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.

Cambridge is publishing the mark schemes for the May/June 2011 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.
The following abbreviations may be used in a mark scheme or used on the scripts:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEF</td>
<td>Any Equivalent Form (of answer is equally acceptable)</td>
</tr>
<tr>
<td>AG</td>
<td>Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)</td>
</tr>
<tr>
<td>BOD</td>
<td>Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)</td>
</tr>
<tr>
<td>CAO</td>
<td>Correct Answer Only (emphasising that no “follow through” from a previous error is allowed)</td>
</tr>
<tr>
<td>CWO</td>
<td>Correct Working Only – often written by a ‘fortuitous’ answer</td>
</tr>
<tr>
<td>ISW</td>
<td>Ignore Subsequent Working</td>
</tr>
<tr>
<td>MR</td>
<td>Misread</td>
</tr>
<tr>
<td>PA</td>
<td>Premature Approximation (resulting in basically correct work that is insufficiently accurate)</td>
</tr>
<tr>
<td>SOS</td>
<td>See Other Solution (the candidate makes a better attempt at the same question)</td>
</tr>
<tr>
<td>SR</td>
<td>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)</td>
</tr>
</tbody>
</table>

**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.
| 1 | $E(T) = 9.6$
Var(wt of one bag) = 0.0016
Var($T$) = $3 \times 0.0016$
sd of $T = \sqrt{3 \times 0.0016} = 0.0693$ | B1
M1
M1
A1 [4] | May be impl. by Var($T$) = 0.0048 or 0.0144 |

| 2 | $\bar{X} \sim N(3, \frac{2}{60})$
$2.8 - 3 = (-1.033)$
$\sqrt{\frac{2}{60}}$
$\Phi(-1.033) = 1 - \Phi(1.033)$
$= 0.151$ | B2
M1
M1
A1 [5] | B1 for N & $\mu = 3$; (oe)
B1 for $\frac{84}{60}$ or $\frac{7}{80}$ or 0.0375 (oe)
(oe working with totals or proportions)
With or without c.c. |

| 3 (i) | Constant average rate of goals scored
Goals random
Goals indep | B1
(SR score B1 for any two not in context)
Not Goals scored singly
(because this is inherent in the context so it’s not a condition) |

| 3 (ii) | $e^{-1.8} (\frac{1.8^3}{3!} + \frac{1.8^4}{4!} + \frac{1.8^5}{5!})$
$= 0.259$ | M1
A1 [2] | Poisson probs, $\lambda = 1.8$. Allow 2, 6 included |

| 3 (iii) | $1 - e^{-1.8}$
$(1 - e^{-1.8})^{10}$
$= 0.164$ | M1
M1

| 4 (i) | $\bar{x} = 8.4$
$8.4 \pm z \frac{1.3}{\sqrt{15}}$
$z = 2.576$
$[7.54, 9.26]$ | B1
M1
B1

| 4 (ii) | No because pop normal
so $\bar{x}$ normally distr | B1
B1 [2] | SR If ‘Yes’ or no conclusion, but 2 correct statements score B1 |

| 4 (iii) | 8 within CI
Claim justified | B1 \checkmark
B1 \checkmark [2] | ft (i) |

---

**Mark Scheme: Teachers’ version**

**Syllabus**

**Paper**

GCE AS/A LEVEL – May/June 2011

9709

72
### Page 5

<table>
<thead>
<tr>
<th>Mark Scheme: Teachers’ version</th>
<th>Syllabus</th>
<th>Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCE AS/A LEVEL – May/June 2011</td>
<td>9709</td>
<td>72</td>
</tr>
</tbody>
</table>

#### 5

**Part (i)**

Po(3.3)

\[ e^{-3.3}(1 + 3.3 + \frac{3.3^2}{2}) \]

\[ = 0.359 \]

- **B1** seen or implied
- **M1** Poisson \( P(0) + P(1) + P(2) \). Allow + \( P(3) \)
- **A1** Allow wrong \( \lambda \).
- Accept equiv method.

**Part (ii)**

\( X \sim \text{Po}(36) \)

\[ \text{X} \sim \text{N}(36, 36) \]

\[ \frac{36 \sqrt{36}}{36} = 2.08(3) \]

- **B1** comp with 1.96
- **B1** Evidence to support claim
- **M1** Allow with no or wrong cc or no √
- **A1** 2.08(3) or 0.0186/0.0187 if area comparison

- **M1** Valid comparison
- **A1\sqrt{[6]}** Correct conclusion (ft their \( z \))

**Total:** 9

#### 6

**Part (i)**

\( H_0: P(6) = \frac{1}{6} \)  \( H_1: P(6) > \frac{1}{6} \)

- **B1** [1] Condone undefined \( p \)

**Part (ii)**

\[ \left( \frac{5}{6} \right)^{10} + 10 \times \left( \frac{5}{6} \right)^9 \times \frac{1}{6} + \frac{10}{2} \times \left( \frac{5}{6} \right)^8 \times \frac{1}{6}^2 + \frac{10}{1} \times \left( \frac{5}{6} \right)^7 \times \frac{1}{6}^3 \]

\[ 1 - \left( \frac{5}{6} \right)^{10} + 10 \times \left( \frac{5}{6} \right)^9 \times \frac{1}{6} + \frac{10}{2} \times \left( \frac{5}{6} \right)^8 \times \frac{1}{6}^2 + \frac{10}{3} \times \left( \frac{5}{6} \right)^7 \times \frac{1}{6}^3 \]

\[ = 0.0697 \] (3 sfs)

- **B1** [1]
- **M1** (1 – \( P(0,1,2,3) \)) o.e. using B(10,1/6)
- **A1\sqrt{[6]}** Accept 0.0698

**Part (iii)**

Die biased towards a six but result < 4 so no evidence of bias

- **B1** [1] or equiv. Must be in context

**Part (iv)**

\( P(0, 1, 2 \text{ or } 3 \text{ sixes}) \)

\[ \left( \frac{1}{2} \right)^{10} + 10 \times \left( \frac{1}{2} \right)^9 \times \frac{1}{2} + \frac{10}{2} \times \left( \frac{1}{2} \right)^8 \times \frac{1}{2}^2 + \frac{10}{3} \times \left( \frac{1}{2} \right)^7 \times \frac{1}{2}^3 \times \left( \frac{1}{2} \right) \]

\[ = 0.172 \] or 11/64

- **B1** Stated or attempted. Can be implied
- **M1** Attempt at \( P(0,1,2,3) \) with \( p = 1/2 \), allow end errors.

**Total:** 8
### Question 7

#### (i)
\[ \int_{-1}^{1} k(1-x) \, dx = 1 \]
\[ \left( k \left[ x - \frac{x^2}{2} \right]_{-1}^{1} = 1 \right) \]
\[ 2k = 1 \]
\[ k = \frac{1}{2} \quad \text{(AG)} \]

- **M1 A1 [2]** Attempt integ \( f(x) = 1 \) with correct limits

#### (ii)
\[ \int_{0.5}^{1} \frac{1}{2}(1-x) \, dx = \frac{1}{2} \left[ x - \frac{x^2}{2} \right]_{0.5}^{1} \]
\[ = \frac{1}{10} \quad \text{or} \quad 0.0625 \]

- **B1 [1]**

#### (iii)
\[ \int_{-1}^{1} \frac{1}{2}(x-x^3) \, dx \]
\[ = \frac{1}{2} \left[ \frac{x^2}{2} - \frac{x^3}{3} \right]_{-1}^{1} \]
\[ = -\frac{1}{3} \quad \text{or} \quad -0.333 \]

- **M1 A1 A1 [3]**

#### (iv)
\[ \int_{-2}^{1} (1-x) \, dx = 0.25 \]
\[ \left( \frac{1}{2} \left[ x - \frac{x^2}{2} \right]_{-2}^{1} = 0.25 \right) \]
\[ \left( \frac{1}{2} \left( a - \frac{a^2}{2} \right)_{-1}^{1} = 0.25 \right) \]
\[ a^2 - 2a - 2 = 0 \]
\[ a = 1 - \sqrt{3} \quad \text{or} \quad -0.732 \]

- **M1 A1 A1 [3]**

- **[Total: 9]**

---

© University of Cambridge International Examinations 2011