Announcements

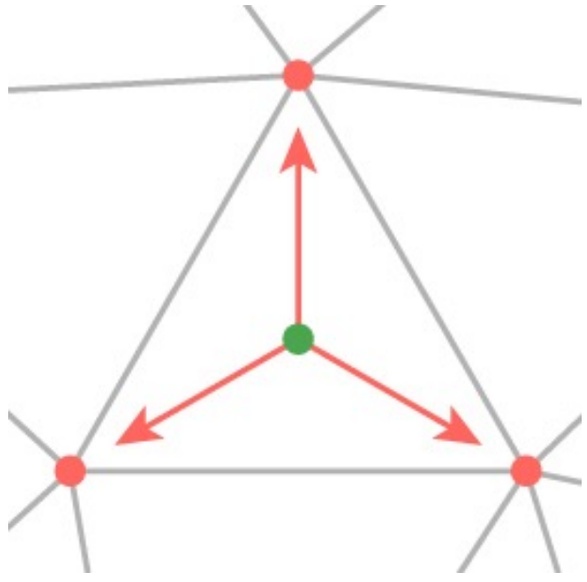
- Friday's class: watch video(s) ahead, work on Problems in class.
- Meet in 420 Friday, back to AW Monday
- Office hours have been lonely ;-(

Goals

- Know how to find out whether a 2D point is inside a given triangle.
- Understand the advantages and disadvantages of modeling objects using triangle meshes.
- Know how contiguous meshes of triangles can be represented using separate triangle sets, indexed triangle sets, triangle strips, and triangle fans.

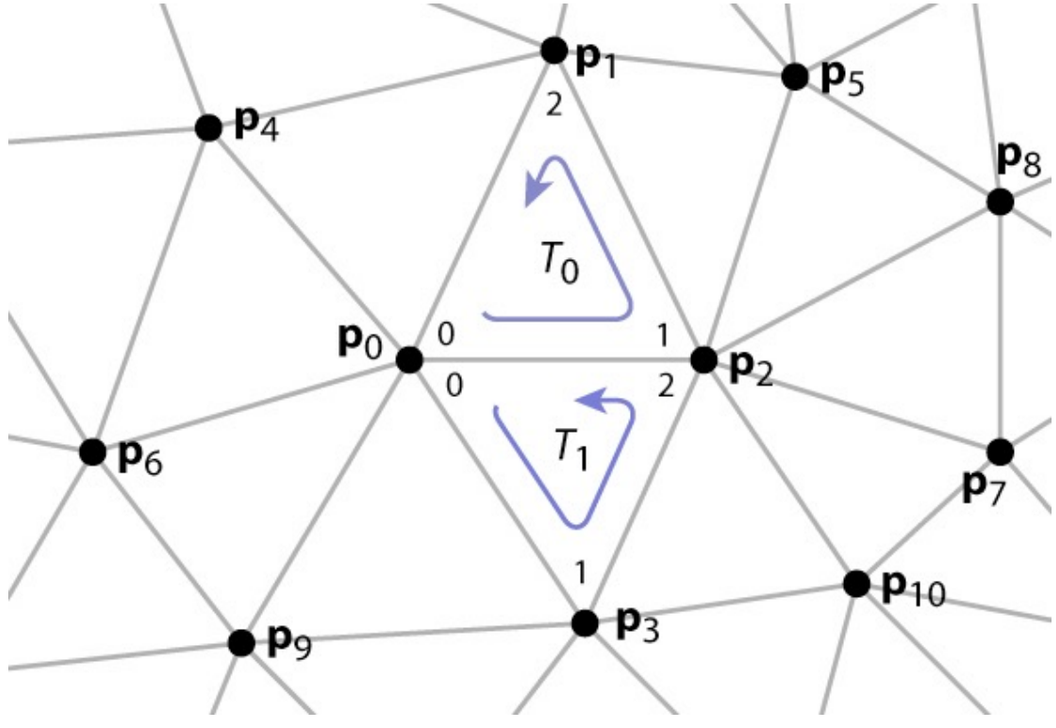
Indexed Triangle Set (A1)

- Vertices are listed once, without duplicates
- Each Triangle stores **indices** of its vertices

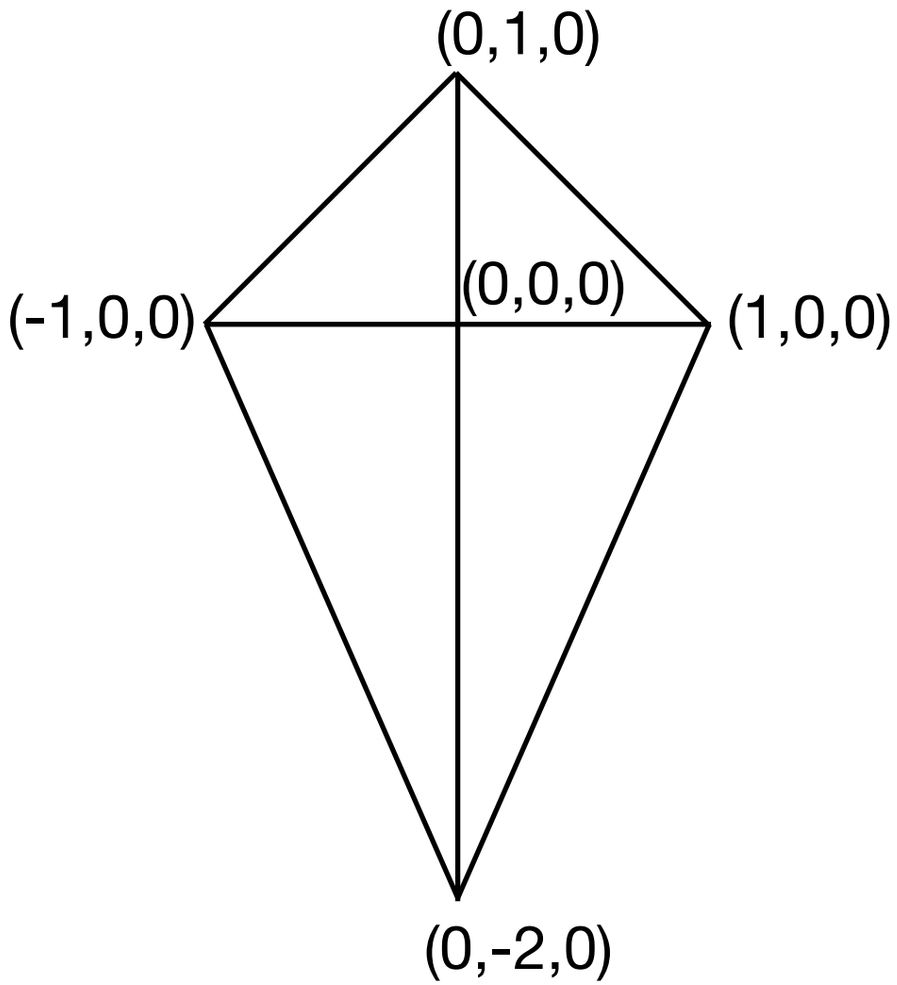


verts[0]	x_0, y_0, z_0
verts[1]	x_1, y_1, z_1
	x_2, y_2, z_2
	x_3, y_3, z_3
	⋮

tInd[0]	0, 2, 1
tInd[1]	0, 3, 2
	⋮



Problems: Kite Mesh



Represent this surface using:

1. Separate triangles.
2. Indexed triangle set.

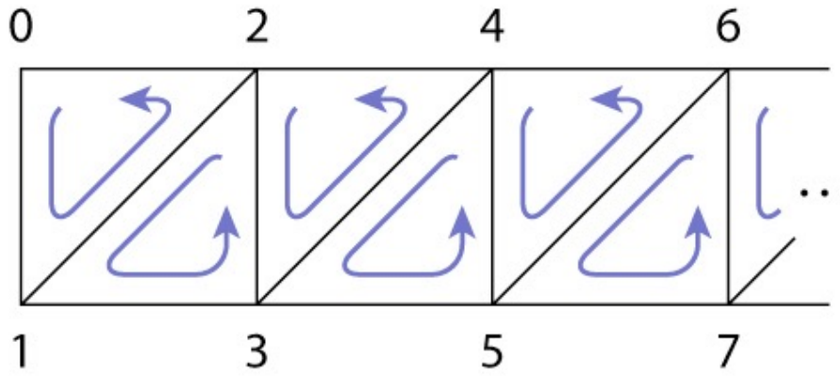
Note: all the triangles are facing towards you in the view shown.

Storage Cost?

- Always depends on the geometry, but for contiguous surface meshes, indexed triangle sets usually give large space savings.
  - Exercise: verify this on the tetrahedron example

Triangle Strips

- Takes advantage of mesh properties:
  - Each triangle is usually adjacent to previous
  - Next triangle reuses previous two vertices



- Every subsequence of 3 vertices is a triangle

Vertex sequence

0, 1, 2, 3, 4, 5, 6, 7, …

leads to triangle sequence:

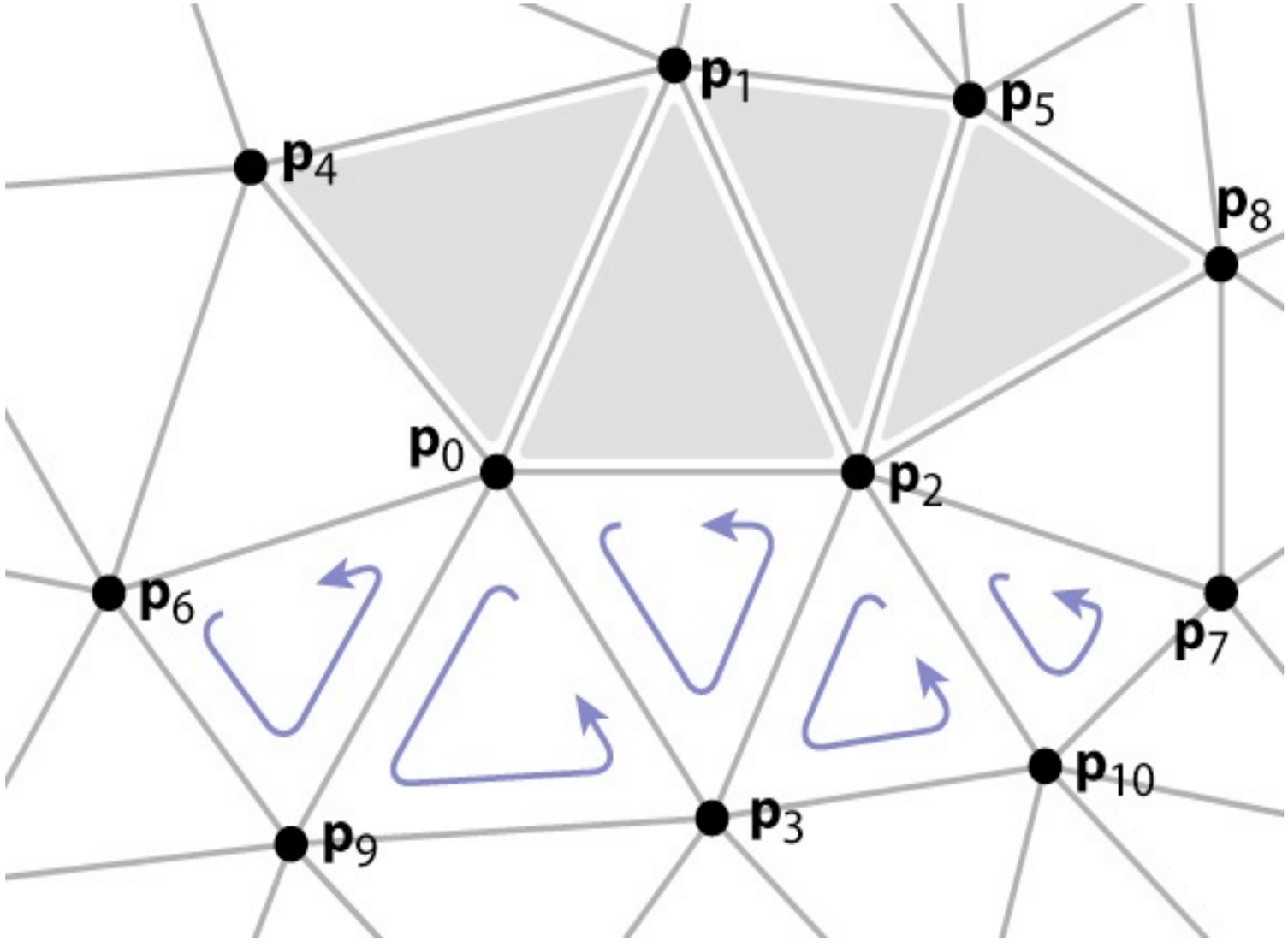
(0 1 2), (2 1 3), (2 3 4), (4 3 5), (4 5 6), (6 5 7), …

For long strips, about one index per triangle!

Triangle Strips

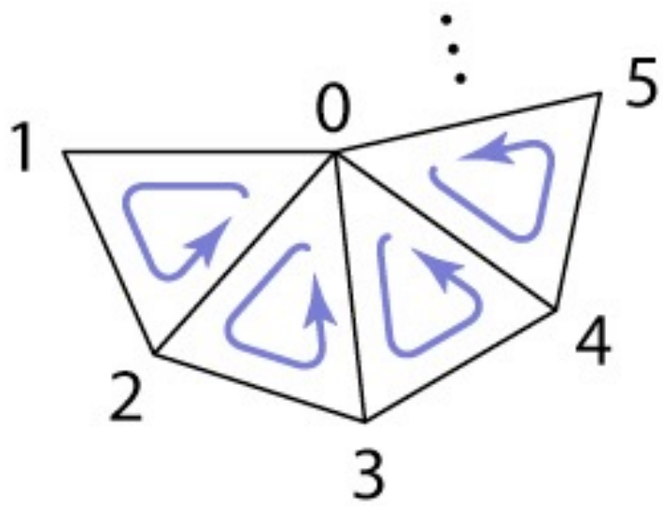
verts[0]	x_0, y_0, z_0
verts[1]	x_1, y_1, z_1
	x_2, y_2, z_2
	x_3, y_3, z_3
	⋮

tStrip[0]	6, 0, 4, 1, 2, 5, 8
tStrip[1]	6, 9, 0, 3, 2, 10, 7
	⋮



Triangle Fans

- Same idea as triangle strips, but keep oldest index rather than newest



- Every sequence of three vertices is a triangle

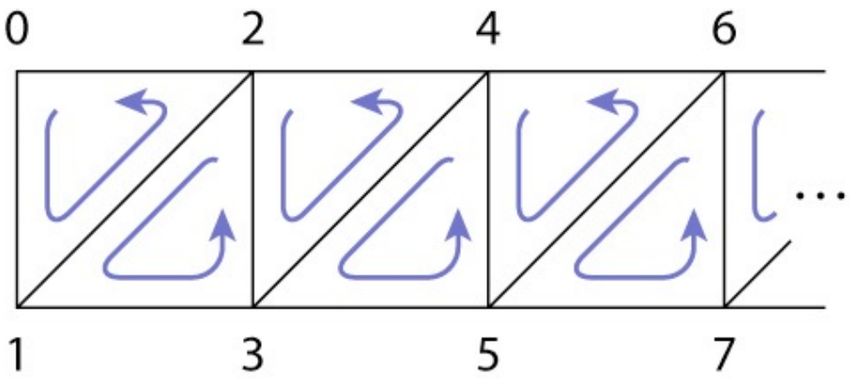
- Same benefits as triangle strips

What else?

- Indexed triangle sets are good for rendering, but not great for mesh **processing**.
- What if we want to efficiently find:
  - all triangles containing a vertex?
  - all triangles adjacent to a triangle?
  - the triangle across a particular edge of a triangle?
- You can augment the mesh data structure to store more. See Section 12.1.4.

Problems 3-5 (last time)

Triangle Strip:



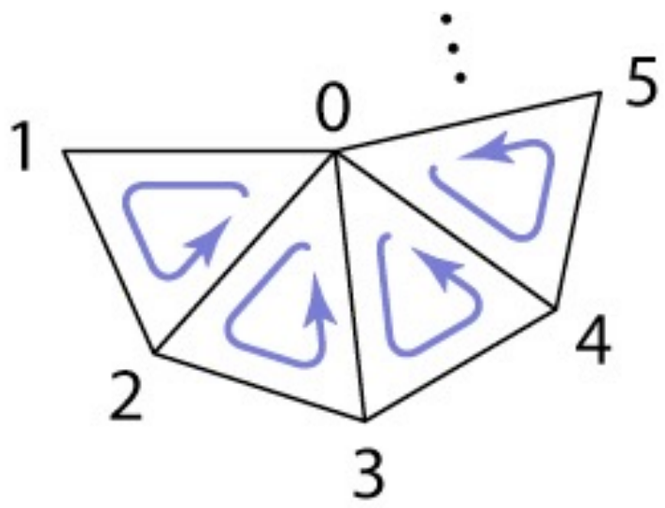
Vertex sequence

0, 1, 2, 3, 4, 5, 6, 7, …

leads to triangle sequence:

(0 1 2), (2 1 3), (2 3 4), (4 3 5), …

Triangle Fan:



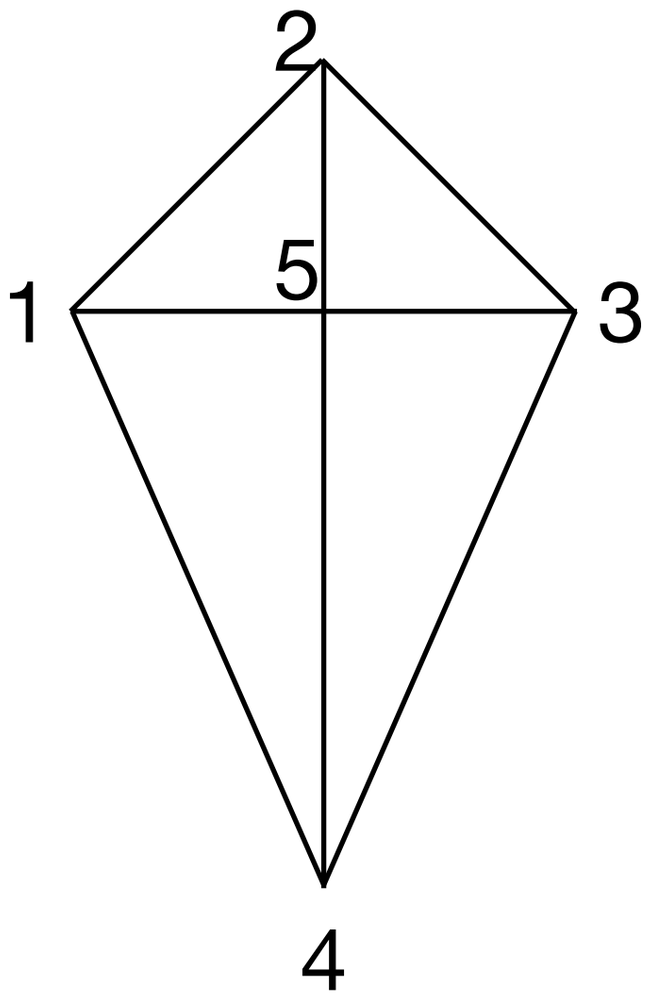
Vertex sequence

0, 1, 2, 3, 4, 5, ...

leads to triangle sequence:

(0 1 2), (0 2 3), (0 3 4), (0 4 5), ...

Exercise: Kite Mesh



Give the sequence of indices for a **Triangle fan** representing this kite, assuming the vertex positions are stored at the indices labeled on the diagram.

Note: all the triangles are facing towards you in the view shown.