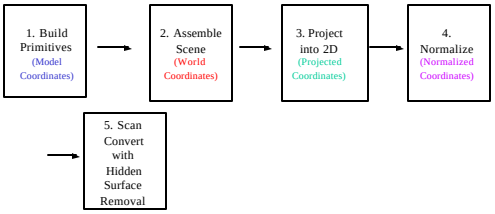
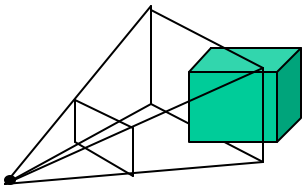
Computer Graphics

Z Sweedyk
Lecture 8

Graphics Pipeline 5



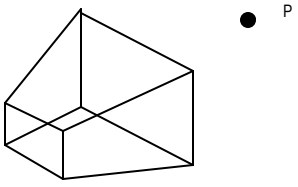
Now for clipping



Overview

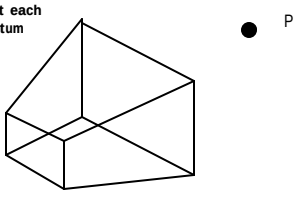
- Vertex clipping
- Line clipping
- Polygon clipping

Vertex Clipping:
Is P in (or on)?



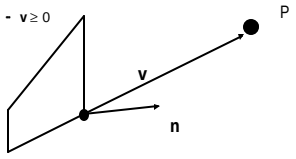
Vertex Clipping:
Is P in?

P is in iff **it is in wrt each plane of the frustum**



Vertex Clipping:
Is P in wrt a plane of the frustum?

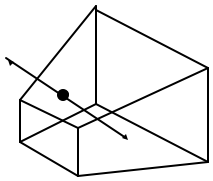
P is in iff $\mathbf{n} \cdot \mathbf{v} \geq 0$



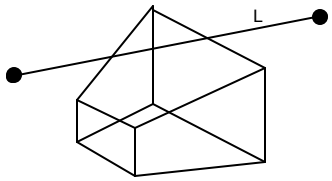
n is the inward facing normal.

v is a vector from some point on the plane to P.

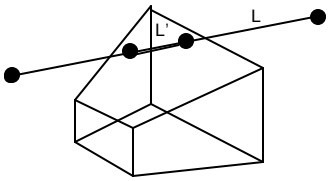
What is an inward facing normal?



Line (Segment) Clipping:
Is L in, out, or both?



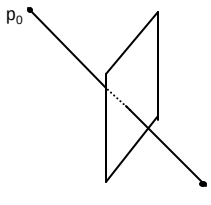
If both return L'



Line Clipping

- Slow test
- Speed up

Clipping a line segment against a plane of the frustum



Classify endpoint p_o & p_1

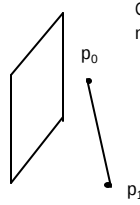
Case: p_o & p_1 in _____

Case: p_o & p_1 out_____

Case: p_o in & p_1 out _____

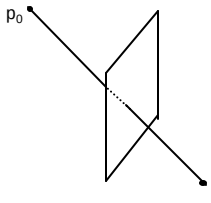
Case: p_o out & p_1 in _____

Clipping a line segment against a plane of the frustum



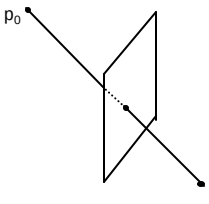
Case: p_o & p_1 in go on with next test

Clipping a line segment against a plane of the frustum



Case: p_o & p_1 out then L is out

Clipping a line segment against a plane of the frustum

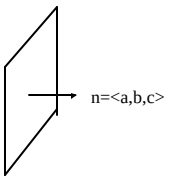


Case: p_o in & p_1 out _____

Case: p_o out & p_1 in _____

Replace out with intersection point

Equation of a Plane



This plane is the set of points (x,y,z) where ax + by +cz=d

$d=ax_0+by_0+cz_0$ where (x_0,y_0,z_0) is any point on the plane.

Speed up

- Assign an "out-code" to the endpoints, p_0 and p_1, of L.
- The out-code for p_i is $b_0b_1b_2b_3b_4b_5$

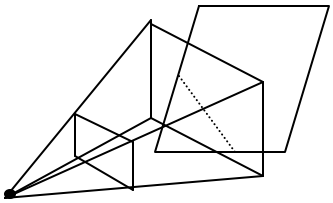
Where b_j is 1 if p_i is out wrt plane j

0 otherwise

Speed Up Test

- L is "definitely out" if the bitwise AND of the out-codes is non-zero.
- L is "definitely in" if the bitwise OR of the out-codes in zero.
- Else let j be a bit set to 1 in the OR of the outcodes. Clip to plane j. Compute the out-code for the new endpoint.
- Restart Test

Polygon clipping



Polygon Clipping

- If v_0 is in then write v_0
- For i=1…n-1
  - If v_i in and v_{i+1} in then write v_{i+1}
  - If v_i out and v_{i+1} out then do nothing
  - If v_i in and v_{i+1} out then write intersection point
  - If v_i out and v_{i+1} in then write intersection point and v_{i+1}

Speed Up

- Use line clipping speed up.