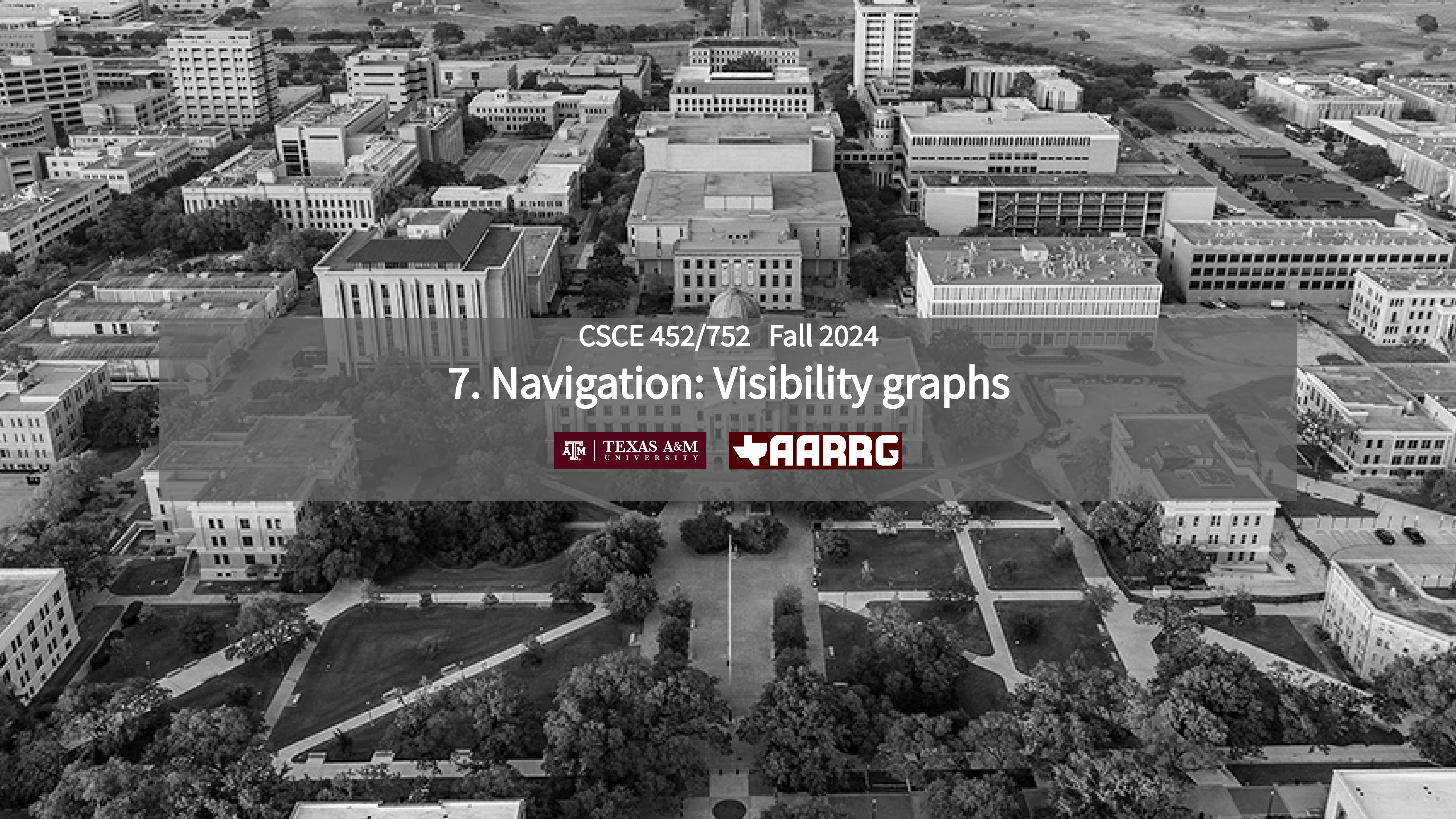


CSCE 452/752 Fall 2024

7. Navigation: Visibility graphs

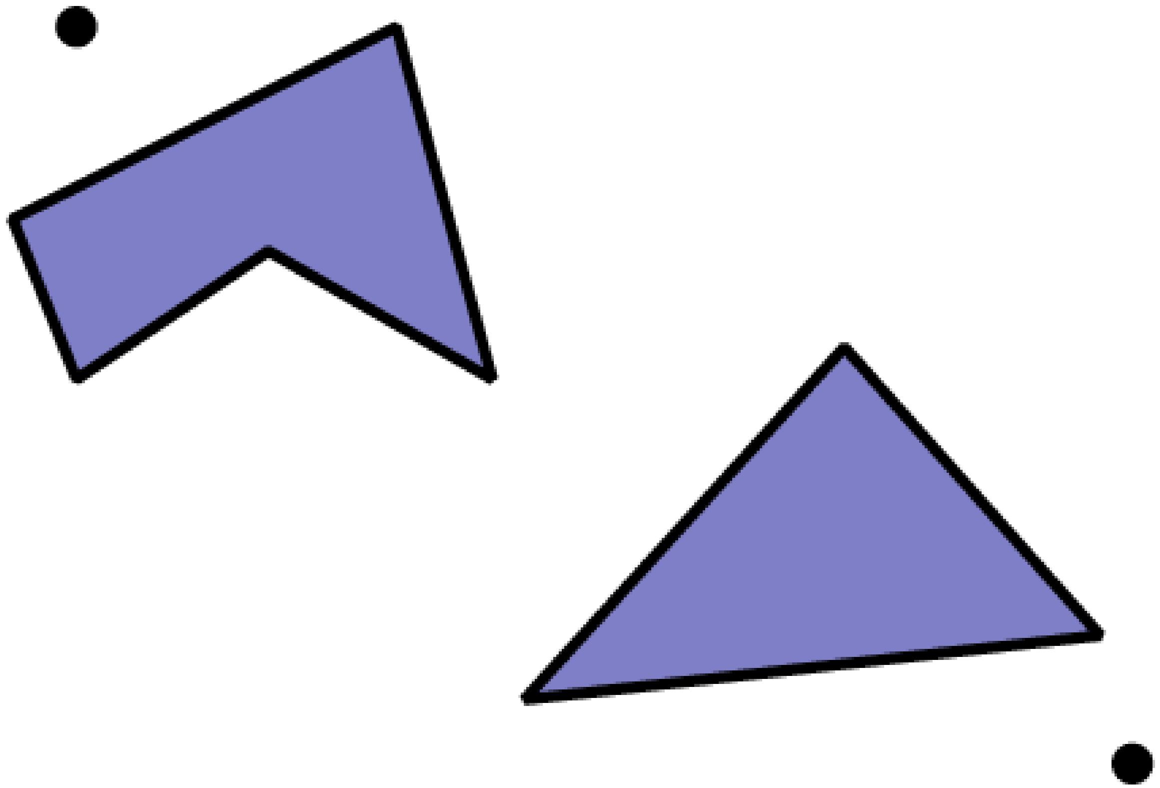
TEXAS A&M UNIVERSITY

AARRG

Introduction

Definition

A **visibility graph** can be used to compute shortest paths among known polygonal planar obstacles.



Problem

Given:

- A set of **obstacles** represented as **polygons**.
- A non-obstacle **starting state** x_I.
- A non-obstacle **ending state** x_G.

Compute:

- The **shortest path** between x_I and x_G that avoids the obstacles.

Visibility graph definition

Definition

The **visibility graph** is a weighted graph that includes all paths consisting of line segments between obstacle vertices, the start, or the goal.

Nodes:

- One node for each polygon vertex.
- Two extra nodes for x_I and x_G.

Edges:

- Between each pair of nodes that can be connected with an obstacle-free segment.
- Weights equal to the distance between nodes.

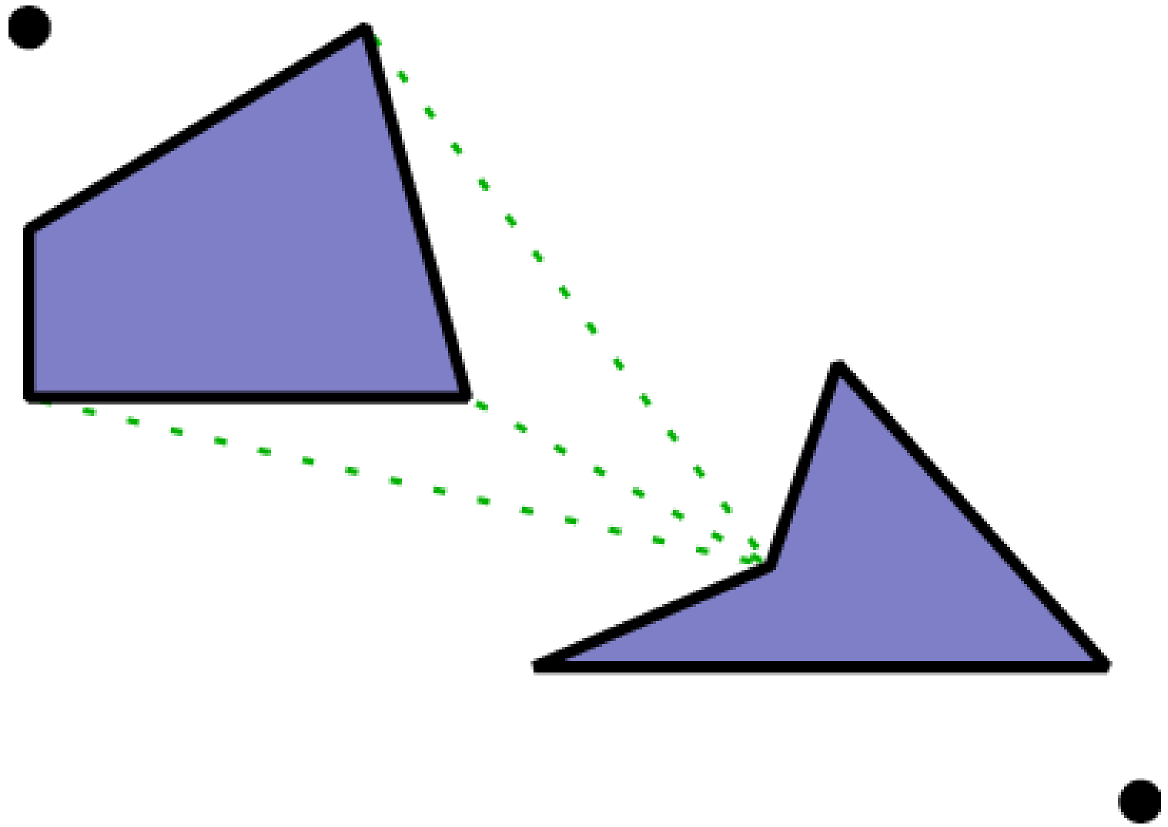
Comment 1: Some edges can be eliminated

Consider an edge in the visibility graph between obstacle vertices.

- Extend that edge into a full line.
- Inspect one of the endpoints of the edge. Do the two obstacle edges lie on opposite side of the extended line? If so, eliminate that edge.
- Repeat for the other endpoint.

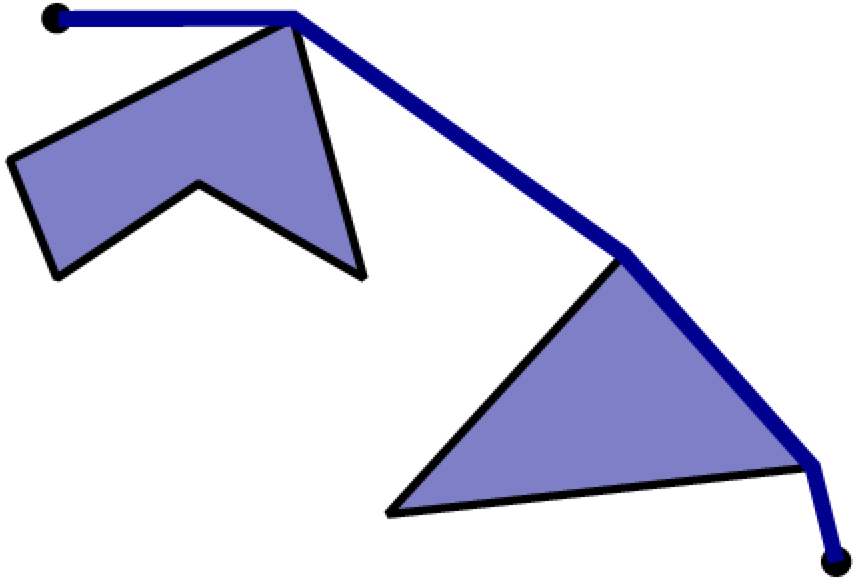
The result is called a **reduced visibility graph**.

Comment 1: Some edges can be eliminated

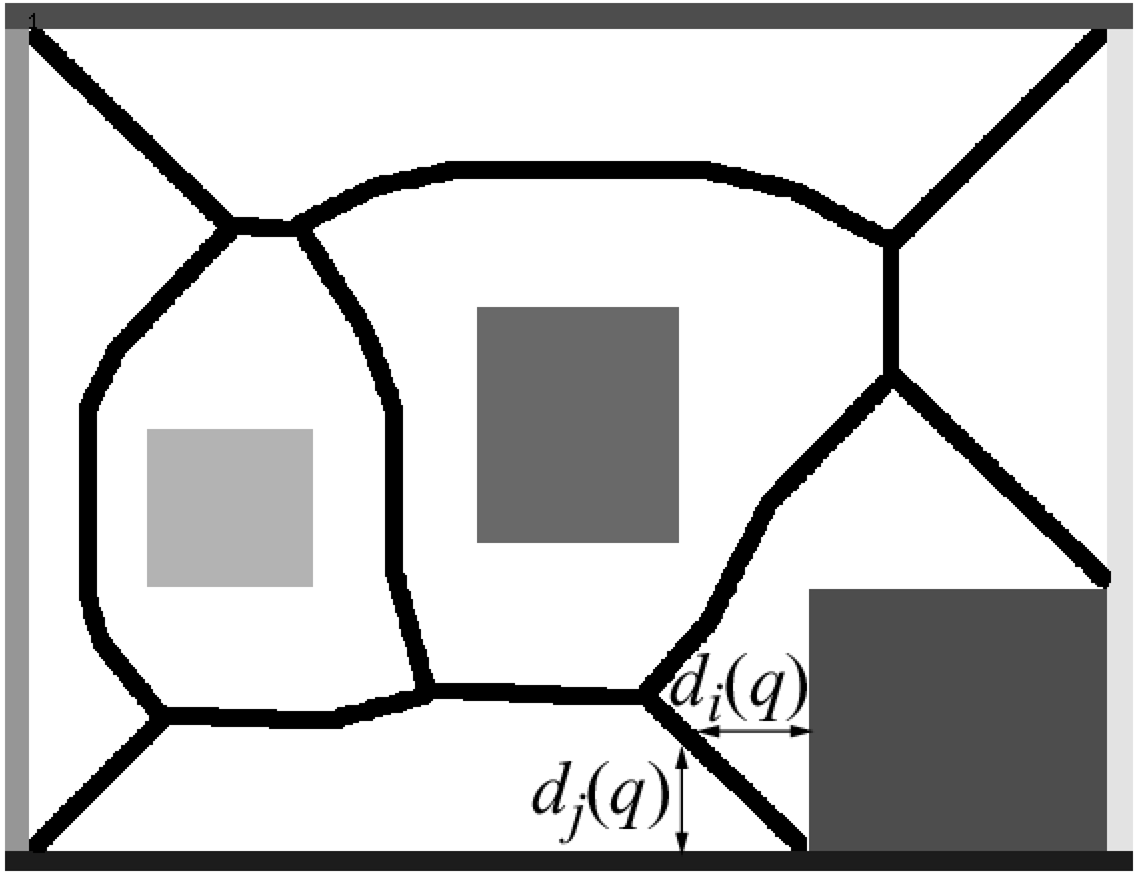


Comment 2: Shortest vs. Safest paths

The paths generated by this method are, by construction, very unsafe. Be careful what you ask for!



visibility graph



Voronoi graph