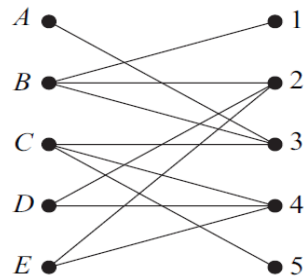


NETWORKS and Decision Mathematics

Question:

Five people, A, B, C, D and E, are to be allocated to five tasks, 1, 2, 3, 4 and 5.
The following bipartite graph shows the tasks that each person is able to undertake.



- (a) Represent this information in an adjacency matrix.
 (b) Initially, A is allocated to task 3, B to task 2 and C to task 4.
 (i) Demonstrate, by using an alternating-path algorithm from this initial matching, how each person can be allocated to a different task.
 (ii) Find a different allocation of people to tasks. Total -6 marks

Step	Method/ Hint	Answer	Marks allocation (where applicable)
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PART (a) of the question:

Step 1	Identify that an adjacency matrix looks at the likelihood of a path occurring between one task and a person completing that task <ul style="list-style-type: none"> ➤ This requires a 5x5 matrix with some 0's and 1's, where 0's represent no path and 1's represent a path occurring (or transposed) ➤ Include labelling people A to E and tasks 1 to 5 	<table border="1" style="border-collapse: collapse; margin: auto;"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <th><i>A</i></th> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <th><i>B</i></th> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <th><i>C</i></th> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <th><i>D</i></th> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <th><i>E</i></th> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> </tr> </tbody> </table>		1	2	3	4	5	<i>A</i>	0	0	1	0	0	<i>B</i>	1	1	1	0	0	<i>C</i>	0	0	1	1	1	<i>D</i>	0	1	0	1	0	<i>E</i>	0	1	0	1	0	2 marks
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<i>C</i>	0	0	1	1	1																																		
<i>D</i>	0	1	0	1	0																																		
<i>E</i>	0	1	0	1	0																																		

Step	Method/ Hint	Answer	Marks allocation (where applicable)
PART (b)(i) of the question:			
Step 1	<p>NOTE:</p> <ul style="list-style-type: none"> - Ignore paths that do not lead to a complete match. - For all paths, the order may start from 1 and/or 5. - The initial path MUST have only 4 'terms' - Correct 4 term path - Correct pair of paths (order is only important if second path has 6 terms) 	<p>Match - must be stated and not simply 'shown' on a diagram</p> <p>Option 1: $D - 2 + B - 1$ and $E - 4 + C - 5$</p> <p>$D - 2 + B - 1$ then $E - 2 + D - 4 + C - 5$</p> <p>$E - 4 + C - 5$ then $D - 4 + E - 2 + B - 1$</p> <p>Thus: $A3, B1, C5, D2, E4$</p> <p>Or,</p> <p>Option 2: $D - 4 + C - 5$ and $E - 2 + B - 1$</p> <p>$D - 4 + C - 5$ then $E - 4 + D - 2 + B - 1$</p> <p>$E - 2 + B - 1$ then $D - 2 + E - 4 + C - 5$</p> <p>Thus: $A3, B1, C5, D4, E2$</p>	<p>3 marks</p> <p>Note:</p> <ul style="list-style-type: none"> - If student works on diagrams, then the marks can be earned, BUT only one path per diagram (2 paths on 1 diagram = 0 marks). - The start vertex and path must be clear and correct = 1 mark. - The start vertex and path on a second diagram must be clear and correct = 2 marks. - Matches written = 1 mark



Step	Method/ Hint	Answer	Marks allocation (where applicable)
PART (b)(ii) of the question:			
Step 1	Identify the original task allocation and identify the ability to allocate person D or person E to different tasks ➤ Using the task allocation from previous part, find alternate allocation	Match - must be stated and not simply 'shown' on a diagram Match A3, B1, C5, D4, E2 or A3, B1, C5, D2, E4	1 mark Answer will depend on original answer given