UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 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.

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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	$4p + 5p^2 + 1.5p + 2.5p + 1.5p = 1$ $10p^2 + 19p - 2 = 0$	M1	Summing 5 probs to = 1 can be implied
	$p = 0.1$ or -2	A1	For 0.1 seen with or without –2
	$p = 0.1$	A1 [3]	Choosing 0.1 must be by rejecting –2
2	**(i)** $\Sigma(x - 50) = 824 - 16 \times 50 = 24$	B1	Correct answer
	$\frac{\Sigma(x-50)^2}{16} - \left(\frac{\Sigma(x-50)}{16}\right)^2 = 6.5^2$	M1	Consistent substituting in the correct coded variance formula OR valid method for Σx^2 then expanding $\Sigma(x - 50)^2$, 3 terms at least 2 correct
	$\Sigma(x - 50)^2 = 712$	A1 [3]	Correct answer
	(ii) new mean = 896/17 (= 52.7)	B1	Correct answer
	new var = $\frac{712 + 22^2}{17} - \left(\frac{24 + (72 - 50)}{17}\right)^2$	M1	Using the correct coded variance formula with $n = 17$ and new coded mean^2 OR their $(\Sigma x^2 + 72^2)/17$ – their new mean^2
	new sd = 7.94	A1 [3]	Rounding to correct answer, accept 7.95 or 7.98 or 7.91

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3	P(E and 12) = $\frac{2}{5}\times\frac{4}{36}=\frac{8}{180}$ (2/45)	M1	2/5 or 3/5 mult by dice-related probability seen anywhere
		A1	$\frac{2}{5}\times\frac{4}{36}$ seen oe
	P(12) = $\frac{3}{5}\times\frac{1}{36}+\frac{8}{180}=\frac{11}{180}$ (0.0611)	M1	Summing two 2-factor probs involving 2/5 and 3/5
		A1ft	3/5 × 1/36 + their P(E and 12), ft their P(E 12)
	$P(E\mid 12)=\frac{P(E\ and\ 12)}{P(12)}$	M1dep	Subst in condit prob formula, must have a fraction
	$=\frac{8}{11}$ (0.727)	A1 [6]	Correct answer
	OR list		
	Even: 2 and (4,3) or (3,4) or (2,6) or (6,2) 4 and ditto Gives 8 options	M1 A1	List attempt evens 8 options
	Odd: 1 and (6,6) or 3 and (6,6) or 5 and (6,6) Gives 3 options	M1 A1	List attempt odds 3 options
	Prob($E\mid 12$) = 8/11	M1 A1	(Their even)/(their total) Correct answer
4	**(i)**		
	sugar | flour 194 | 1 5 9 195 | 3 8 1 | 196 | 2 4 7 | 197 | 7 9 4 3 | 198 4 | 199 8 | 200 7 4 1 | 201	B1 B1 B1	Correct stem must be integers. (stem and leaves can be in reverse order) Correct leaves flour must be single and ordered Correct leaves sugar must be single and ordered
	key 1 | 196 | 2		
	means 1.961 kg for sugar and 1.962 kg for flour	B1ft [4]	Correct key needs all this, ft if single leaves and 1.96 etc in stem
	(ii) med = 1.989 kg	B1	correct median
	IQ range = 2.011 – 1.977	M1	subt their LQ from their UQ, UQ > med, LQ < med
	= 0.034 kg	A1 [3]	Correct answer

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5	**(i)**	Zotoc: $z = \dfrac{367 - 320}{21.6} = 2.176$ Ganmor: $z = \dfrac{367 - 350}{7.5} = 2.267$	M1	Standardising either car's fuel, no cc, no sq, no √
		P(Zotoc) = 0.985	A1	Correct answer
		P(Ganmor) = 0.988	A1 [3]	Correct answer
	(ii)	$z = 0.23$	B1	± 0.23 seen
		$0.23 = \dfrac{x - 320}{21.6}$	M1	Standardising either car, no cc, no sq rt, no sq
		$x = 324.968$	M1ind	320 + d – 320 i.e. just d on num
		$d = 4.97$	A1 [4]	Correct answer, –4.97 gets A0
6	**(i)**	constant/given prob, independent trials, fixed/given no. of trials, only two outcomes	B1 B1 [2]	One option correct Three options correct
	(ii)	P(8, 9, 0, 1) =	M1	One term seen involving $(0.3)^x(0.7)^{9-x}({}^9C_x)$
		${}^9C_8(0.3)^8(0.7) + (0.3)^9 + (0.7)^9 + {}^9C_1(0.3)(0.7)^8$	A1	Correct unsimplified expression
		= 0.196	A1 [3]	Correct answer
	(iii)	mean = 90 × 0.3 = 27 var = 18.9	B1	Expressions for 27 and 18.9 (4.347) seen
		P($X > 35$) = $1 - \Phi\left(\dfrac{35.5 - 27}{\sqrt{18.9}}\right)$	M1	Standardising one expression, must have sq rt in denom, cc not necessary
		= 1 – Φ(1.955) = 0.0253	M1	Continuity correction applied at least once
		P($X < 27$) = $\Phi\left(\dfrac{26.5 - 27}{\sqrt{18.9}}\right)$ = 1 – Φ(0.115)	M1	$(1 - \Phi_1) + (1 - \Phi_2)$ accept (0.0329 + 0.5) if no cc
		= 0.4542 Total prob = 0.480 accept 0.48	A1 [5]	Rounding to correct answer

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7	**(i)**	4M 2W or 5M 1W chosen in $^{10}C_4 \times {}^9C_2 + {}^{10}C_5 \times {}^9C_1$ = 9828	M1 A1 A1 [3]	At least 1 of $^{10}C_4 \times {}^9C_2$ *and* $^{10}C_5 \times {}^9C_1$ seen Correct unsimplified expression Correct answer
	(ii)	$^9C_3 \times {}^8C_1 + {}^9C_4 = 798$ Prob = 798/9828 = 0.0812	M1 A1 [2]	One of $^9C_3 \times {}^8C_1$ *and* $^9C_4 \times ({}^8C_0)$ seen Correct answer
	(iii)	Albert + not T... $^9C_3 \times {}^8C_2 + {}^9C_4 \times {}^8C_1$ = 3360 Tracey + not A... $^9C_4 \times {}^8C_1 + {}^9C_5$ = 1134 Number of ways = 4494	M1 A1 A1 [3]	One of $^9C_3 \times {}^8C_2$ or $^9C_4 \times {}^8C_1$ or $^9C_5 \times ({}^8C_0)$ seen Unsimplified 3360 or 1134 seen Correct final answer
	(iv)	6! – 4! × 5 × 2 or 6! – 5! × 2 (= 480) OR 4! × 5 × 4 or 4! × $^5P_2$ (= 480) prob = 480/6! = 2/3 (0.667) OR using probabilities…as above OR Women together 5!/4! (= 5) Women not together = 15 – 5 = 10 total ways MMMMWW = 6!/4!2! = 15 prob = 2/3	 B1 M1 A1 [3] B1 M1 A1	 6! – 4! × 5 × 2 or 6! – 5! × 2 or 4! × 5 × 4 or 4! × $^5P_2$ dividing by 6! correct answer 5 or 10 seen Dividing by 15 Correct answer

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