$	M1 M1 M1		${}_{12}C_2$ seen mult or alone in num (not added) ${}_{18}C_2$ seen mult or alone in num (not added) ${}_{30}C_4$ seen in denom
		$= 0.368$	A1	[4]	Correct answer

	wrapped	unwrapped	total
choc	7	10	17
not choc	5	8	13
total	12	18	30

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7	**(i)** $P(> 42) = P\left(z > \frac{42 - 41.1}{3.4}\right)$	M1		Standardising no cc no sq rt no sq
	$= P(z > 0.2647)$			
	$= 1 - 0.6045$			
	$= 0.3955$	A1		Correct prob rounding to 0.395 or 0.396
	$\text{Prob} = (0.3955)(0.6045)^2{}_3C_1$	M1		Binomial ${}_3C_x$ powers summing to 3, any p, $\Sigma p = 1$
	$= 0.433$ or 0.434	A1	[4]	Rounding to correct answer
	(ii) $-1.282 = \frac{26.5 - \mu}{\sigma}$	B1		±1.282 seen
		B1		±1.645 seen
	$1.645 = \frac{34.6 - \mu}{\sigma}$	M1		An eqn with a z-value, μ and σ, no $\sqrt{\sigma}$ no σ^2
		M1		Sensible attempt to eliminate μ or σ by substitution or subtraction
	$\mu = 30.0$ $\sigma = 2.77$	A1	[5]	Correct answers, accept 30.1, accept 30, rounding to 2.77
	(iii) $P(B6 < 34.6) = P\left(z < \frac{34.6 - 41.1}{3.4}\right)$	M1		Standardising for B6 no cc no sq rt no sq
	$= P(z < -1.912) = 1 - 0.9720$			
	$= 0.0280$	A1		Correct answer rounding to
	$P(B5 < 34.6) = 0.95$	M1		Mult by 0.95 or their regurgitated 0.95
	$P(\text{both} < 34.6) = 0.028 \times 0.95$			
	$= 0.0266$	A1	[4]	Correct answer rounding to 0.027, accept 0.027

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