**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Level**

# MARK SCHEME for the May/June 2013 series

## 9694 THINKING SKILLS

**9694/31** Paper 3 (Problem Analysis and Solution), 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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

CAMBRIDGE
International Examinations

**1 (a) What is the price of a room for the week beginning Nov 5th? [2]**

The weekly room price is twice the difference between the single for one week and the (per person) price for a double for one week.

1 mark for \$550 – \$500 **or** \$50 (WWW) **or** algebraic representation of the two relevant relations (e.g. $a + b + x = 550$ and $(2a + 2b + x)/2 = 500$).
2 marks for $2 \times \$(550 - 500) = \underline{\$100}$

**(b) Considering only holidays which begin on one of the dates shown in the table, for which week or weeks will it not be possible to be sure of the room price? [1]**

The room price for each of the weeks in the table can be calculated using the method in (i). That leaves the second week of a two-week holiday commencing on Dec 17, i.e. the week beginning Dec 24.

**(c) What is the highest weekly room price, for the weeks for which it can be determined?[1]**

Using the same method as in (i) for each row, we can see that for the first three weeks the price is \$100, and \$110 thereafter, so \$110.

**(d) What is the cheapest date for an outbound flight, and what is the (one-way) cost per person on that day? [4]**

From the single prices, we can see that:
the flight cost for flying out on Nov 5 and returning on Nov 12 is \$550 – \$100 = \$450;
and for flying out on Nov 5 and returning on Nov 19 is \$660 – \$200 = \$460;
and for flying out on Nov 12 and returning on Nov 19 is \$570 – \$100 = \$470.
We can obtain each week's price by subtracting one of these from the sum of the other two, since $(a + b) + (a + c) – (b + c) = 2a$.

Thus, for Nov 5: \$450 + \$460 – \$470 = \$440 for two, or \$220 one-way.
The rest of the figures can be 'unzipped' by subtracting the room price and the outward flight from the numbers in the first column, giving \$230, \$240, \$300, \$300, \$240, \$240, \$250.

1 mark for any correct set of three consecutive (as above) holidays' return flight costs (e.g. \$450, \$460 and \$470). This may be implied by \$225, \$235, \$270 (1 week holidays beginning on the 5th, 12th, 19th Nov).
2 marks for (algebraic) representations of three relevant relations (e.g. $a + b = 450$, $b + c = 470$, $a + c = 460$).
3 marks for obtaining the correct flight price for any single day (WWW) or other incorrect flight prices **or** giving \$220 without clearly stating which week it linked to.
4 marks for \$220 on Nov 5th

SC: 2 marks for using a wrong price (for the 5th Nov) to (correctly) unzip at least three further prices, and concluding appropriately.

**(e) What is the total price for two people going for two weeks from December 10th? [2]**

This will be twice the single price for two weeks, less a room for two weeks:

1 mark for both \$710 and \$110, **or** \$600 (WWW), **or** combination of the six clearly-identified costs (Dec 10th flights, 2 room costs, Dec 24th flights).
2 marks for 2 × \$710 – \$220 = \$1200.

**2 (a) (i) What is the minimum cost to tile a rectangular area of 120 cm x 110 cm? [2]**

Rows cost alternately \$9 (using 3.2.2.2.3) and \$6 (2.2.2.2.2.2).
5 rows are needed, so use three of the cheaper rows.
(3 × 6) + (2 × 9) = \$36. (WWW)

1 mark for appreciation of any two of the following:
Some rows must be LSSSL
These cost \$9
Some rows must be SSSSSS
These cost \$6
There are 5 rows in total

Award 1 mark for layout + correctly calculated price for a non-optimal tiling of the area – which must cover the area required, and not have coincident edges.

**(ii) What is the minimum cost to tile a rectangular area of 130 cm x 110 cm? [1]**

Each row uses one Large (at alternate ends). Rows cost \$(5 + 3), and 5 rows needed.

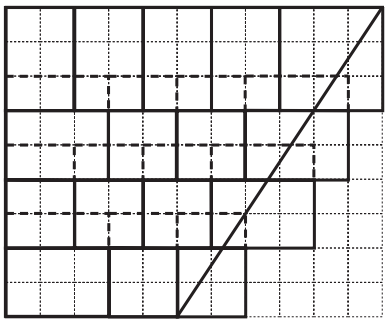
\$40 (WWW)

**(iii) What is the minimum cost to tile a rectangular area of 700 cm x 390 cm? [2]**

10 rows with 35 Standard tiles = \$350.
9 rows with 32 Standard tiles and 2 Large tiles = \$342.
Total cost \$692 (WWW).

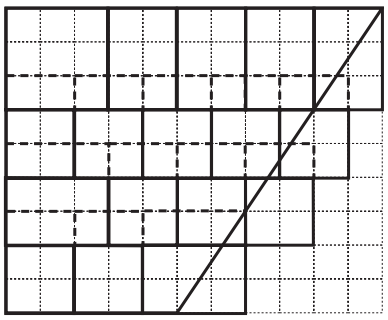
1 mark for 19 rows **or** for 32S and 2L seen or implied (e.g. by \$695).

**(b) The bottom left tile can be Large or Standard. Which of these enables the cheaper overall cost? Justify your answer, describing the arrangements and calculating the costs. [3]**



SSSSL
LSSL
SSSL
LSS

5 Large and 11 Standard = $26



LSSSS
SSSSS
LSSS
SSL

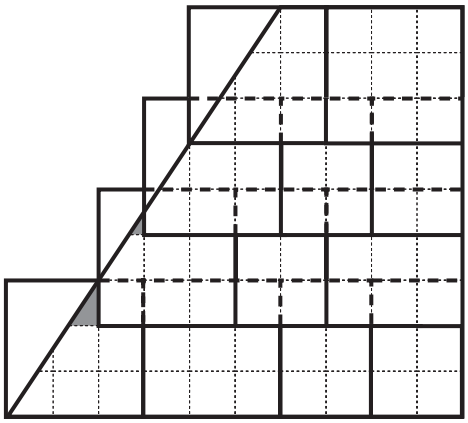
<u>3 Large and 14 Standard = $23</u>

Failing to abide by the strict inequality:
LSSSS
SSSSS
LSSS
SSSS

(2 Large and 16 Standard = $22)

1 mark for any lay-out and cost which covers the area, **or** an attempt to calculate one of the three designs but with a numerical error.
2 marks for one of the three shown above (layout + correct cost).
3 marks for the correct lay-out, cost and justification.

**(c) Identify a part of this roof that cannot be tiled, even if the rules are relaxed to allow the top of the tile to be at least 10 cm across. [2]**



2 marks for any unambiguous indication of either of the shaded triangles.
1 mark for a solution which identifies an area, correct to the nearest row, including one of the shaded triangles (but lacking precision), but less than the entire left-hand edge.

**3 (a) Show that Sheila will take 1442 seconds to get from her house to her friend's, if she travels in a straight line from one to the other. [2]**

Distance across each terrain is 412 m. Therefore she will take 412 + 824 + 206 seconds altogether = 1442 seconds.

2 marks for the three underlined terms, added up.
1 mark for 412 m (or 412.31…) seen.

**(b) How long would it take for her to walk in a straight line to the bridge, and then jog directly to her friend's house? [1]**

The times involved are 1204 seconds + 50 seconds + 50 seconds = 1304 seconds.

**(c) What would be the shortest time in which Sheila could make the journey, if she decided she wanted to swim the river, but swim the shortest distance possible? [4]**

The quickest way to do this would be to walk to the crossing point 100 m up from the bottom (141 seconds), swim directly across (200 seconds), and then jog to her friend's house (552 seconds) = 893 seconds

4 marks for the underlined answer.
3 marks for the more obvious route: straight to the river (100 seconds), swim directly across (200 seconds) and then jog to her friend's house (602 seconds) = 902 seconds.
2 marks for 900 seconds, or for 926.5 seconds.
1 mark for any other correctly calculated time (involving 100 m swims only) – see list below.

316 + 200 + 453 = 969 seconds
412 + 200 + 403 = 1015 seconds
510 + 200 + 353.5 = 1063.5 seconds
608 + 200 + 304 = 1112 seconds
707 + 200 + 255 = 1162 seconds
806 + 200 + 206 = 1212 seconds
906 + 200 + 158 = 1264 seconds
1005 + 200 + 112 = 1317 seconds
1105 + 200 + 70.5 = 1375.5 seconds

**(d) What is the shortest time in which Brett could get from his house to Sheila's? Justify your answer. [4]**

Quickest route is to enter the river 600 m from the bridge and exit the river 700 m from the bridge: 608 seconds + 282 seconds + 510 seconds = <u>1400 seconds</u>.
4 marks for underlined answer and comparison with at least one other pathway.
3 marks for underlined answer with correct working (as above), but no justification.
2 marks for any two of the pathways correctly calculated.
1 mark for any pathway's time correctly calculated.

**(e) If his fastest route to Brett's house involves swimming, what does this tell you about his jogging speed? [4]**

$300 + 200/v > 200 + 316/v$
Therefore <u>$v > 1.16$ m/s</u>

3 marks for correct phrasing of inequality.
1 mark each for seeing the expressions $300 + 200/v$, $200 + 316/v$, $282 + 224/v$, $300 + 224/v$, $448 + 141/v$, $400 + 141/v$, $382 + 141/v$ (up to a maximum of 2).
Award 3 marks for the 'suboptimal answer', found by solving the inequality in which the expression for Mitch's journey across the bridge is compared with a slower swimming journey: $300 + 200/v > 282 + 224/v$ yields the solution $v > 1.33$. This must be accompanied by appropriate working.

If candidates attempt to tackle the problem using 'trial and improvement':
1 mark for calculating times for routes which both cross the bridge and swim, for any given jogging speed.
2 marks for considering a second jogging speed.
3 marks for identifying an interval which includes the minimum of 1.16, and which lies between 1.1 and 1.5 (inclusive).

**4 (a) Piedra del Aguila in Argentina is situated at latitude 40°S, longitude 70°W. The local time here in June is UT-3 (i.e. 3 hours behind UT).**

**(i) What are the UT sunrise and sunset times in Piedra del Aguila on June 8th? [3]**

Answer: Sunrise at 11:57
Sunset at 21:21

If 3 marks cannot be awarded, award 1 mark for each of the following:

- Evidence of appreciation that there is a difference of 280 minutes (7 x 40) / 4 hours 40 minutes between sunrise and/or sunset at longitudes 70°W and 0°.
- Attempt to add 4 hours 40 minutes (or incorrectly calculated time difference) to 07:17 and/or 16:41.

Award these partial marks even if only seen in the working to **(a)(ii)**.

**(ii) What are the local times of sunrise and sunset in Piedra del Aguila on June 8th? [1]**

Answer: Sunrise at 08:57
Sunset at 18:21
(both times required)

Accept 3 hours subtracted from incorrect UT answers in **(a)(i)**.

**(b) How much later is sunrise in Jigenxiang than it is in Dandong? [1]**

Answer: 3 hours 20 minutes / 200 minutes (50 x 4)

**(c) What is the local time of sunrise on June 8th in**

**(i) Mantoloking? [2]**

Answer: 05:27

If 2 marks cannot be awarded, award 1 mark for an answer of 09:27 (UT).

**(ii) Shelter Cove? [2]**

Answer: 05:47

If 2 marks cannot be awarded, award 1 mark for 08:47 **or** 12:47 (UT) **or** for evidence of appreciation that sunrise in Shelter Cove is 3 hours 20 minutes / 200 minutes (or the answer given in **(b)**) later than in Mantoloking.

**(d) Harrison in Michigan, Rochester in Minnesota and Eugene in Oregon all have 15 hours 23 minutes of daylight on June 8th. What is the latitude of these three cities? [1]**

Answer: 44°(N)

**(e) Use the graph and the previous information you have been given to deduce the latitude and longitude of the Four Corners Monument. [5]**

Answer: Latitude 37°N — award 1 mark
Longitude 109°W — award 4 marks

If 4 marks cannot be awarded, award 1 mark each for each of the following (maximum 3 marks:

- Time of daylight at Four Corners is 14 hours 38 minutes.
- Sunrise at this latitude is 04:40 UT (allow 04:39 UT) at longitude 0° (and/or sunset is 19:18 UT).
  (Sunrise at 40°N is 27 minutes earlier than at 30°N, and sunset is 27 minutes later, so 14 hours 38 minutes of daylight means that sunrise is 18 minutes earlier than at 30°N and sunset is 18 minutes later.)
- Sunrise at Four Corners is 11:56 UT (and/or sunset is 02:34 or 26:34).
- The time difference between sunrise (and/or sunset) at Four Corners and longitude 0° is 7 hours 16 minutes / 436 minutes.