DECISION MATHS PRACTICE PAPER 4: MARK SCHEME

Q.1

(a)

S	T	R	R>0?	Output	
25000	0	17000	Y		Line 1
	3400				Line 2
		7000			Line 3
			Y		Line 4
	4450				Line 5
		–5000			Line 6
			n		Line 7
				4450	

Lines 1 & 2: M1A1

Lines 3-7: M1A1

Output correct: A15

(b) Tax on £25 000 is £4450 B1ft1

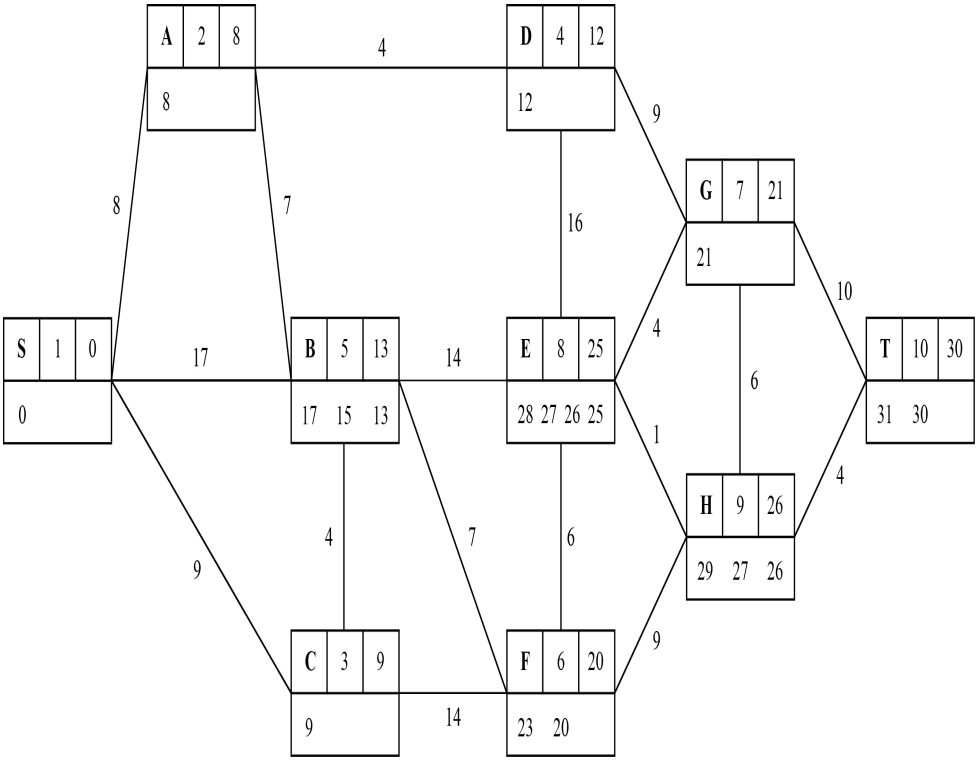
(c) Tax free sum = £8000: B11

[7]

2. You have to check a number of bins comparable to (k-1) to find the right bin to place the *k*th item.

Total number of checks = $\sum_{1}^{n}(k-1)=\frac{1}{2}n(n-1)$, which is $O(n^2)$ **(2)**

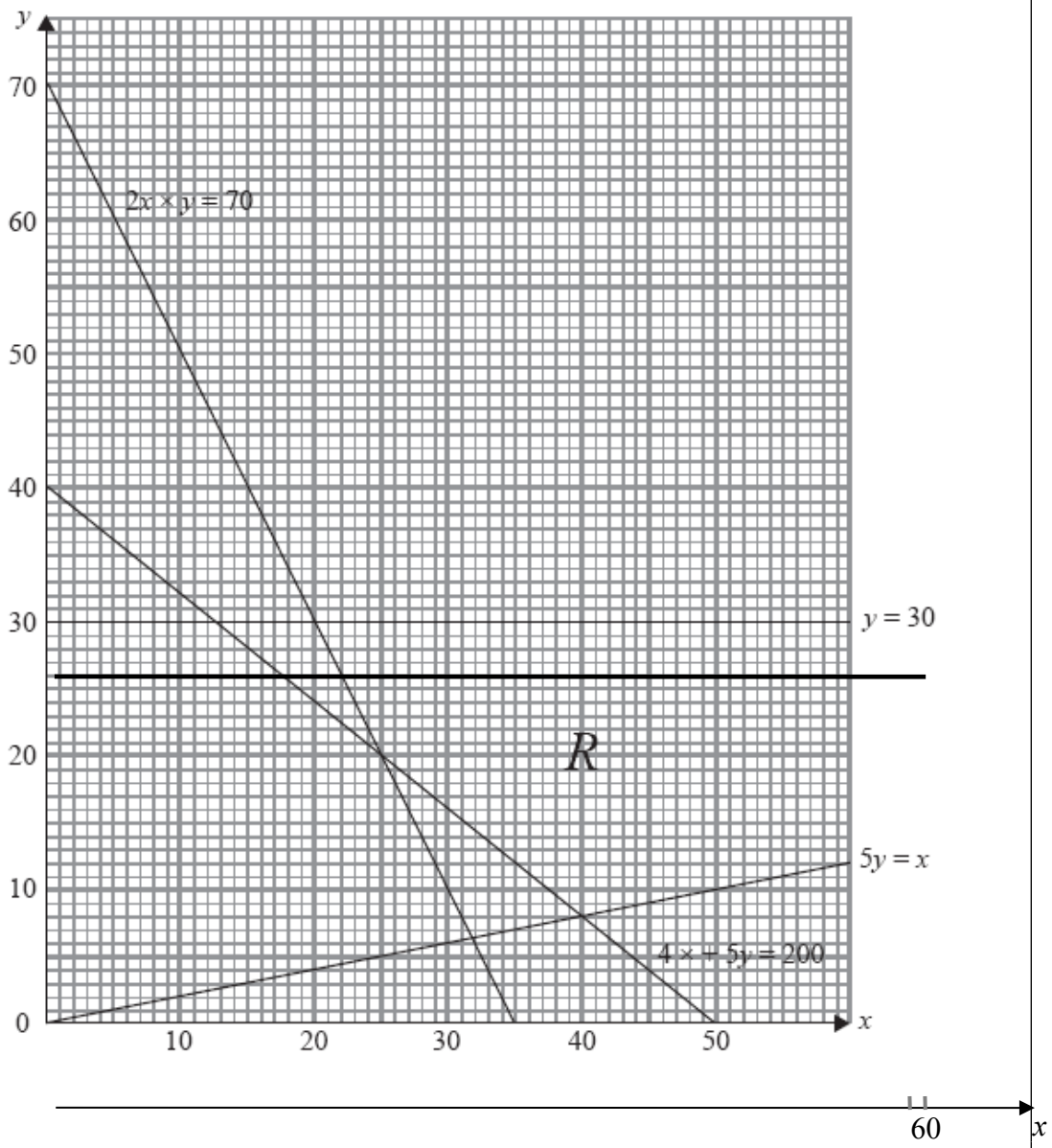
3. As the number *n* of items increases, the time for the QuickSort bit increases by a factor *n* log *n*, and the time for the FirstFit bit by a factor n^2. For big n, n^2 is much bigger than *n* log *n*, so the combined algorithm is $O(n^2)$ **(3)**

Question Number	Scheme	Marks
4.(a)		M1 A1 (A,B,C,D) A1 (E,F,G) A1ft(H and T)
	Shortest path S to T: SADGEHT Length of shortest path S to T: 30 (miles)	A1 A1ft **(6)**
(b)	Shortest path S to T via F: SCBFEHT Length is 31 (miles)	B1 B1 **(2)**
		[8]

5. If a list has *n* items, the first pass of BubbleSort will call for a maximum of (n-1) comparisons. The second pass, (n-2). The third, (n-3). The total number of comparisons is a maximum of (n-1)+(n-2)+(n-3)+… + 1 = ½n(n-1). So the algorithm is $O(n^2)$, also called quadratic order. **(2)**

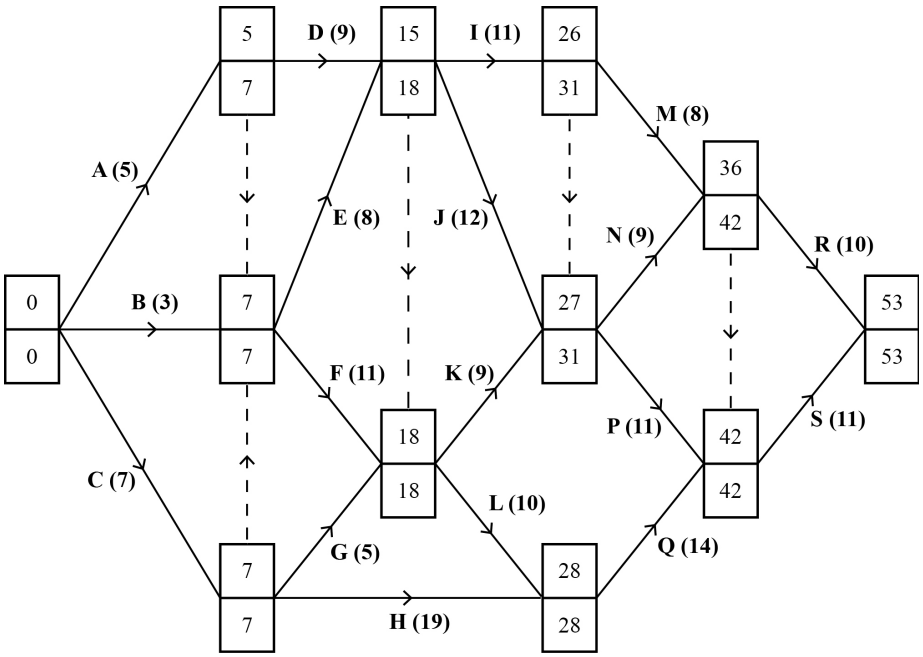
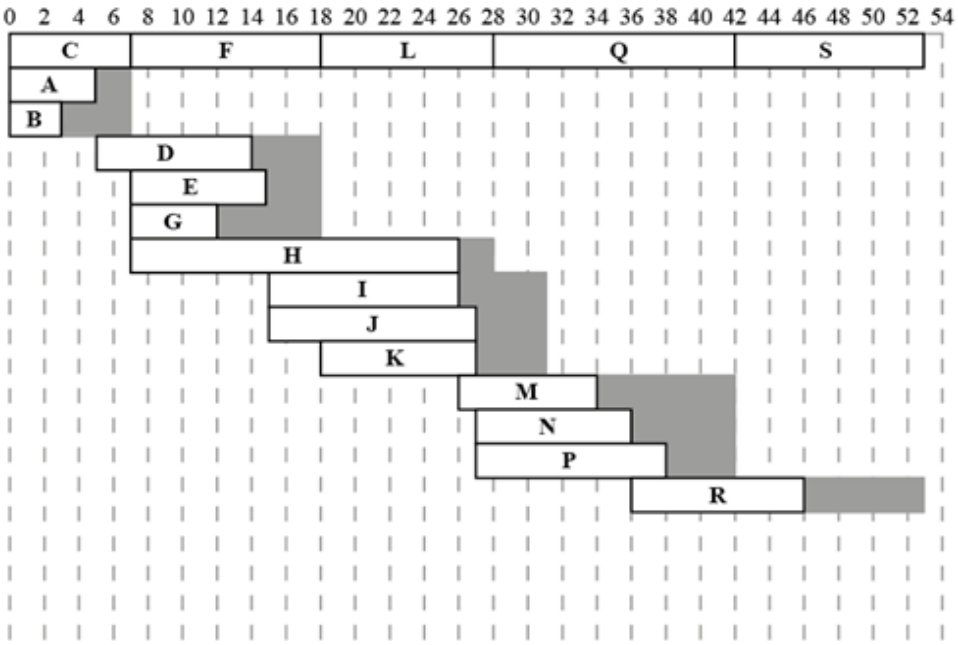
Increasing the number of items sorted from 50 to 1000 is increasing it by a factor of 200, therefore increasing the time by a factor of 200^2. The sort on the list of 1000 items will take about 720 seconds. **(2)**

This is only an estimate because the order of an algorithm gives you only an approximation of how much the time needed increases with the number of items. **(1)**

Question Number	Scheme	Marks
6.		
6(a)	$5y \quad x$	B1 B1 **(2)**
(b)	$2x + y \quad 70$ and $4x + 5y \quad 200$	B3,2,1 **(3)**
(c)	Two lines correctly added	B1 B1 **(2)**
(d)	R correctly labelled	B1 **(1)**
(e)	(T =) $10x + 4y$	B1 **(1)**
(f)		

<table>
<tr><th>Question Number</th><th>Scheme</th><th>Marks</th></tr>
<tr><td></td><td>
<table>
<tr><th>Vertex</th><th>Time (mins)</th></tr>
<tr><td>(20,30)</td><td>320</td></tr>
<tr><td>(25, 20)</td><td>330</td></tr>
<tr><td>(40, 8)</td><td>432</td></tr>
<tr><td>(60,12)</td><td>648</td></tr>
<tr><td>(60,30)</td><td>720</td></tr>
</table>
</td><td>M1
A1
A1</td></tr>
<tr><td></td><td>So produce 20 celebration arrangements, 30 party arrangements taking 320 (minutes)</td><td>A1
(4)

Total 13 marks</td></tr>
</table>

Question Number	Scheme	Marks
7.(a)		M1 A1 M1 A1 **(4)**
(b)	Float on M = 42 – 26 – 8 = 8	M1 A1 **(2)**
(c)(i)	2 day delay on P – no effect on the project completion date (float on P is 4)	B1
(c)(ii)	2 day delay on Q – project finishes 2 days late (Q is a critical activity)	B1 **(2)**
(d)		M1 A1 (any 6 more) M1 A1 (all 11) **(4)** **[12]**