UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

9709 MATHEMATICS

9709/63 Paper 63, 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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UNIVERSITY of CAMBRIDGE
International Examinations

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.

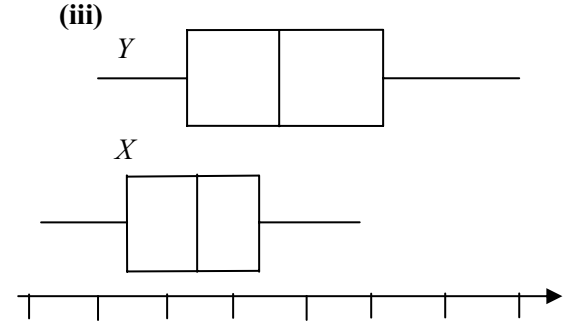
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1	$\frac{{}^{13}C_3 \times {}^{39}C_4}{{}^{52}C_7}$	M1	Using combinations with attempt to evaluate product of 2 in num and only 1 in denom
		M1	Correct numerator or denominator
	$= 0.176$	A1	Correct answer
	OR P(RRR) = $\frac{13}{52} \times \frac{12}{51} \times \frac{11}{50} \times \frac{39}{49} \times \frac{38}{48} \times \frac{37}{47} \times \frac{36}{46} \times {}^{7}C_3$	M1	**OR** Multiplying 3 unequal red probs with 4 unequal non-red probs
		M1	Multiplying a probability by ${}^{7}C_3$
	$= 0.176$	A1 [3]	Correct answer
2	**(i)** $\bar{x} = 130 - 287/82$	M1	287/82 seen added or subt to 130 OR 287 seen added or subt to 82 × 130
	$= 126.5$ (126, 127) cm	A1 [2]	Correct answer
	(ii) $\frac{\Sigma(x-130)^2}{82} - (-3.5^2) = 6.9^2$	M1	6.9^2 + (±their coded mean)^2 seen or implied
	$\Sigma(x - 130)^2 = 4908.5$ cm (4910)	A1 [2]	correct answer
3	**(i)** P(> 5) = ${}^{7}C_6(0.6)^6(0.4) + (0.6)^7$ $= 0.1306 + 0.02799$ $= 0.159$	M1	Summing 2 or 3 binomial probs of the form ${}^{7}C_r(0.6)^r(0.4)^{7-r}$
		A1 [2]	Correct answer
	(ii) P(bark) = P(park, bark) + P(not park, bark) $= 0.6 \times 0.35 + 0.4 \times 0.75$ $= 0.51$	M1	Summing two appropriate 2-factor probabilities
		A1 [2]	Correct answer
	(iii) Variance (number of times) = 7.2	B1 [1]	Correct final answer

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4	**(i)**	ends cola, 5!/2!2! = 30 ends green tea, 5!/3!2! = 10 ends orange juice, 5!/3!2! = 10 total = 50 ways	M1 A1 A1	Considering all three options Any one option correct Correct answer
		OR P(ends same) $= \frac{3}{7}\times\frac{2}{6}+\frac{2}{7}\times\frac{1}{6}+\frac{2}{7}\times\frac{1}{6}$	M1	OR Considering all three options
		$=\frac{5}{21}$	A1	Correct fraction
		$\frac{5}{21}\times\frac{7!}{3!2!2!} =$ 50 ways	A1 [3]	Correct answer
	(ii)	colas together, no restrictions, 5!/2!2! = 30 ways colas together and green tea together, 4!/2! = 12 ways 30 – 12 = 18 ways.	M1 A1 M1 A1 A1	Considering all colas together, or 5! seen Correct answer Considering all colas tog and all green tea tog, or 4! seen Correct answer Correct final answer
		OR$_1$ Attempt to list	M1A1 M1A1 A1	**OR$_1$** 10 or more, 12 or more correct 14 or more, 16 or more correct 18 correct
		OR$_2$ $3\times\frac{4\times3}{2}=18$	M1 A1 M1 A1 A1 [5]	**OR$_2$** Considering all colas together, or 3! seen 3 ways for colas and orange juice Considering green teas not together 4 × 3 or (4 × 3)/2 Correct final answer
5	**(i)**	P(2) = P(0,2) + P(2,0) = 6/10 × 3/7 + 3/10 × 4/7 = 30/70 = 3/7 AG	M1 A1 [2]	Summing two 2-factor probabilities Correct answer legit obtained
	(ii)	<table><tr><td>x</td><td>0</td><td>2</td><td>4</td><td>6</td></tr><tr><td>P($X = x$)</td><td>24/70</td><td>30/70</td><td>13/70</td><td>3/70</td></tr></table>	B1 B1 [2]	Correct values for rv X Correct probs
	(iii)	E(X) = 13/7 Var(X) = 120/70 + 208/70 + 108/70 – $(13/7)^2$ = 2.78	B1ft M1 A1 [3]	 Using variance formula correctly with mean^2 subtracted numerically, no extra division Correct final answer
	(iv)	P(A2 | Sum 2) $= \frac{3/10\times4/7}{30/70}$ = 0.4	M1 A1 [2]	Correct numerator with a 0 < denom < 1 Correct answer

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6	**(i)** for X: Median = 0.825 cm IQ range = 0.019 cm (0.833 – 0.814)	B1 B1 [2]	Correct median Correct IQ range
	(ii) $q = 4$ $r = 2$ **SR** $q = 0.824$ and $r = 0.852$	B1 B1 [2] B1	 Must be 4 and 2 not 3 and 1
	(iii)  	B1 B1ft B1ft B1 [4]	Labels X, Y and length/cm, linear scale from 0.80 to 0.87 and both on one diagram Correct median and quartiles for X ft theirs must be a box Correct median and quartiles for Y ft theirs must be a box Whiskers correct no line through middle
	(iv) Y has longer insects on average Y has larger range	B1 B1 [2]	Correct statement about lengths Correct statement about spreads
7	**(i)** $0.431 = \dfrac{135-\mu}{\sigma}$	B1	One $\pm z$-value correct, accept 0.430
		B1	A second $\pm z$-value correct
	$-0.842 = \dfrac{127-\mu}{\sigma}$	M1	Solving two equations relating μ, σ, 135, 127 and their z-values (must be z-values)
	$\sigma = 6.29$ $\mu = 132$	A1 A1 [5]	Correct answer accept 6.28 Correct answer
	(ii) $P(X < 145) = P\left(z < \dfrac{145-132.3}{6.284}\right)$	M1	Standardising no sq rt no cc
	$= P(z < 2.023)$ $= 0.978$	M1 A1 [3]	Correct use of normal tables Answer rounding to 0.978 or 0.979
	(iii) $p = 1/3$ P(at least 2) = 1 – P(0, 1)	M1	Binomial expression with powers summing to 8 and ${}^{8}C_{\text{something}}$. (any p)
	$= 1 - [(2/3)^8 + {}^8C_1 \times (1/3)^1 (2/3)^7]$	A1	Correct unsimplified expression
	$= 0.805$	A1 [3]	Answer rounding to 0.805

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