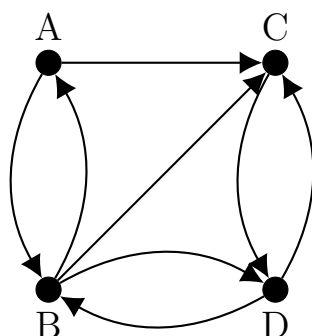


# Converting a graph to a matrix

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Say we have a graph of ‘votes’ as below. Each node is a candidate, and an arrow represents a vote from one candidate to another.



First, make a table showing assigning votes between candidates by noting who the votes went ‘from’ and ‘to’. If a candidate voted for multiple others, divide their 1 available vote by the number of others they voted for.

Here, we see:

- A splits their vote in half, between B and C;
- B splits their vote three ways, voting for all the other candidates;
- C votes only for D;
- D splits their vote in half, between B and C.

You can see these voting relationships if you look down the columns of the following matrix. For example, looking at A’s column, you see entries of  $\frac{1}{2}$  against B and C corresponding to their split vote for B and C.

		From			
		A	B	C	D
To	A	0	$\frac{1}{3}$	0	0
	B	$\frac{1}{2}$	0	0	$\frac{1}{2}$
	C	$\frac{1}{2}$	$\frac{1}{3}$	0	$\frac{1}{2}$
	D	0	$\frac{1}{3}$	1	0

Now make a matrix using these values as the entries.

$$M = \begin{bmatrix} 0 & \frac{1}{3} & 0 & 0 \\ \frac{1}{2} & 0 & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{3} & 0 & \frac{1}{2} \\ 0 & \frac{1}{3} & 1 & 0 \end{bmatrix}$$

Or, in Python,

```
M = Matrix([[0,1/3,0,0],[1/2,0,0,1/2],[1/2,1/3,0,1/2],[0,1/3,1,0]])
```