

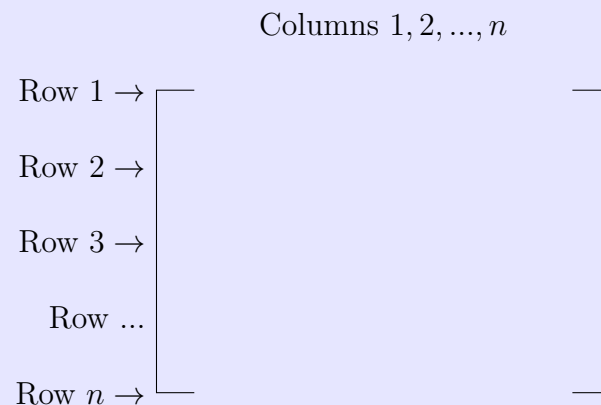
7.4 Connections to Matrices and Relations

Please write down all people in your team.

- 1.
 - 2.
 - 3.
 - 4.
-

7.4.1 Adjacency matrix

Given a graph G with vertex set $V = \{v_1, v_2, \dots, v_n\}$ and edge set E , we define the **adjacency matrix** of G as follows. The matrix M is an $n \times n$ array of natural numbers, which we imagine having rows and columns labelled as follows:



The entry in row i , column j (referred to as the (i, j) - entry of M or, more concisely, M_{ij}) is defined as

M_{ij} = the number of edges connecting v_i and v_j in G .

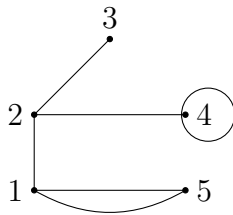
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^aDiscrete Mathematics, by Ensley and Crawley

Question 1

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Fill out the adjacency matrix for the following graph.



		Columns				
		1	2	3	4	5
Rows	1					
	2					
	3					
	4					
	5					

Question 2

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Draw a graph that corresponds to the adjacency matrix

		Columns				
		1	2	3	4	5
Rows	1	0	1	0	1	1
	2	0	0	0	0	0
	3	0	0	1	1	0
	4	0	1	0	0	0
	5	0	0	0	1	0

7.4.2 Directed graphs

1. A **directed graph**, like a graph, consists of a set V of vertices and a set E of edges. Each edge is associated with an ordered pair of vertices called its **endpoints**. In other words, a directed graph is the same as a graph, but the edges are described as *ordered pairs* rather than unordered pairs;
2. If the endpoints for edge e are a and b in that order, we say e is an edge **from a to b** , and in the diagram we draw the edge as a straight or curved arrow from a to b .
3. For a directed graph, we use (a, b) rather than $[a, b]$ to indicate an edge from a to b . This emphasizes that the edge is an **ordered pair**, by utilizing the usual notation for ordered pairs.
4. A **walk** in a directed graph is a sequence $v_1 e_1 v_2 e_2 \dots v_n e_n v_{n+1}$ of alternating vertices and edges that begins and ends with a vertex, and where each edge in the list between its endpoints in the proper order. (That is, e_1 is an edge from v_1 to v_2 , e_2 is an edge from v_2 to v_3 , and so on.) If there is no chance of confusion, we omit the edges when we describe a walk.
5. The **adjacency matrix** for a directed graph with vertices $\{v_1, v_2, \dots, v_n\}$ is the $n \times n$ matrix where M_{ij} (the entry in row i , column j) is the number of edges from vertex v_i to vertex v_j .

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^aDiscrete Mathematics, Ensley and Crawley

Question 3

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Draw a directed graph with vertices $V = \{1, 2, 3, 4, 5\}$ and edges $E = \{(1, 4), (1, 5), (2, 1), (3, 4), (4, 3), (5, 2)\}$.