HW 2

1. You and your friends are going on a road trip from Pullman to Atlanta, Georgia. Below is map indicating major cities along the way and the distances between them. Use Dijkstra's Algorithm to find a shortest path from Pullman to Atlanta.

(a) Show each step of the algorithm.
(b) At each step of the algorithm, include the set of Visited Nodes and the set of Unvisited Nodes.
(c) At each step of the algorithm, include a table that contains (1) the current distance from Pullman to each node and (2) the previous node visited for each node.

Step 1

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	∞	
Denver	∞	
Albuquerque	∞	
Sioux Falls	∞	
Kansas City	∞	
Dallas	∞	
Minneapolis	∞	
Nashville	∞	
Atlanta	∞	

Visited Nodes

$V = \{\}$

Unvisited Nodes

$U = \{\text{Pullman}, \text{Boise}, \text{Denver}, \text{Sioux Falls}, \text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Step 2

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1150	Pullman
Albuquerque	∞	
Sioux Falls	1250	Pullman
Kansas City	∞	
Dallas	∞	
Minneapolis	1420	Pullman
Nashville	∞	
Atlanta	∞	

Visited Nodes

$V = \{\text{Pullman}\}$

Unvisited Nodes

$U = \{\text{Boise}, \text{Denver}, \text{Sioux Falls}, \text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Step 3

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	∞	
Dallas	∞	
Minneapolis	1420	Pullman
Nashville	∞	
Atlanta	∞	

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}\}$

Unvisited Nodes

$U = \{\text{Denver}, \text{Sioux Falls}, \text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Step 4

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	1720	Denver
Dallas	∞	
Minneapolis	1420	Pullman
Nashville	∞	
Atlanta	∞	

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}, \text{Denver}\}$

Unvisited Nodes

$U = \{\text{Sioux Falls}, \text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Step 5

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	1610	Sioux Falls
Dallas	∞	

Node	Shortest Distance	Previous Node
Minneapolis	1420	Pullman
Nashville	∞	
Atlanta	∞	

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}, \text{Denver}, \text{Sioux Falls}\}$

Unvisited Nodes

$U = \{\text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Step 6

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	1610	Sioux Falls
Dallas	1900	Albuquerque
Minneapolis	1420	Pullman
Nashville	∞	
Atlanta	∞	

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}, \text{Denver}, \text{Sioux Falls}, \text{Albuquerque}\}$

Unvisited Nodes

$U = \{\text{Minneapolis}, \text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Step 7

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman

Node	Shortest Distance	Previous Node
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	1610	Sioux Falls
Dallas	1900	Albuquerque
Minneapolis	1420	Pullman
Nashville	2300	Minneapolis
Atlanta	∞	

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}, \text{Denver}, \text{Sioux Falls}, \text{Albuquerque}, \text{Minneapolis}\}$

Unvisited Nodes

$U = \{\text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Step 8

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	1610	Sioux Falls
Dallas	1900	Albuquerque
Minneapolis	1420	Pullman
Nashville	2160	Kansas City
Atlanta	∞	

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}, \text{Denver}, \text{Sioux Falls}, \text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}\}$

Unvisited Nodes

$U = \{\text{Nashville}, \text{Dallas}\}$

Step 9

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	1610	Sioux Falls
Dallas	1900	Albuquerque
Minneapolis	1420	Pullman
Nashville	2160	Kansas City
Atlanta	2680	Dallas

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}, \text{Denver}, \text{Sioux Falls}, \text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}, \text{Dallas}\}$

Unvisited Nodes

$U = \{\text{Nashville}\}$

Step 10

Node	Shortest Distance	Previous Node
Pullman	0	
Boise	300	Pullman
Denver	1120	Boise
Albuquerque	1250	Boise
Sioux Falls	1250	Pullman
Kansas City	1610	Sioux Falls
Dallas	1900	Albuquerque
Minneapolis	1420	Pullman
Nashville	2160	Kansas City
Atlanta	2410	Nashville

Visited Nodes

$V = \{\text{Pullman}, \text{Boise}, \text{Denver}, \text{Sioux Falls}, \text{Minneapolis}, \text{Albuquerque}, \text{Kansas City}, \text{Nashville}, \text{Dallas}\}$

Unvisited Nodes

$U = \{\}$

(d) After completing the algorithm, describe the route of the shortest path from Pullman to Atlanta

Go from Pullman to Sioux Falls to Kansas City to Nashville to Atlanta, for a total of 2410