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.

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

CIE is publishing the mark schemes for the October/November 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.
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.
<table>
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<tr>
<th></th>
<th>Correct Answer</th>
<th>Mark Scheme: Teachers' version</th>
<th>Syllabus</th>
<th>Paper</th>
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</thead>
</table>
| **1** |   | 20p = 1.6  
\[ p = 0.08 \] | M1 | Equation relating \( 20p \) to the mean  
Correct \( p \) can be implied  
A1 |   |
|   |   | \[ P(X > 2) = 1 - \{(0.92)^{20} + ^{20}\text{C}_1(0.08)(0.92)^{19} + ^{20}\text{C}_2 (0.08)^2 (0.92)^{18}\} \] | M1 | Bin expression involving \( p^x(1-p)^{20-x} \) any \( p \)  
M1 |   |
|   |   | = 1 - (0.1887 + 0.3281 + 0.2711)  
= 0.212 | M1 | Subtracting 2 or 3 binomial probs from 1, one of which is \( P(0) \)  
A1 | Correct answer |
| **2** |   | \(-0.16 - p + 0.16 + 2q + 0.66 = 1.05 \)  
\[-p + 2q = 0.39 \]  
\[ p + q = 0.42 \]  
\[ q = 0.27 \]  
\[ p = 0.15 \] | M1 | Attempt at \( \Sigma px = 1.05 \) no dividing  
A1 | Correct simplified equation  
A1 | Accept \( p = 0.42 - q \) oe  
B1 | Both answers correct |
|   |   | \[ \text{Var} (X) = 4 \times 0.08 + p + 0.16 + 4q + 1.98 - (1.05)^2 \]  
= 2.59 | M1 | Subst in \( \Sigma px^2 - \text{mean}^2 \) formula, mean\(^2\) subt numerically, \( p +ve \) and < 1  
A1 | Correct answer |
| **3** |   | \( P(85 < x < 100) \)  
\[ = 0.5 - \Phi \left( \frac{85 - 100}{7} \right) \]  
\[ = 0.5 - \Phi (-2.143) \]  
\[ = 0.5 - (1 - \Phi(2.143)) \]  
\[ = 0.9839 - 0.5 \]  
\[ = 0.484 \] | B1 | \( \pm \frac{85 - 100}{7} \) seen oe or \( \pm 2.14 \)  
M1 | \( \Phi - 0.5 \)  
A1 | Correct answer rounding to |
|   |   | \[ z = \Phi^{-1} (0.67) = 0.44 \]  
\[ 0.44 = \frac{a - 100}{7} \]  
\[ 103.1 \text{ min (103) = upper limit} \]  
\[ 96.9 \text{ min = lower limit} \] | B1 | \( \pm 0.44 \) seen  
M1 | Standardising, with or without sq rt, no cc, no \( 7^2 \)  
must be \( z \)-value e.g. could be 0.412 or 0.413  
Correct upper or lower boundary allow even if obtained from \( z = 0.412 \)  
A1 | Correct other boundary |

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4 (i) 67

(ii) LQ = 64  
    Med = 73  
    UQ = 90

B1 [1]

M1  Attempt to find all 3 quartiles can be implied

B1  Correct end whiskers (not dots or boxes), not
    through box, must look accurate

B1  Correct median line in box must look accurate

B1  Correct box ends must look accurate

B1  Correct uniform scale from at least 33 to 99, and
    label ‘books’ oe can be seen in title or scale

B1  Any sensible comment about width of books or
    s.d / IQ range not mean/median.

(iii) books are fatter/ wider, or
      standard deviation /IQ range of the
      number of books per shelf is less

5 (a) (i)  1 × 5 × 4 × 3 or \(^5C_3 \times 3!\) or \(^5P_3\)
    = 60

M1 [2]  One of these oe

A1  Correct final answer

(ii)  1 × 6^3 = 216

M1 [2]  Seeing 6^3

A1  Correct answer

(b) (i) 5G 0B = \(^5C_5 \times \binom{6}{0}\) = 56
1G 4B = \(^1C_1 \times \binom{6}{4}\) = 15
3G 2B = \(^3C_2 \times \binom{6}{2}\) = 54

M1  \(\Sigma\) 2 or three 2-factor products, C or P

A1  Any correct option unsimplified

A1  A second correct option unsimplified


(ii)  \(\binom{11}{2} + \binom{11}{5}\)
    = 55 + 462
    = 517

M1  Adding two single perm or comb options

B1  One correct unsimplified option

A1  Correct answer

OR cousins in P(3B, 2G) + P(4B, 1G) + P(5B, 0G) + cousins out P(3B, 2G) + P(2B, 3G) + P(1B, 4G) + P(0B, 5G)
    = 28 + 24 + 3 + 28 + 168 + 210 + 56
    = 517
6 (i) \[
\frac{4C_2 \times 7C_1}{11C_3} = 0.255
\]

OR \[
\frac{4 \times 3 \times 7 \times 3}{11 \times 10 \times 9} = 0.255 \text{ (14/55) (42/165)}
\]

M1 Using 2 combs mult for numerator and 1 comb for denom
M1 Correct denom or num unsimplified
A1 Correct answer

(ii) \[
\]

\[
= \frac{4 \times 3 \times 7}{11 \times 10 \times 9} + \frac{4 \times 7 \times 6}{11 \times 10 \times 9} + \frac{7 \times 4 \times 6}{11 \times 10 \times 9} + \frac{7 \times 6 \times 5}{11 \times 10 \times 9}
\]

\[
= \left[\frac{14}{165} + \frac{28}{165} + \frac{28}{165} + \frac{7}{33}\right]
\]

\[
= \frac{7}{11} \text{ (0.636)}
\]

OR using a tree diagram

M1 Summing four 3-factor options with or without replacement
A1 At least 3 correct unsimplified options
A1 Correct answer. Award B3 if the correct answer is stated with no working.

(iii) \[
P(P|O) = \frac{P(P \cap O)}{P(O)}
\]

\[
= \frac{P(P, P, O) + P(P, O, O)}{P(O)}
\]

\[
= \frac{28}{70} = \frac{4}{10} = 0.4
\]


(iv) \[
\mu = 121 \times \frac{4}{11} = 44
\]

\[
\sigma^2 = 121 \times \frac{4 \times 7}{11 \times 11} = 28
\]

\[
P(X < 39) = \Phi \left(\frac{38.5 - 44}{\sqrt{28}}\right)
\]

\[
= \Phi(-1.039)
\]

\[
= 1 - 0.8506
\]

\[
= 0.149
\]

B1 44 and 28 or 5.29 seen
M1 Standardising, with or without cc, must have sq rt on denom
M1 cc either 39.5 or 38.5
M1 Correct area “1 – \Phi” seen