CS 584: Spatial Computing Assignment 7: Spatial Networks

Mitchell Scott

Emory University

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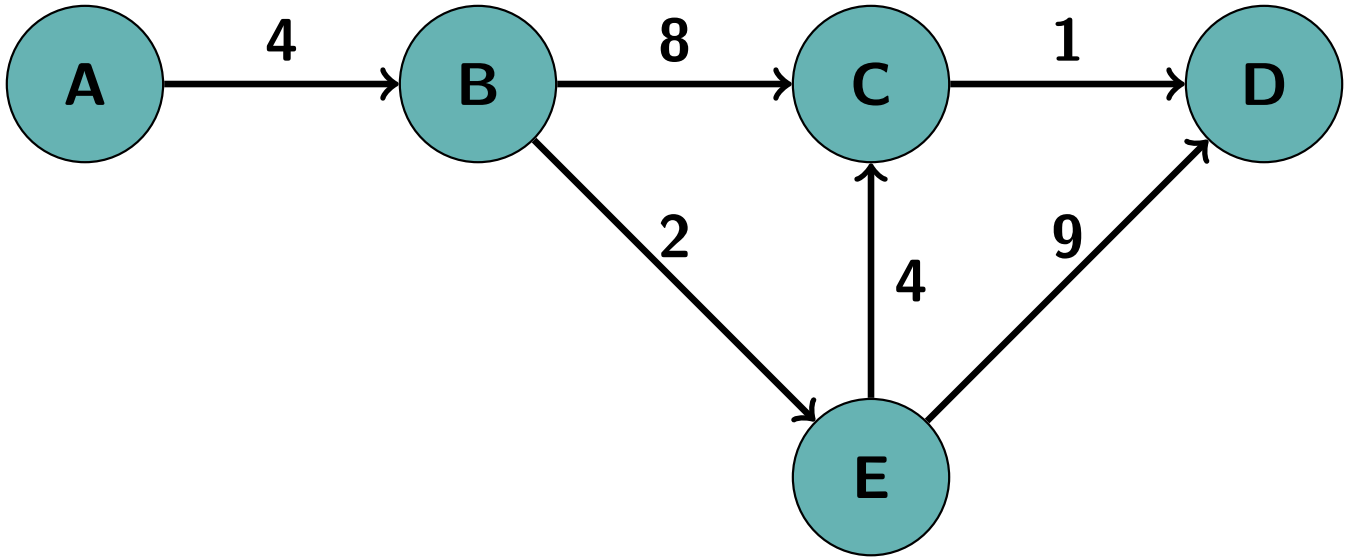
Assignment 7-1 I



1. **Is this network directed or undirected? Explain your answers!**

Solution

This network is **directed** *since it is possible to get from* **A** *to* **B**, *but impossible to get from* **B** *to* **A**. *The arrow with one direction indicates that the edge is uni-directional, so a directed graph.*

Assignment 7-1 II

2. **Which nodes are adjacent to Node B?**

Solution

Since we are in a directed graph, the definition for **adjacent** *is two vertices* v_1, v_2 *are adjacent if* $(v_1, v_2) \in E^1$ *OR* $(v_2, v_1) \in E$. *This means* **A** *is adjacent to* **B** *since (*$\mathbf{A}$,$\mathbf{B}$*)*$\in E$. *Similarly, the vertices that* **B** *points to are adjacent, which are* **C**, **D** *since (*$\mathbf{B}$,$\mathbf{C}$*)*$\in E$, *(*$\mathbf{B}$,$\mathbf{E}$*)*$\in E$.
Thus the set of all nodes adjacent to **B** *are* $\{\mathbf{A}, \mathbf{C}, \mathbf{E}\}$.

3. **What is the degree of Node C?**

Solution

Since the definition of **degree** *is the " number of outgoing edges, then* deg $\mathbf{C} = 1$, *as it has two incoming edges but only one outgoing edge.*

Assignment 7-1 III

4. **In class we talked about representing a network as a labelled adjacency matrix (or cost matrix). Provide the labelled adjacency matrix (cost matrix) for the network above.**

Solution

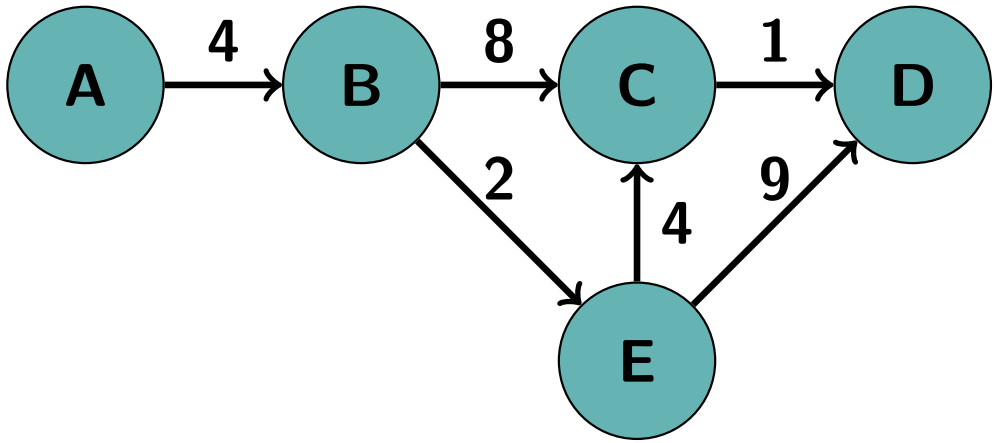
	A	**B**	**C**	**D**	**E**
A	*0*	*4*	∞	∞	∞
B	∞	*0*	*8*	∞	*2*
C	∞	∞	*0*	*1*	∞
D	∞	∞	∞	*0*	∞
E	∞	∞	*4*	*9*	*0*

Table: *Cost Matrix where staying at the same node is 0 cost, and non existing edges are denoted by '∞'.*

[1] where E is the edge set and **E** is the node.

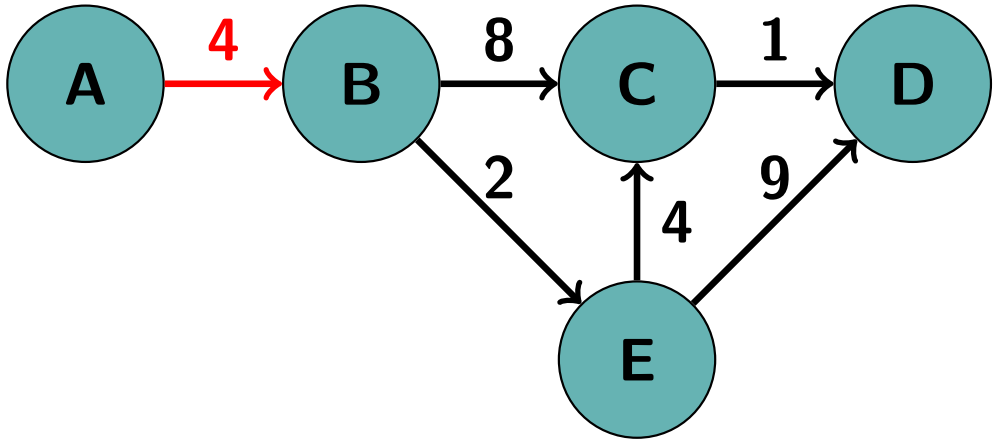
Assignment 7-2 I

- at Step 0, we haven't seen anything yet.



Node	Dist.
A:	∞
B:	∞
C:	∞
D:	∞
E:	∞

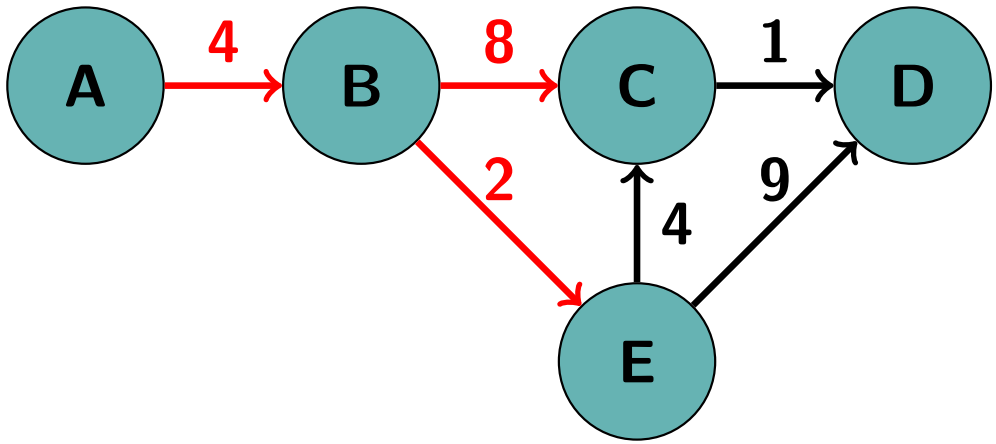
- at Step 1, we mark **A** as green with a distance of 0, and go to **B** with distance 4.



Node	Dist.
A:	0
B:	4
C:	∞
D:	∞
E:	∞

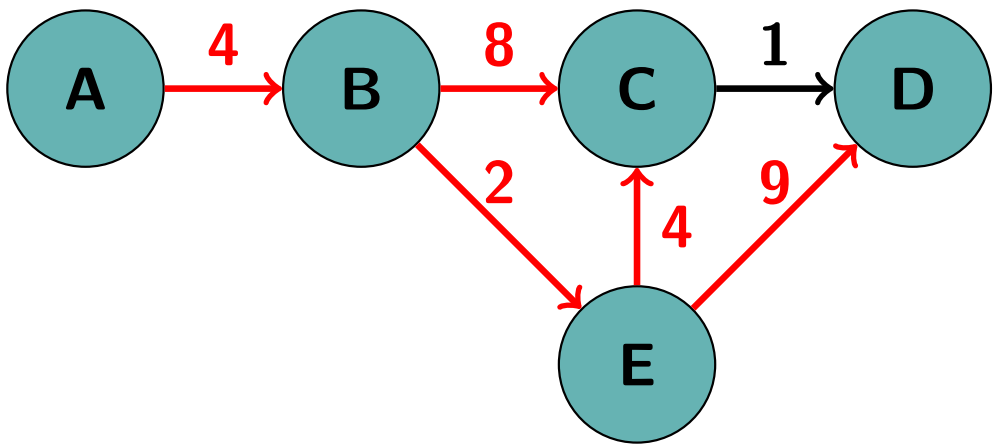
Assignment 7-2 II

- at Step 2, we mark **B** as green with a distance of 4, and go to **E** with distance 6.



Node	Dist.
A:	0
B:	4
C:	12
D:	∞
E:	6

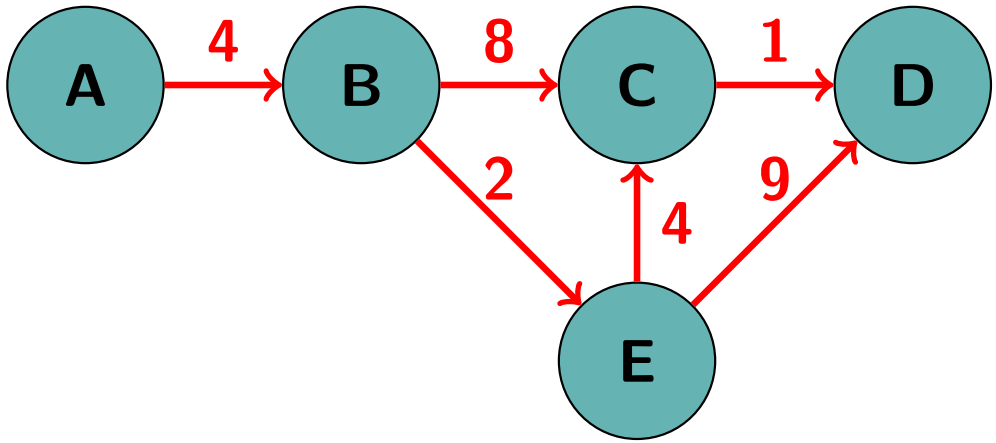
- at Step 3, we mark **E** as green with a distance of 6, and go to **C** with (*updated) distance 10.



Node	Dist.
A:	0
B:	4
C:	10*
D:	15
E:	6

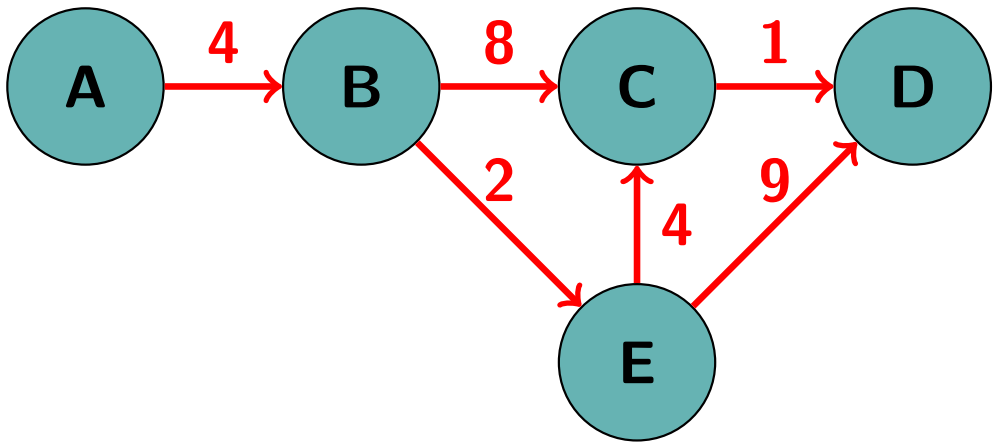
Assignment 7-2 III

- at Step 4, we mark **C** as green with a distance of 10, and go to **D** with (*updated) distance 11.



Node	Dist.
A:	0
B:	4
C:	10
D:	11*
E:	6

- at Step 5, we mark **D** as green with a distance of 11. With no more yellow nodes, we terminate.



Node	Dist.
A:	0
B:	4
C:	10
D:	11
E:	6