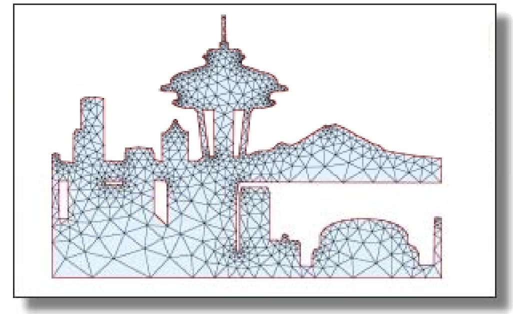
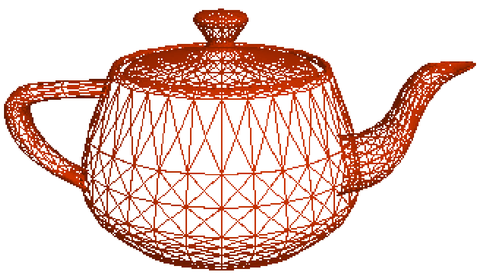
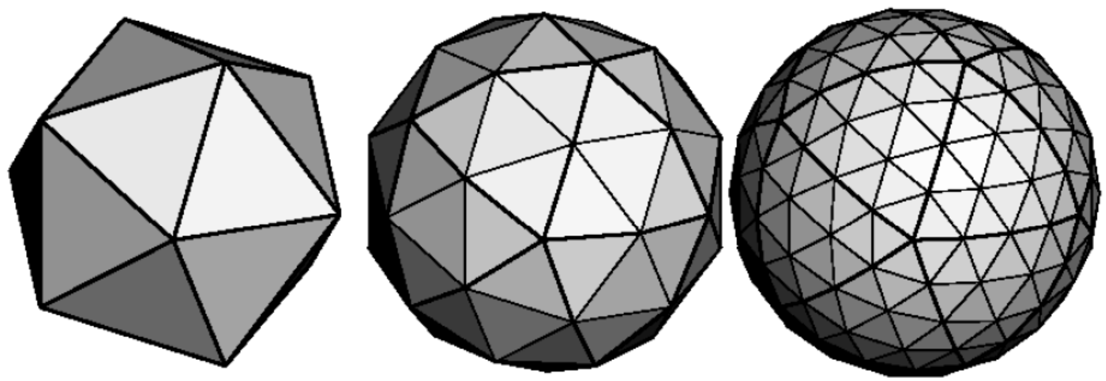
Triangular Mesh

- Geometric shapes can be triangulated



Polygonal approximation of surfaces:



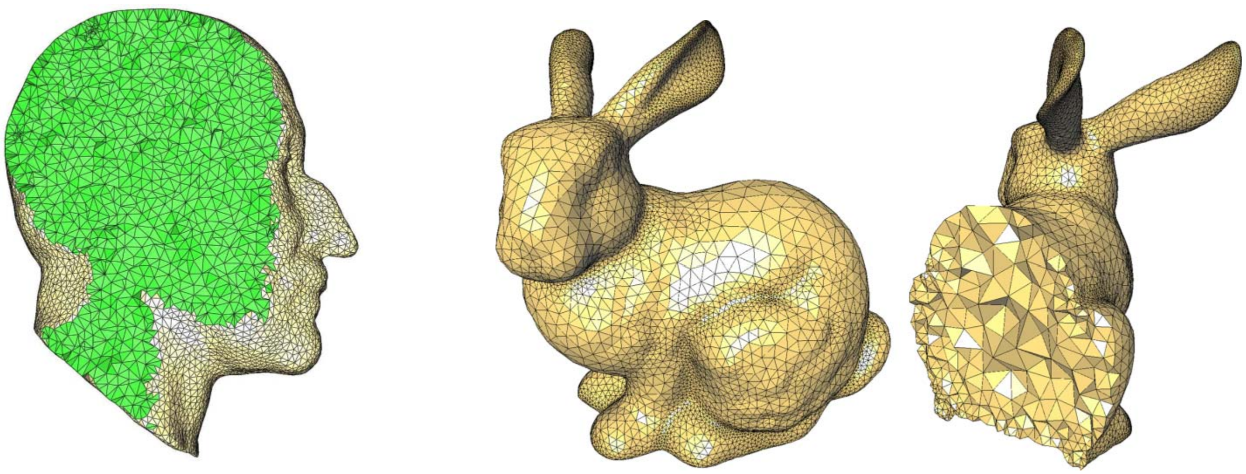


Any 2D shape or 3D surface (2-manifold) can be approximated with locally linear polygons. To improve (visual or numerical approximation quality), we only need to increase the number of edges

Tetrahedral Mesh

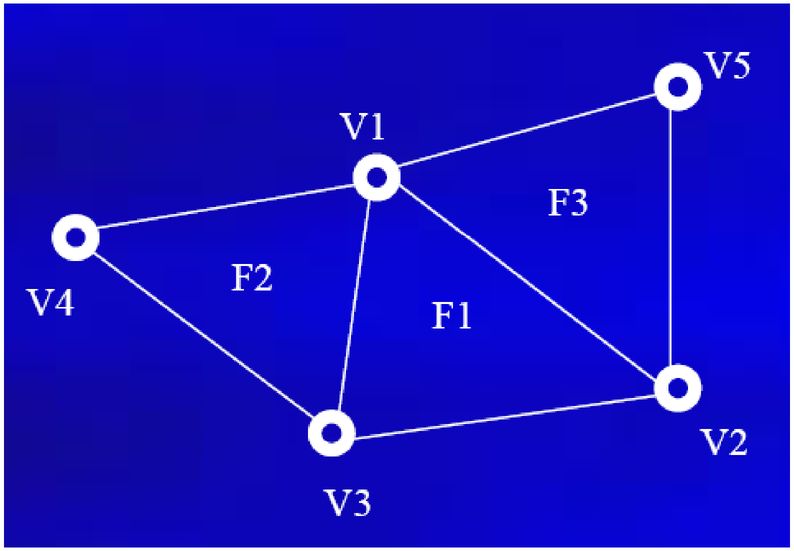
- Solid shapes can be tetrahedralized

Polyhedra approximation of solid geometric data



Any 3D volumetric data (3-manifold) can be approximated with locally linear polyhedra. To improve (visual or numerical approximation quality), we only need to increase the number of edges

How to Represent Triangular Meshes?

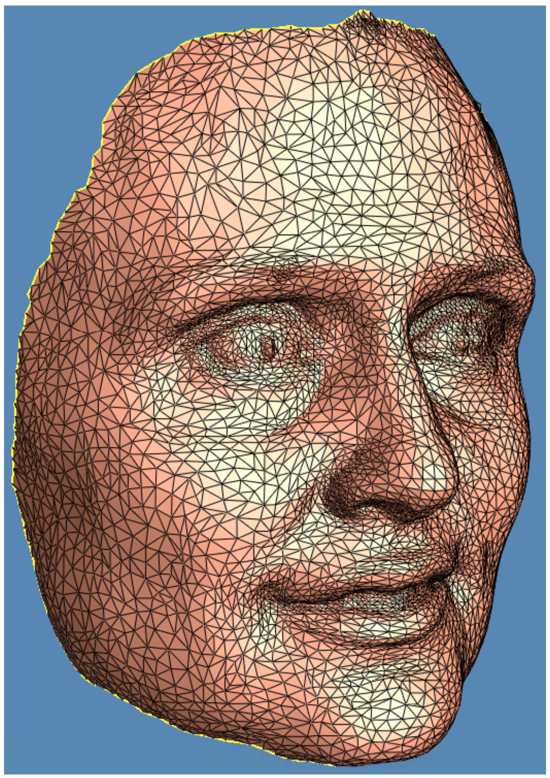


Vertex table	
V1	(x1,y1,z1)
V2	(x2,y2,z2)
V3	(x3,y3,z3)
V4	(x4,y4,z4)
V5	(x5,y5,z5)

Face table	
F1	V1,V3,V2
F2	V1,V4,V3
F3	V5,V1,V2

How to Represent Triangular Meshes?

Example: a female face mesh with 10k triangles



```
Vertex 1 0.6036570072 0.4613159895 0.07038059831
Vertex 2 0.6024590135 0.4750890136 0.07134509832
Vertex 3 0.6083189845 0.4888899922 0.07735790312
Vertex 4 0.611634016 0.5039420128 0.08098520339
Vertex 5 0.6236299872 0.5097290277 0.09412530065
Vertex 6 0.633580029 0.5194600224 0.1063940004
Vertex 7 0.6350849867 0.5272089839 0.1108580008
Vertex 8 0.6459569931 0.5308039784 0.1247610003
Vertex 9 0.6456980109 0.5446619987 0.1324290037
Vertex 10 0.6566579938 0.5420470238 0.1465270072
Vertex 11 0.6629710197 0.5443329811 0.1586650014
Vertex 12 0.671701014 0.541383028 0.1747259945
Vertex 13 0.6746420264 0.5451539755 0.1851660013
Vertex 14 0.6825680137 0.5424500108 0.206724003
Vertex 15 0.6884790063 0.5414119959 0.2314359993
Vertex 16 0.6935830116 0.5439419746 0.2590880096
Vertex 17 0.6981750131 0.5425440073 0.2817029953
Vertex 18 0.7026360035 0.5316519737 0.2960689962
Vertex 19 0.7058500051 0.5267260075 0.3085480034
Vertex 20 0.7095490098 0.5337790251 0.3253619969
Vertex 21 0.7104460001 0.5344949961 0.3296009898
Vertex 22 0.7158439755 0.5286110044 0.3463560045
Vertex 23 0.7237830162 0.5144050121 0.3689010143
Vertex 24 0.7282400131 0.5028949976 0.3827379942
```

```
Face 1 63 3 4
Face 2 64 63 4
Face 3 5 64 4
Face 4 65 5 6
Face 5 7 65 6
Face 6 8 65 7
Face 7 9 66 8
Face 8 10 66 9
Face 9 67 66 10
Face 10 11 67 10
Face 11 12 67 11
Face 12 14 75 13
Face 13 68 76 15
Face 14 16 68 15
Face 15 17 68 16
```

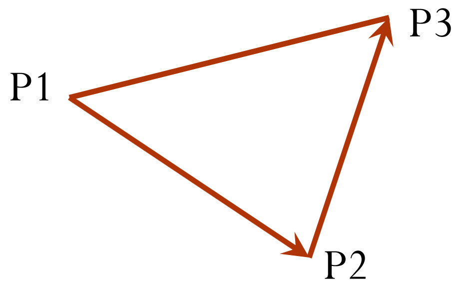
Face Normal

A normal of a face [p1,p2,p3] can be computed as p1p2 * p2p3, where * is the cross-product

You can either

(1) directly assign it to each vertex on this face,

(2) or compute the weighted-average of its one-ring faces.



See more explanations here:

http://www.lighthouse3d.com/opengl/terrain/index.php3?normals

Homework 1

Due: 9/12