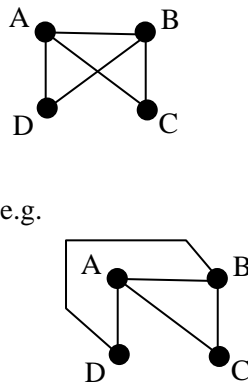
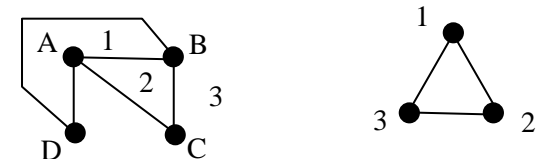
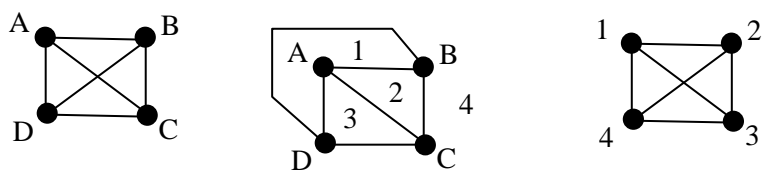


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Mark Scheme

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Question	Answer	Marks	Guidance
1 (i)	 <p>e.g.</p>	<p>M1</p> <p>A1</p> <p>B1</p> <p>[3]</p>	<p>simple and connected but not complete. (Ignore directions)</p> <p>cao</p> <p>planar - cao</p>
1 (ii)	<p>e.g.</p> 	<p>M1</p> <p>A1</p> <p>[2]</p>	<p>exactly 3 vertices</p> <p>cao</p>
1 (iii)		<p>B1</p> <p>M1</p> <p>A1</p> <p>[3]</p>	<p>complete graph on 4 letters</p> <p>4 regions</p> <p>cao (planar OK)</p>

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Question		Answer										Marks	Guidance
2	(i)											B1 B1 B1 B1 B1 [5]	i=2 row OK i=3 row OK FT i=4 and 5 rows OK cao comparisons swaps
										comps	swaps		
		i=1	9	7	3	11	5	13		5	3		
		i=2	7	3	9	5	11	13		4	3		
		i=3	3	7	5	9	11	13		3	2		
		i=4	3	5	7	9	11	13		2	1		
		i=5	3	5	7	9	11	13		1	0		
2	(ii)	comparisons 6 swaps 3										B1 B1 [2]	cao (OK if in 2 parts) cao (OK if in 2 parts)
2	(iii)	further swaps 6										B1 [1]	cao

Question	Answer	Marks	Guidance
3 (i)	<p>AB 13 ABC 26 ABCD 39 ABE 44 ABCF 35 ABCG 39 ABCDH 52 ABCGI 46</p>	<p>B1 B1 B1 B1</p> <p>B1 B1</p> <p>[6]</p>	<p>Dijkstra – C correct other working values order of labelling labels</p> <p>Note that D and G could be labelled in the reverse order.</p> <p>first 4 pairs second 4 pairs</p>
3 (ii)	<p>Turn distances to times throughout the network. Add 10 mins to every arc incident upon C. (or do Dijkstra twice, once with C deleted, and compare with the adjusted time through C)</p>	<p>E1 E1 [2]</p>	<p>Explanations needed, not answers any correct logic</p>

Question	Answer	Marks	Guidance																																												
<p>4 (i) & (ii)</p>	<p>Minimum completion time = 100 minutes Critical activities are A, C, D, I, J and L</p>	<p>M1 A1 A1 A1 A1 [5] M1 A1 M1 A1 B1 B1 [6]</p>	<p>activity on arc single start and end A, B, C OK D, F, I OK rest OK forward pass (must have at least one join correct) FT backward pass (must have at least one burst correct) FT cao cao</p>																																												
<p>4 (iii)</p>	<p>e.g. Critical activities (100 mins) + others. e.g. B has to be done whilst A is underway.</p>	<p>B1 [1]</p>	<p>Needs a comparison of times, possibly implied.</p>																																												
<p>4 (iv)</p>	<p>(If L omitted in (i) ignore omission here.) e.g.</p> <table border="1" data-bbox="331 1066 1608 1201"> <tr> <td></td> <td></td> <td></td> <td>30</td> <td></td> <td></td> <td></td> <td></td> <td>85</td> <td>95</td> <td></td> </tr> <tr> <td>Simon</td> <td></td> <td>A</td> <td></td> <td>C</td> <td>D</td> <td></td> <td>I</td> <td>J</td> <td>L</td> <td></td> </tr> <tr> <td>Friend</td> <td>B</td> <td>E</td> <td>K</td> <td>H</td> <td>F</td> <td>G</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>10</td> <td>25</td> <td>40</td> <td>50</td> <td>60</td> <td></td> <td></td> <td></td> <td></td> <td>100</td> </tr> </table>				30					85	95		Simon		A		C	D		I	J	L		Friend	B	E	K	H	F	G						10	25	40	50	60					100	<p>M1 A1 A1 A1 [4]</p>	<p>diagram like this or attempted cascade ... no more than 1 omitted activity nowhere needing more than 2 people precedences correct fully correct, inc who does what</p>
			30					85	95																																						
Simon		A		C	D		I	J	L																																						
Friend	B	E	K	H	F	G																																									
	10	25	40	50	60					100																																					

Question	Answer	Marks	Guidance
<p>5 (i)</p>	<p>e.g. Let x be the number of snowboards Let y be the number of (pairs of) skis $x + y \leq 600$ $x \leq 250$ and $y \leq 500$ $1.1x \leq y$</p>	<p>B1 B1 B1 B1 B1</p> <p>B1 B1 B1 B1</p> <p>B1</p> <p>[10]</p>	<p>or vice-versa of course</p> <p>both</p> <p>FT horizontal line FT vertical line FT positive slope line $x+y = 600$</p> <p>Note ... error tolerance of +/- half a small square within feasible region.</p> <p>shading ... follow any pentagon bounded by the y-axis, a horizontal line, a vertical line, a negatively inclined line and a positively inclined line</p>

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Question		Answer	Marks	Guidance
5	(ii)	Objective = $40x + 50y$ 29000 at (100,500) 27500 at (250,350) Solution ... 100 snowboards and 500 pairs of skis	B1 M1 A1 [3]	objective considering profits at the two indicated points of their pentagon (or using a profit line) cao www
5	(iii)	€10 or more	B1 [1]	cao (allow €1 etc)
5	(iv)	35 snowboards	M1 A1 [2]	moving to appropriate new feasible point on their negatively inclined line cao... integer! (allowing 30 to 40 for graphical inaccuracy)

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Mark Scheme

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Question		Answer	Marks	Guidance
6	(i)	e.g. 0, 1, 2 → 1 3, 4, 5, 6, 7 → 2 8 → 3 9 → 4	M1 A1 [2]	either 3 numbers for 1 or 5 numbers for 2 all proportions correct
6	(ii)	random number 5 3 2 4 7 9 1 1 8 time interval (mins) 2 2 1 2 2 4 1 1 3 arrival times 0 2 4 5 7 9 13 14 15 18	M1 A1 B1 [3]	all outcomes achieved with first 2 correct for their rule all correct FT accumulation
6	(iii)	e.g. 00 13 → 0.1 14 41 → 0.25 42 83 → 1 84 97 → 2 98, 99 ignore and “redraw”	M1 A1 A1 [3]	ignore some proportions correct efficient (fewer than 7 rejected)
6	(iv)	random number 23 15 01 32 45 47 86 71 17 83 processing time 0.25 0.25 0.1 0.25 1 1 2 1 0.25 1	M1 A1 [2]	first 4 customers correct for their rule all correct FT
6	(v)	e.g. 0 5 → 1 6 9 → 0.25	B1 [1]	
6	(vi)	random number 8 3 0 1 4 0 2 5 7 6 payment time 0.25 1 1 1 1 1 1 1 0.25 0.25	B1 [1]	FT
6	(vii)	arrival 0 2 4 5 7 9 13 14 15 18 departure 0.5 3.25 5.1 6.35 9 11 16 18 18.5 19.75	M1 A1 [2]	deals with a wait correctly all correct FT
6	(viii)	arrival 0 2 4 5 7 9 13 14 15 18 departure 0.5 3.25 5.1 6.35 9 11 16 18 15.5 19.25	M1 A1 [2]	deals with last 3 correctly all correct FT