MARK SCHEME for the May/June 2015 series

9694 THINKING SKILLS

9694/32 Paper 3 (Problem Analysis and Solution), maximum raw mark 50

1 (a) What is the earliest she could offer a workshop, and where would it be? **[1]**

There is yoga at 10 and 12, and she cannot arrange an hour-long workshop at 11 if she had to be elsewhere, so first available slot is <u>1 pm at "Unity"</u>. (Both time and location required, but acceptable to point to the relevant blank slot in the table.)

(b) (i) How many workshops would have to be moved to a later date? **[1]**

Workshops can move down and/or to the right, but the 22 events cannot be moved into 22 slots as the 11am Bliss would be empty. The rest can be done, so just <u>one</u>.

(ii) Suggest a revised timetable with the fewest workshops changed as possible, and the fewest times changed. **[2]**

Time	Bliss	Stage
10 am	Meditation	Hatha Yoga
11 am		Macrobiotic Food
12 noon	**Vinyasa Yoga**	Cuddles
1 pm	Carpathian Water Buffalo	Origami
2 pm	**Body Painting**	Healing
3 pm	**Tree Hugging**	Privacy Rights In International Law
4 pm	Fire Twirling	Massage
5 pm	Mud Bath	**Sunflowers**
6 pm	Tea Ceremony	Spontaneous Choir
7 pm	Chanting	**Recycling OR Ashtanga Yoga**
8 pm	**Iyengar Yoga**	Silent Disco
Postponed	**Ashtanga Yoga or Recycling**	

1 mark for a valid reorder that isn't minimal (but only postpones one)
If no marks in (b), allow 1 mark for a reorder that fails to note no earlier time allowed, or 1 mark for noting that there are two times when all three are in use.

(c) Which two of 1 pm, 2 pm and 3 pm did he choose? Explain your answer. **[2]**

There will be people wanting to both 2 pm and 3 pm, so <u>1 pm</u> has to be one of the two (and would clearly be convenient anyway).

There are too many people (12 + 30 > 40) wanting to go to existing 2 pm sessions for them all to stay for 1pm [1 mark], so second session should be at <u>3 pm</u>, [1 mark for both times or for not 2 pm] with at least all of those planning to attend another 3 pm (21 + 11) staying for the 1 pm.

(d) Assuming that everyone who came to Bliss at 1 pm did attend one of the two sessions, what are the maximum and minimum numbers of other people that could attend the second session? **[3]**

Since between 32(33) and 39(40) people will attend 1 pm (including Michel), between 53 – 39 = 14 and 53 – 32 = 21 (plus Michel) will be at the 3 pm, so there are between 39 – 21 = 18 and 39 – 14 = 25 spaces. So 18 will find space and 25 might.

Both max and min correct: 3 marks
2 marks for only one correct OR both correct statements of 3pm attendees (15/22).
1 mark for either both limits fudged (19/20 and 26/27) or only one (fudged limit) given, OR correctly stating both min and max attendees at 1pm (33/40) OR correctly stating one of the min or max attendees at 3pm (15/22).

(e) What is a two-move re-arrangement that will still allow Alys to attend the workshops on Sunflowers, Chanting and Fire Twirling? **[1]**

Fire Twirling must move to The Stage. Either it moves Spontaneous Choir or Massage down, or requires Sunflowers or Chanting to move to Bliss at 8pm.

2 (a) What sizes were the portions after each sister had made her improvement? [2]

After first improvement: {116°, 116°, 128°} [1 mark]
After the second improvement: {116°, 122°, 122°} [1 mark FT]

(b) Give an example of what the first division might have been. [1]

Three numbers of which two numbers add to 256°, one of which is less than or equal to 104°.
e.g. {104°, 104°, 152°}.

(c) A third cake had final portions which resulted in an argument. Give an example of a first division that would have led to this situation. [2]

Award 2 marks for a valid division: original cuts must involve two 'outer' numbers which add to between 260° and 252°, or two 'outer' numbers which add to between 228° and 220°. For example, {102°, 104°, 154°} (outer numbers add to 256°) leads to {104°, 128°, 128°}, and then {116°, 116°, 128°}.

Award 1 mark for a working back from an argumentative third cut: e.g. {116°, 116°, 128°} at the end would have to come from {104°, 128°, 128°}
OR an initial cut which produces an argumentative third, but does not abide by the limit restriction (min<75, max>165) or the sum does not equal 360 (but is between 345 and 375).

(d) On a fourth cake, the first sister made a division which the others were unable to improve upon, but which resulted in an argument. Give two possibilities for the first division. [2]

Award 1 mark for each valid answer.

A valid answer must offer either a cut which immediately fits the requirements:
{114°, 123°, 123°}, {117°, 117°, 126°}
or a cut which fits the requirements after being passed on by the 2nd sister or 3rd sister, for example: {a°, 108°, b°} where a + b = 252; {c°, 107°, d°} where c + d = 253; {96°, 132°, 132°}; {95, 132, 133}.

SC: Award 1 mark if two examples are given which fit the requirements of the question, but do not abide by the limit restriction (min<75, max>165) or whose sums are not 360 (but are between 345 and 375).

(e) The first sister wants to make a division that would result in one of the final portions being as large as possible. Give an example of a first division that would achieve this. [3]

An initial cut of {98°, 98°, 164°} or {97°, 98°, 165°} will lead to a first improvement of {98°, 131°, 131°} and a second improvement of {114°, 115°, 131°}. This leaves the largest portion possible (131°).

1 mark for an attempt to work back from a largest portion between 132 and 142 (or any solution which leads to a largest portion in this interval) OR a second cut which leads to 131.

SC: 2 marks for a solution which leads to 129 or 130°

3 (a) What would be the price for Roger's company to clean a building containing 5 rooms and a total floor area of 50 square metres? **[2]**

50 square metres gives $25 and the 5 rooms add $50 to this total, giving a total of $75. The extra $20 takes the total to $95.

1 mark for $0.5 × 50 AND $10 × 5 **soi**

(b) What should he charge per square metre of floor area to match the price of Roger's company for a building containing 5 rooms and having a total floor area of 50 square metres? **[1]**

He needs to get a total charge of $95, so should charge $1.90 per square metre.

FT answer to (a) ÷ 50

(c) If a building has 6 rooms and would cost the same to clean with either company, what is the total floor area? **[3]**

The other company is charging $80 for the number of rooms and the additional $20, but is then $1 cheaper per square metre of floor area. A floor area of 80 square metres will be the point at which both prices are the same.

1 mark for each of the following:
Identification of the $80 charge for everything except floor area.
Identification that it is then $1 per square metre cheaper.

Allow an algebraic statement such as 80 + 0.5x = 1.5x as implying both of the above marks.

(d) How much should Trevor charge per square metre of floor area for the 'Express' service? **[3]**

His profit from the standard service is $0.60 per square metre, so he wants to get a total profit of $1.20 per square metre from the "Express" service. He will be paying a total of $2.70 per square metre to the cleaners, so will need to set his price at $3.90 per square metre.

If 3 marks cannot be awarded, award 1 mark for each of the following:
Calculation that the profit on the standard service is $0.60
Calculation that $2.70 will need to be paid to the cleaners

SC: award 2 marks for a solution which fails to consider the 1 cleaner hired by Trevor when operating a normal service, leading to an answer of $5.70 per square metre.

(e) (i) **What is the minimum number of rooms that could be in such a building?** **[1]**

The price has changed by $5 per room, so there must be at least <u>4</u> rooms.

(ii) **What is the floor area of a building with this minimum number of rooms?** **[2]**

<u>55</u> square metres

Trevor's price is $1.50 per square metre and the price of the other company is $0.50 per square metre, plus $20, plus $5 per room. Trevor's price is $1 per square metre more and this must be for 20 square metres to compensate for the fixed charge of the other company, 15 square metres to make the other company cheaper and 5 square metres per room.

1 mark for calculation that the additional cost in Trevor's price is due to 15 square metres of floor space OR calculation of the prices for both companies for a particular floor area.

(f) **What is the maximum number of rooms that there could be in this building? Justify your answer.** **[3]**

The smallest room would have to have a floor area of at least 11 square metres for this to make Trevor's price cheaper again.
The total floor area must be at least the number of rooms multiplied by the floor area of the smallest room.
The required inequality can be expressed algebraically:
$1.5(11n) > 20 + (0.5 \times 11n) > 1.5(11(n-1))$, where n is the number of rooms.
The second half of this inequality yields $n < 6.083$, i.e. 6 rooms.
This means that the 6 room option is too small for the smallest room to have an area of 11 square metres, so the maximum possible is <u>5 rooms</u>.

Alternatively, if we assume that floor areas do not have to be exact multiples then 6 rooms is possible and 7 rooms is not (as 7 rooms at 10 square metres would only match the other company price, not beat it).

If 3 marks cannot be awarded, award 1 mark for each of the following (max 2):
Statement that the smallest room would need an area of at least 11 square metres.
Evidence of understanding that the total area is at least the product of the number of rooms and the area of the smallest room.

4 (a) **How many correct answers altogether have been given to Geography questions?** **[2]**

<u>50</u> (17 (Wesley) + 16 (Norma) +17 (Sophie))

If 2 marks cannot be awarded, award 1 mark for identification of Wesley, Norma and Sophie and/or extraction of 17, 16 and 17.

(b) (i) **How many incorrect answers and how many passes did Norma have in Round 1?** **[1]**

<u>3 incorrect answers and 1 pass</u> (80 – 9)

(ii) **How many incorrect answers and how many passes did Sophie have in Round 1?** **[1]**

<u>0 incorrect answers and 5 passes</u> (75 – 4)

(c) **What category did Wesley Double Dare?** **[2]**

<u>People</u> (Round 4)

1 mark for Round 4
OR
1 mark for a demonstration that any one of the other rounds could not have been his DD round.

(d) (i) **What is the minimum number of points she could have scored in Round 4?** **[1]**

<u>52</u> (70 – 18)

This would be the score with 6 incorrect answers.

(ii) **What is the maximum number of points she could have scored in Round 4?** **[1]**

<u>64</u> (70 – 6)

This would be the score with 6 passes.

(e) (i) **What category must Norma select for Round 7?** **[1]**

<u>Literature; she has already answered questions on People and Science</u>.

(ii) **If she decides to Double Dare, what is the minimum number of correct answers she needs to guarantee that she will win the Cup?** [2]

<u>19</u>

If Wesley scored the maximum of 100 points, Norma would need to score at least 147 points.
18 correct answers = 140 points
19 correct answers = 170 points

If 2 marks cannot be awarded, award 1 mark for 146 stated as the key difference.

(iii) **If she decides not to Double Dare, how many correct answers from Wesley would guarantee that he will win the Cup, even if he answers all of his other questions incorrectly?** [2]

<u>15</u>

If Norma scored the maximum of 100 points, Wesley would need to score at least 55 points (or 54 if he has still given more correct answers in total than Norma).
13 correct answers could result in a maximum of 57 points.
14 correct answers could result in a maximum of 64 points.
15 correct answers results in a minimum of 60 points.

If 2 marks cannot be awarded, award 1 mark for an answer of 13 or 14 with the relevant points calculated.

(iv) **Should Norma Double Dare Round 7, or not? Explain the reasoning behind your opinion.** [2]

2 marks for a recommendation which is supported by reference to at least two relevant aspects of the data provided – one from each side of the argument.

1 mark for reference to just one relevant aspect of the data provided, or aspects which consider only one side of the decision. For example:

Nobody has answered more than 18 questions correctly in any round and/or nobody has answered fewer than 14 questions correctly in any round.

Norma has not answered more than 16 questions correctly in any round.

Wesley has scored at least 70 points in every round.

If Norma Double Dares, she needs at least 16 correct answers to score more points than she would otherwise.

Eamonn has scored at least 60 points every round.

A poor round is more likely to see her miss out on the $200 runner-up prize if she Double Dares than if she doesn't
OR Her previous rejection of Literature shows that she does not feel that she can perform well in this category.