

Creating a Road Network Graph

Course 4, Module 3, Lesson 1

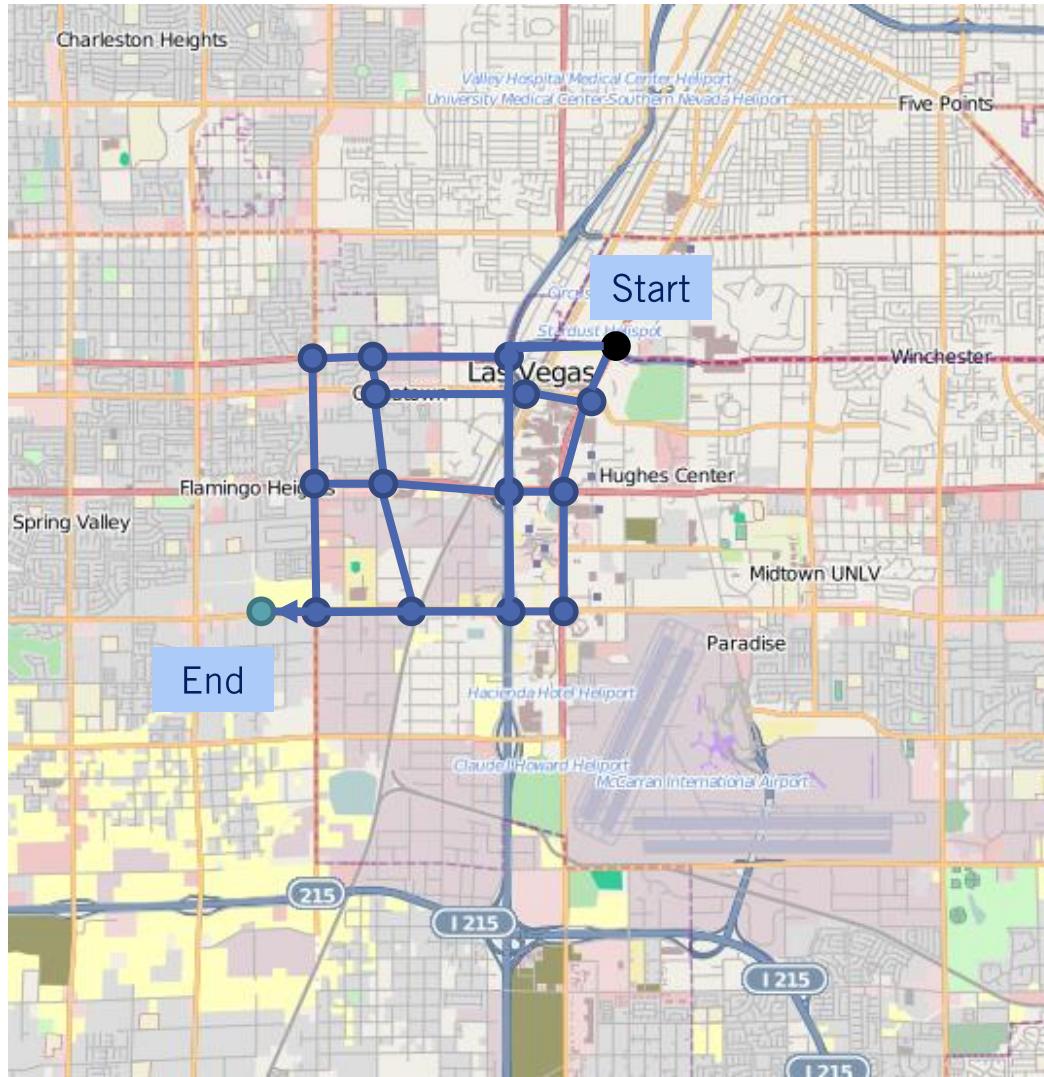


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Learning Objectives

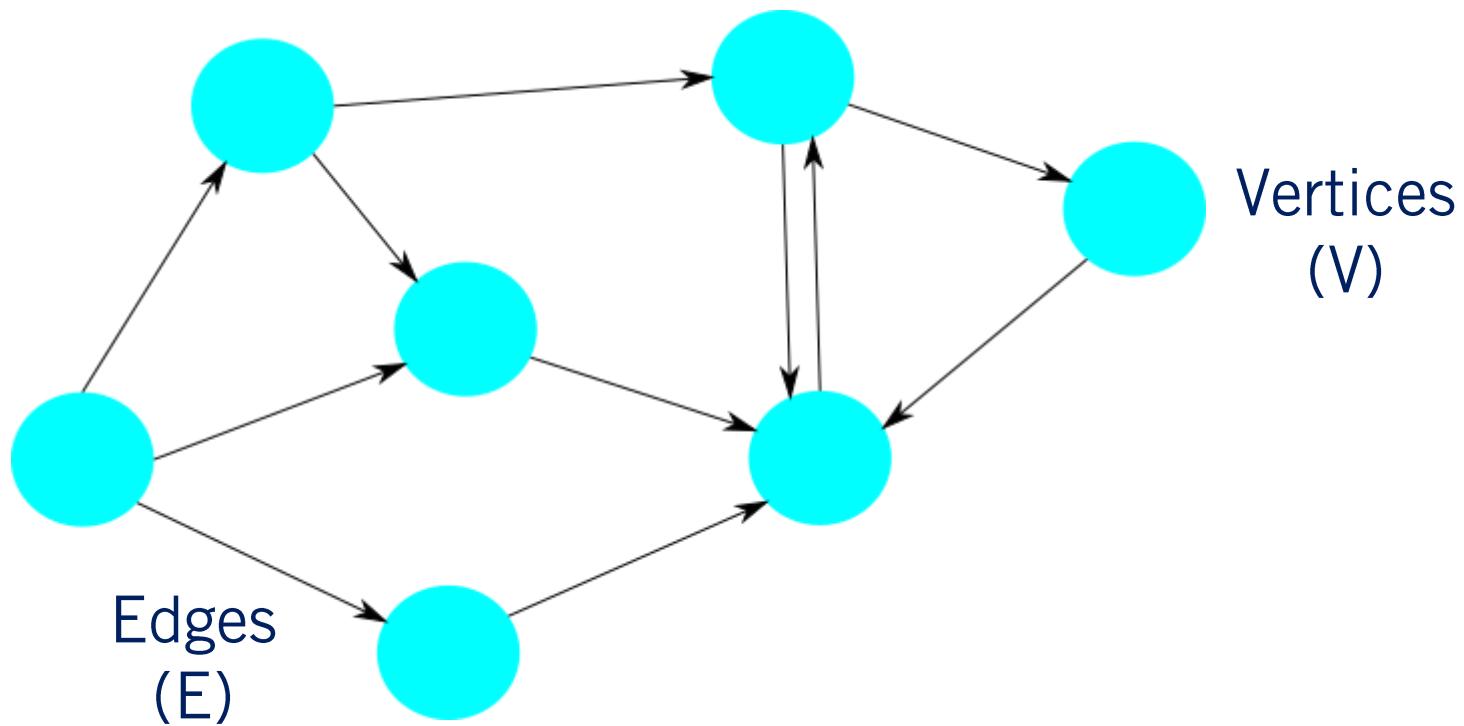
- Understand the mathematical concept of a graph
- Use a directed graph to represent a road network
- Implement Breadth-First Search

Mission Planning



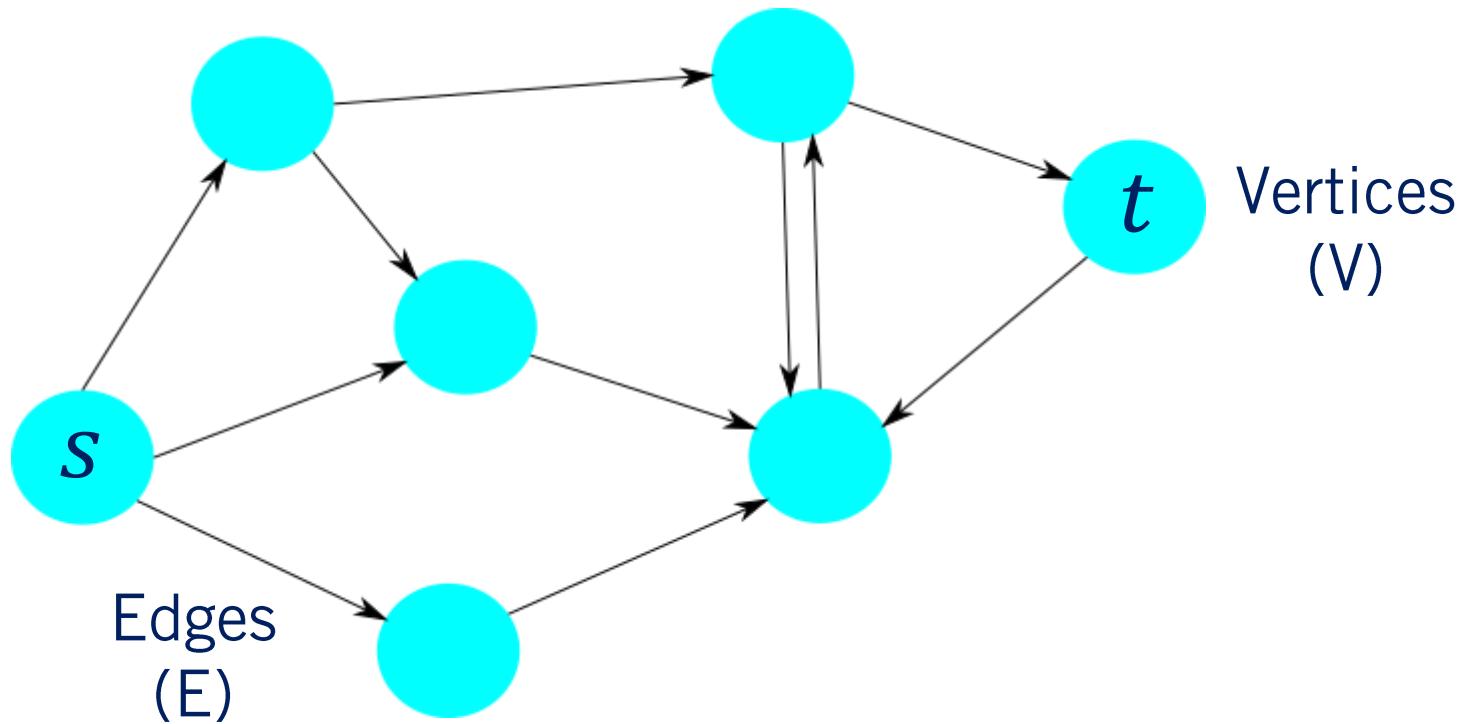
Graphs

Graph: $G = (V, E)$



Graphs

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Breadth First Search (BFS)

Algorithm BFS(G,s,t) 

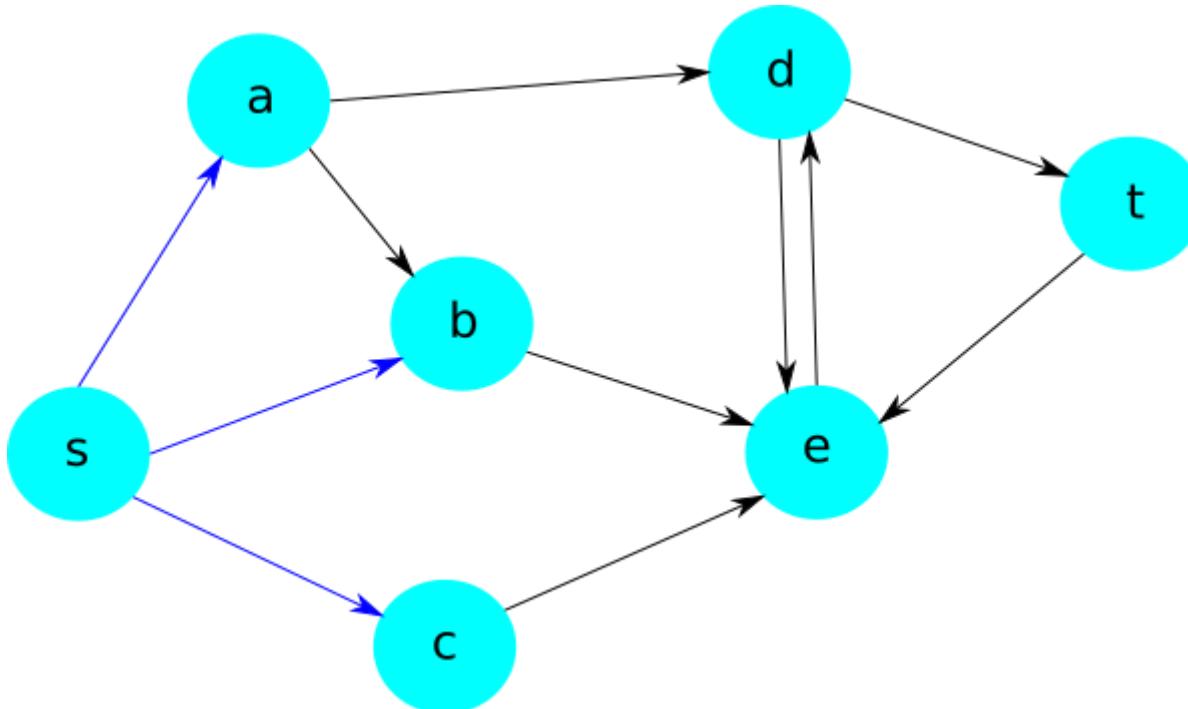
```
1. open ← Queue()
2. closed ← Set()
3. predecessors ← Dict()
4. open.enqueue(s)
5. while ! open.isEmpty() do
6.   u ← open.dequeue()
7.   if isGoal(u) then
8.     return extractPath(u, predecessors)
9.   for all v ∈ u.successors()
10.    if v ∈ closed or v ∈ open then
11.      continue
12.    open.enqueue(v)
13.    predecessors[v] ← u
14.    closed.add(u)
```

Example - First Wavefront

Open Queue:

a
b
c

Closed Set: s

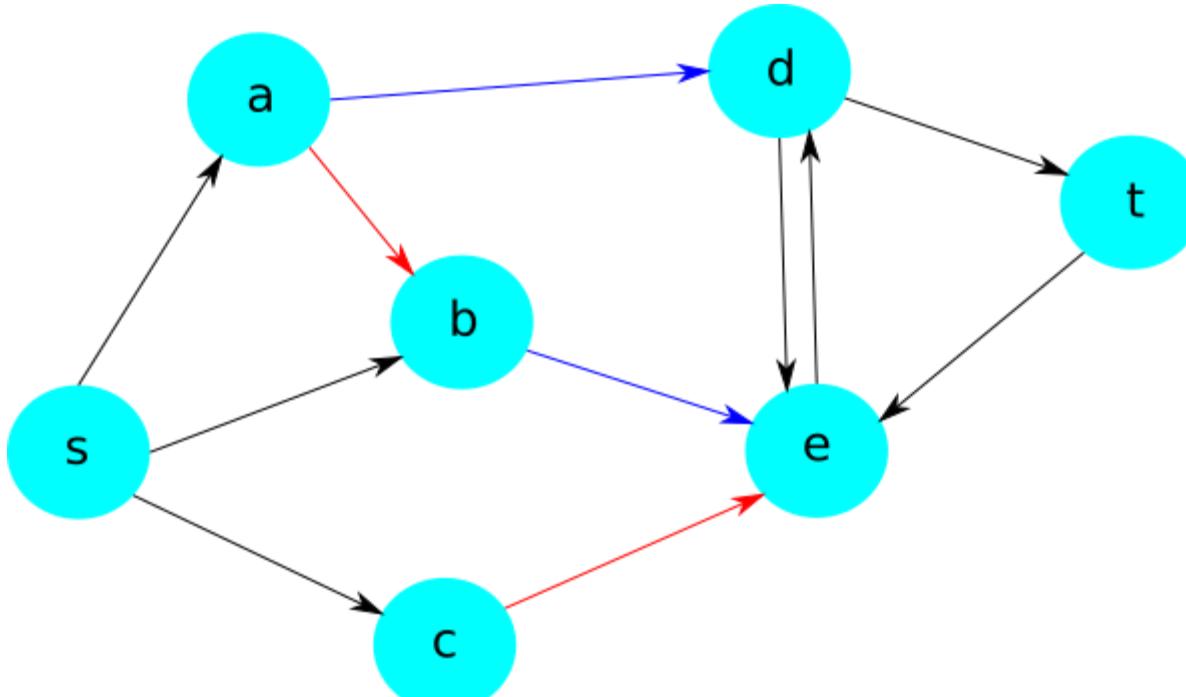


Example - Second Wavefront

Open Queue:

d
e

Closed Set: s
a
b
c



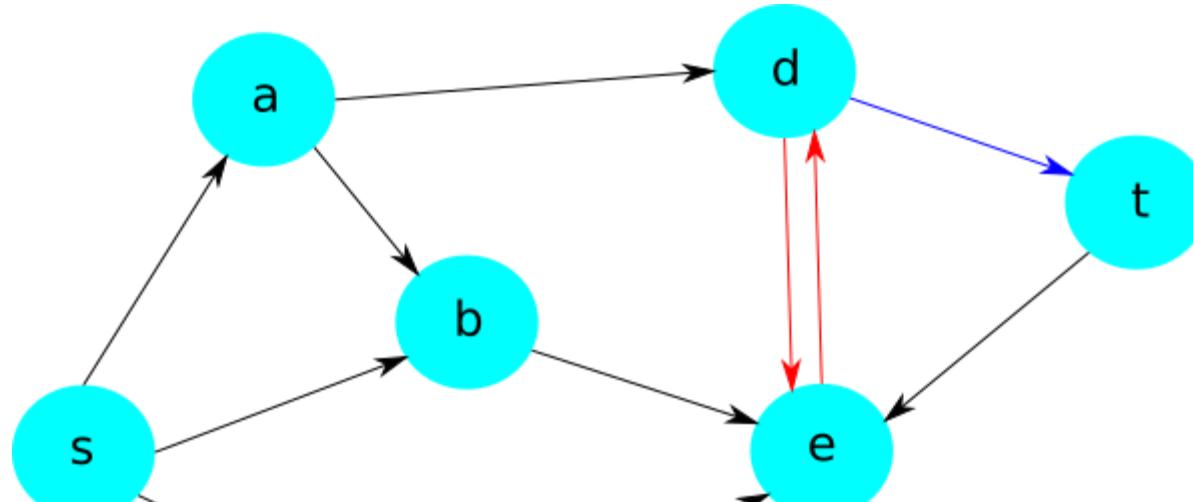
Example - Third Wavefront

Open Queue:

t

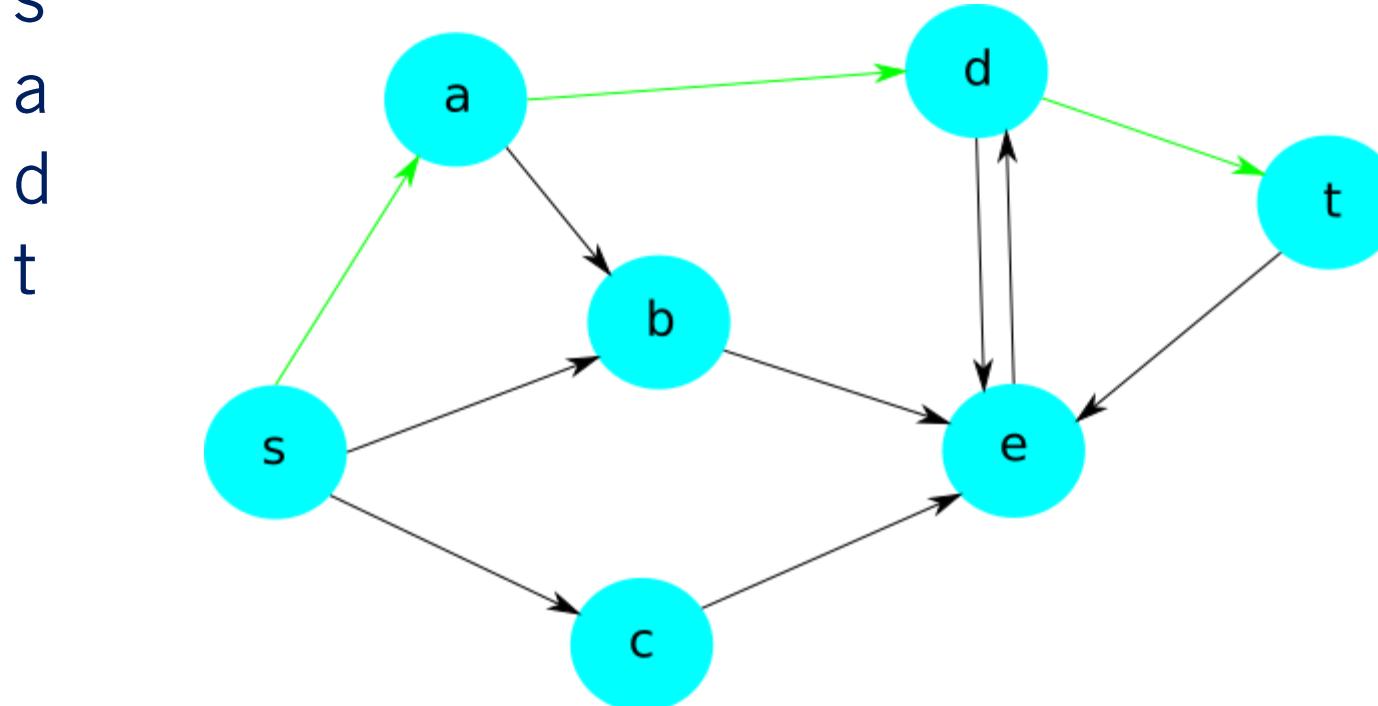
Closed Set:

s
a
b
c
d
e



Example - Optimal Path

Final Path: s



Summary

- Recognize the mission planning problem as a map-level navigation problem
- Learned how to embed a graph in the map
 - Vertices connected by road segments, which correspond to edges
- Learned how to use BFS to search an unweighted graph for the shortest path to the destination



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