THINKING SKILLS **9694/33**

Paper 3 Problem Analysis and Solution **October/November 2018**

MARK SCHEME

Maximum Mark: 50

Published

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 International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)	<u>12</u> days (4th, 6th, 8th, 10th, 12th, 14th, 18th, 20th, 22nd, 24th, 26th, 28th)	1
1(b)	<u>9</u> days (6th, 8th, 10th, 12th, 18th, 20th, 22nd, 26th, 28th) *Award 1 mark for 8 or 10 or 3 less than their (a)* *OR a list of six dates on which Fred takes a pill (4th, 9th, 14th, 19th, 24th, 29th)* *OR 21 days (complement of correct answer)*	2
1(c)	He should begin taking his pill on either Thursday <u>3rd June</u> or Friday <u>4th June</u>, allowing him to go out on 4 weekend days, which is the maximum possible. *Award 1 mark for either of these days* *OR for clear indication that 4 weekend days.(6th, 12th, 20th, 26th) is the limit*	2
1(d)	*Treatme*: <u>8</u> days. *Sortmeout*: <u>5</u> days So <u>*Treatme*</u> would allow more days. *1 mark for T = 8 OR S = 5.*	2
1(e)	He will not finish a box of Makemewell, as this would take him roughly 175 days and they expire after 150. He will not finish a box of Sortmeout, as this would take him roughly 480 days and they expire after 400. So these will cost $0.03 per day and $0.025 per day / 33 days per $ and 40 days per $ respectively. For Treatme to be cheaper than Sortmeout, a box must last him at least (approximately) 240 days; which it easily does. (Treatme provides 58 days per dollar / $0.0174… dollars per day, so is easily cheaper than Sortmeout.) So Treatme will be cheapest. *1 mark for correctly dealing with at least two expiry dates, e.g. 30/50/50 pills useable or 150/350/400 days* *1 mark for correctly calculating an appropriate rate of cost per day for any pill or reciprocal OR calculating the cost of an arbitrary time period 400days+* *[M] 150 days@$4.50 : 0.033$pd : 33dp$* *[T] 350 days@$6 : 0.017$pd : 58dp$* *[S] 400 days@$10 : 0.025$pd : 40dp$* *1 mark for justification based on relevant rates that T will be cheaper than S.*	3

Question	Answer	Marks
2(a)	An increase of 10 each year would result in a total of $35 + 5 \times 10 = \underline{85}$.	1
2(b)(i)	An extra 20 *Cuckoos* resulted in an extra 10 cars, so <u>50%</u>.	1

Question	Answer	Marks
2(b)(ii)	If all 35 cars in year zero are from *Cuckoos,* there are 70 *Cuckoos* before the expansion. Thus there would be $5 \times 20 - 70 = \underline{30}$.	1
2(c)	Stopping fourth year children resulted in $55 - 52 = 3$ fewer cars than with no change, so 3 fifth year *Nesters* no longer coming by car. **[1]** This means there were originally 15 *Nesters* coming by car and 20 outsiders. **[1]** Hence *Cuckoos* were 40 of the children. The remaining <u>60</u> would be *Nesters*. **[1]**	3
2(d)	Half of *Cuckoos* and quarter of *Nesters* come by car, but only those not in the last year. The expansion of *Cuckoos* hasn't reached the final year yet, so 32 + 60 *Cuckoos* not in last year. $12 + 46 = \underline{58}$ *1 mark for first step of method: number of Nesters (48) OR Cuckoos (92) not in final year* *OR* *1 mark for method to find number of cars used by those in their final year (N/4 + C/2)* *SC: 1 mark for 62 (= 12 + 50), ignoring proportion of Cuckoos in last school year* *Alternatively:* There would be 10 extra cars, but 4 final year *Cuckoos* no longer drive, so $52 + 6 = \underline{58}$	2
2(e)	There would be <u>68</u> cars in both the fourth and fifth year (since the 20 *Cuckoos* from the first year would now reach their last year.) But, if any *Cuckoos* could come by car, half of the 140, i.e. <u>70</u> would, so this is <u>not fewer</u>. *1 mark for 68 or 70 seen.*	2

Year of expansion	0	1	2	3	4	5
Nesters	60	60	60	60	60	60
Cuckoos	40	60	80	100	120	140
Cuckoos not in final year	32	52	72	92	112	112
Nesters by car	15	15	*12*	12	12	12
Cuckoos by car	20	30	40	*46*	56	56
Total cars	35	45	52	58	68	68

Question	Answer	Marks
3(a)	Trousers bought with jacket: $115 Additional pair of trousers: $40 Total price = $<u>155</u>	**1**
3(b)	The quickest way to complete the order is for one tailor to make the jacket (20 hours) and one tailor to make the trousers (20 hours in total). Therefore 20 hours are needed in total. 16 hours of work will be completed on Tuesday and Wednesday, so the items will be ready on <u>Thursday</u>.	**1**
3(c)	Four working days is a total of 32 hours, so each tailor can make either 3 pairs of trousers ($120 each, so $240) 1 pair of trousers and 1 jacket ($125 – discount $10 each, so $230) 2 waistcoats ($100 each, so $200) The maximum total price would be <u>$240</u>. *If 3 marks cannot be awarded, award 1 mark for (max 2):* *calculating the income per hour for two of the three items ($4, $4.25, $3.33) OR* *correctly calculating one of the three options above (120/240, 125/250, 100/200)* *correctly applying the discount (115/230)* *SC: 2 marks for an answer of $250 for 1 trousers and 1 jacket (forgetting the discount) OR an answer of $120 (forgetting there are two tailors)*	**3**
3(d)	The total time for the order is $5 \times 10 + 7 \times 20 + 3 \times 15 = 235$ hours. **[1]** This means that the shortest time is 120 hours. **[1]** One way to achieve this would be for Harry to do 6 jackets and Joe to do 5 trousers, 1 jacket and 3 waistcoats Alternative: Harry does 1 trouser, 4 jackets and 2 waistcoats, and Joe does 4 trouser, 3 jacket and 1 waistcoat **[1]**	**3**

Question	Answer	Marks
3(e)	The total time needed for completing the orders is 7 hours for the order that is still in progress, 10 hours, 25 hours and 45 hours for the other three orders, making a total of 87 hours for all of the work. **[1]** There is a total of $2 \times 5 \times 8$ = 80 hours available if no extra hours are worked, so 7 extra hours will be needed. **[1]** If Harry is given 40 hours from the three orders (so that he has 4 extra hours), this will leave Joe with 3 extra hours. For example, Harry could be allocated two pairs of trousers followed by the jacket, and Joe the two waistcoats and a pair of trousers. **[1]** *Alternatively, for solutions using scheduling:* *A schedule which allows for the non-urgent orders to be completed on time.* **[1]** *A schedule in which both tailors are occupied for the full 40 hours of the normal week.* **[1]** *Answer of 7 hours.* **[1]**	3
3(f)	If Harry can't work any extra hours then he needs to have work allocated that gets him as close as possible to his 40 hours. After he has completed the 4 hours to finish the waistcoat he can be allocated 35 hours of work to make a total of 39 in the week. <u>8</u> extra hours will be needed.	1
3(g)	Since there are 7 hours more work needed than are available by the end of the week, one of the orders must be completed on Monday. Delaying any one order to be finished on Monday will allow the others to be completed on time. **[1]** The order that is due on Wednesday would need a 40% reduction. The discount would be $16. The order that is due on Friday would need a 20% reduction. The discount would be $18. **[1** *for the value of either discount***]** The best option involves losing $<u>16</u>.	3

Question	Answer	Marks
4(a)	North: 80 + 99 = 179 East: 95 + 92 = 187 South: 36 + 53 = 89 West: 86 + 85 = 171 The most sales took place in <u>East</u> zone	1
4(b)	Carol had the highest sales in Mar and the second highest sales in Jan and Apr Total bonuses were 2 × $50 + $150 = $<u>250</u> *1 mark for an answer showing an incorrect judgement for ONE of Carol's monthly bonuses: e.g. 50 + 150 = $200 or 50 + 50 + 50 + 150 = $300.*	2
4(c)	Tanya works in the West zone, so the first 10 sales are worth 10 points in total. **[1]** The remaining 10 sales are worth 2 points each, so the total is <u>30</u> *SC: 1 mark for 40 or '2 each'*	2
4(d)	Neither North zone employee will receive any bonus Neither East zone employee will receive any bonus In the South zone all sales were worth 2 points, so Rachel will have a bonus of $600 and John will not get a bonus. In the West zone, both employees will receive bonuses. Bonuses will be awarded to Rachel, Oliver and Tanya **[1]** *(dependent on no others identified)* <u>Rachel had a bonus of $600</u> **[1]** <u>Oliver had a bonus of $1200</u> **[1]** <u>Tanya had a bonus of $1100</u> **[1]** *SC: 1 mark for identification that North and East zone employees do not receive bonuses; may be implied by correct points totals for A, C, F and M seen.*	4
4(e)	Martin would have received bonuses for most sales in 2 of the months and second highest in 1 of the months, which would have been $350. He would not have received any bonuses from the points. Therefore his total bonus in the old system was $350. **[1]** Under the new system, Martin would have earned 47 points in the first three months and then 52 points in the second three months, so would receive no bonus for the first three months and $200 in the second three months. **[1]** Martin's total bonus would be <u>$150 less</u>.	3

Question	Answer	Marks
4(f)	A bonus of $1000 requires a total of 60 points for the three month period. Since Oliver is in the West zone he would achieve 30 points from 10 sales every month and would only need an additional 5 sales per month (at 2 points each) to reach 60 points. Oliver's minimum target would be 15 sales per month. **[1]** Since John is in the South zone he can achieve 60 points by making 10 sales per month (at 2 points each). **[1]** Oliver would need to make <u>5</u> sales more per month than John. *SC: 2marks for 15 difference in total sales (rather than number per month)*	**3**