MARK SCHEME for the October/November 2014 series

9694 THINKING SKILLS

9694/33   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 October/November 2014 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

1 (a) Give an example of a numbered vertical rock sample involving the numbers 1, 2, 3 and 4 only, without repeating any number, which must have resulted from a fault followed by erosion. **[1]**

4, 1, 2, 3 OR 3, 4, 1, 2 OR 2, 3, 4, 1

(b) Give an example of such a sample, with at least one number appearing more than once. **[1]**

1, 2, 1

SC – a sample which was caused by both a fold and a fault (e.g. 1232112321)

(c) Give the order of the layers which would be found if three layers of rock (1 2 3) were subjected to a fold, followed by a fault, and then the top layer was completely eroded. Assume that the sample goes deep enough to include all relevant layers. **[2]**

2, 3, (3), 2, 1, (1), 2, 3, (3), 2, 1 : allow repeated layers (shown in brackets)

Award 1 mark if the original '1' is included.

(d) Which one of the four combinations described above could have caused it? You must also identify any layers which were omitted due to the sample being insufficiently deep. **[2]**

Fault then fold; (1 mark) bottom layer [1] omitted (1 mark).

1 mark for appreciation that it required a fault then a fold.

(e) Give two examples of samples with four layers which could not have been produced by the processes defined in this question. **[2]**

For example: 1, 4, 2, 4 and 1, 3, 1, 2 . Most easily achieved by a jump of two layers not resulting from a fault (i.e. not highest to lowest)

1 mark for each impossible sample

(f) What can be concluded about the thicknesses of the three original layers which produced the following rock sample? **[2]**

Top layer = (greater than or equal to) 8 m
Middle layer = 9 m
Bottom layer = 2 m

2 out of 3 correct OR top layer eroded by (at least) 7m : 1 mark
SC [1] : total thickness is (greater than or equal to) 19m

2 (a) (i) How did she distribute the overtime hours over the four weeks? [1]

She will do them <u>all in the same week</u>.

(ii) How much did her employer deduct at the end of the four weeks? [1]

$30 \times \$4 = \$120$ basic per week, from which only $20 can be taken.
Total deduction = $\$25 + 3 \times \$20 = \underline{\$85}$.

Allow follow through mark from (i).

(b) (i) If Hannah were now to work 5 hours overtime per four weeks, how much more would she get on pay day than if she did no overtime? [1]

Basic is $480 per month. The first $20 of overtime would be deducted, so working 5 hours at $5 per hour would only bring in <u>$5</u> more.

(ii) What would Richard receive for the four-week period if Hannah did no overtime? [1]

$4 \times \$20 = \underline{\$80}$.

(c) (i) What is the minimum number of hours of overtime that Hannah would now have to work in order to get more on pay day than if she did no overtime? [1]

$\$480 - \$410 = \$70$ is deducted from basic salary
$\$120 - \$70 = \$50$
Therefore <u>11 hours</u>.

Credit answers which clearly state that 10 hours of overtime would yield the same amount on pay day.

(ii) What does Richard now receive on average each week? [1]

$\$70/4 = \underline{\$17.50}$

(d) What percentage would be sufficient for him to receive $90 per four weeks if Hannah worked 4 hours of overtime each week? [2]

$(4 \times 30 \times \$4) + (4 \times 4 \times \$5) = \$480 + \$80 = \$560$.
$\$560 - \$410 = \$150$.

$90/150 = 0.6 = \underline{60}\%$ **oe**

1 mark for working with arithmetic error, or for concluding 90/560 = 16/17% with some appropriate working.

(e) **Who benefits from this increase, and by how much?** [2]

The increase is $4 \times 30 \times \$0.2 = \underline{\$24}$ per 4 weeks **oe**.
Allow $94 as Richard's new amount [1].
Depending on this result (or $504) seen, award 1 mark for all of this going to <u>Richard</u>.

SC – calculations with not more than one arithmetic error – allow follow through to 2nd mark.

3 (a) **Show that Samantha cannot avoid the tax collector if she travels without changing direction.** [1]

<u>Distance from the wall = 4 blocks. Distance around half the walls = 12 blocks</u>.

(b) **If Samantha decides to change direction once on the way out,**

(i) **what is the greatest distance she could be from the tax collector when she reaches the wall?** [1]

<u>3 blocks</u>

(ii) **what is the probability that Samantha will avoid the tax collector?** [2]

<u>1/12</u>: 1/6 chance she goes in the right direction initially, and 1/2 that she goes the right way (left or right) after one block.

1 mark for 1/6 seen.

(c) **List the points on the city wall where the tax collector could be if**

(i) **he is not able to meet Tabitha,** [2]

W, X, A, B, C

1 mark for **either** W and/or C missing, **or** D and/or V added.

(ii) **he is able to meet Tabitha but not Endora.** [2]

D, E, F

1 mark for explicitly comparing *their sets* of unattainable starting points – correctly BCDEF and WXABC – and selecting an inappropriate subset OR for one extra point added/omitted.

(d) If the tax collector is waiting at point A, from how many of the 37 starting points within the city wall is it impossible for a citizen to avoid him, if the citizen travels without changing direction? **[3]**

There are 5 + 5 + 3 + 1 = <u>14</u> starting points from which it is impossible to avoid the tax collector.

Award 1 mark for a clear attempt to divide the escape points up into those within 1, 2, 3 and 4 blocks from the walls, with at least one of these considered correctly. Award 2 marks if the two of these cases are considered correctly.
Alternatively, award up to 2 marks for answers which analyse points which it is possible to escape from (without changing direction) = 37 – 14 = 23 points. Award 1 mark if this is considered systematically but with one arithmetic error.

SC: if the walls are included as starting points, then there are 15 starting points (2 marks)

(e) What is the greatest distance she could be from the tax collector when she reaches the wall? Describe a possible route for her to take. **[4]**

<u>9 blocks</u>: In steps of 1 block at a time, towards M, then O, then X, then P, then W, then Q, then L, then P.

Award 3 marks for a route taking 8 blocks: In steps of 1 block at a time, towards M, then S, then N, then G, then M, then R, then N.

2 marks for 5 or 6 or 7 blocks with a matching route described.
1 mark for any route which allows her to escape the tax collector.

For any solutions which fit the descriptions above but for one erroneous step, deduct one mark from the allotted mark (and continue to deduct for further erroneous steps).

4 (a) (i) How much will Matt charge Ferreb for the 44 parcels that he will pick up today? **[2]**

Answer: <u>$275</u> (11 × $4 + 33 × $7)

If 2 marks cannot be awarded, award 1 mark for evidence of appreciation that 11 parcels will be charged at the reduced rate / $4 and/or that 33 parcels will be charged at the full rate / $7, OR (10@$4 and 34@$7 =) $206 OR (11@7 and 4@4 =) $93.

(ii) What is the maximum he could charge for picking up 44 parcels from one depot on any one day? **[2]**

Answer: <u>$296</u> (40 × $7 + 4 × $4)

If 2 marks cannot be awarded, award 1 mark for evidence of appreciation that a maximum of 40 parcels (40 × 10) can be charged at the full rate / $7.

(b) How many parcels will Matt have on board when he leaves Payli? [2]

Answer: <u>99</u> parcels

If 2 marks cannot be awarded, award 1 mark for sight of 44 (picked up) or 29 (dropped off), or the calculation $14 + 8 + 11 + 10 + 12 + 17 + 8 + 5 + 14$

(c) In what order must he visit the remaining islands, and how many parcels will he have on board when he returns to Malzay? Justify your answer. [4]

<u>Honia then Tolou</u> (then Malzay), with a demonstration that the other route would entail carrying more than 100 parcels - going to Tolou first would require him to carry 107 parcels. [2 marks].

At Honia: drop off 42, pick up 40; $99 – 42 + 40 = \underline{97}$
At Tolou: drop off 44, pick up 43; $97 – 44 + 43 = \underline{96}$

2 marks for final correct answer; 1 mark for 97 given.

Condone 59, i.e. drops off 37 Malzay parcels.

(d) What is the total distance that Matt will fly today? [2]

Answer: <u>226</u> km $(54 + 29 + 20 + 88 + 35)$ [follow through from incorrect **(c)**]
Tolou then Honia : $54 + 29 + 77 + 88 + 63 = 311$ km

If 2 marks cannot be awarded, award 1 mark for sight of at least three correctly extracted distances.

(e) How many parcels in total did Matt pick up from Payli last Tuesday?   **[3]**

Answer: <u>48</u> (12 to each of the other four depots)

For every 4 parcels (one to each destination) he would have charged $26 ($5 to Honia, $7 to Malzay, $5 to Styha and $9 to Tolou) under the old system.
For every 4 parcels (one to each destination) he now charges $28 (4 × $7) up to a total of 40, then $16 (4 × $4).

12 × $26 = 10 × $28 + 4 × $4 = $296

If 3 marks cannot be awarded, award 2 marks for evidence of appreciation that 40 parcels would have been $260 under the old system AND is $280 now,
OR an algebraic approach to the problem:
$26p = (7 \times 40) + 4(4p – 40)$ where p is the number dealt to each of the islands.

OR

Award 2 marks for **two** correct comparisons of costs for a specific number of parcels (ie correct but incomplete trial and improvement).

If 2 marks cannot be awarded, award 1 mark for **one** correct comparison of costs for a specific number of parcels (which could be simply $26 for 4 parcels under the old system and $28 now).

If no other marks can be awarded, award 1 mark for an answer of 12.