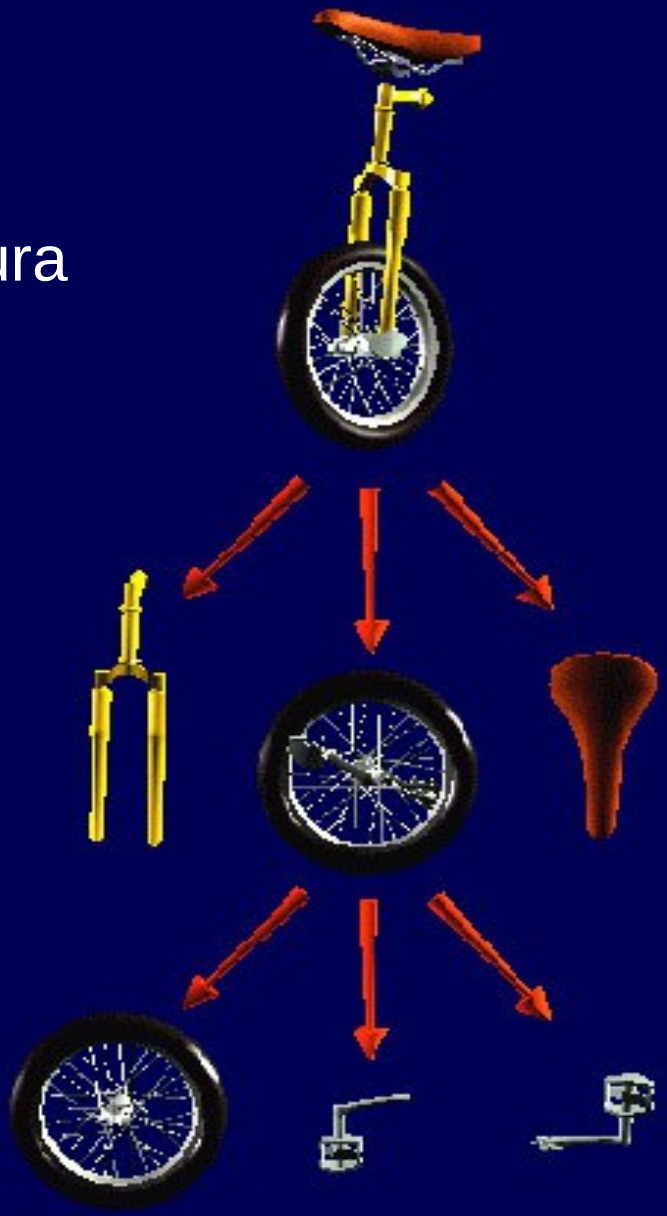
Modeliranje kompleksnih modelov

Hierahična,
drevesna struktura
modela

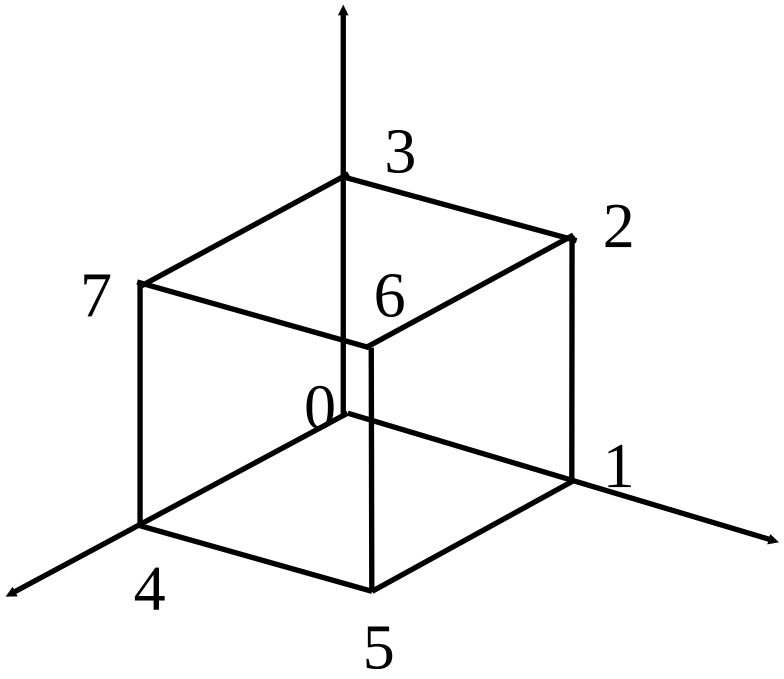


Polygonal Meshes

- Used to model solid objects

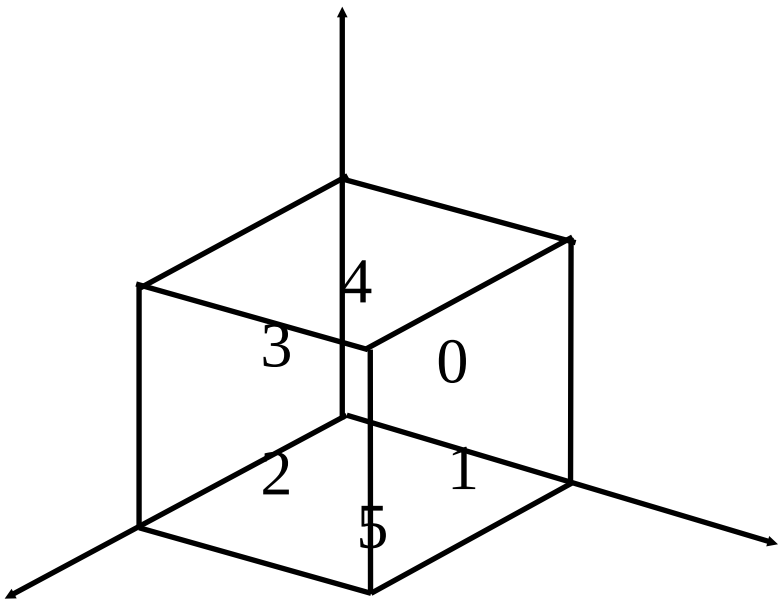
- Objects are defined by:
- List of vertices
- List of normals
- Face list

Vertex List



Vertex	
0	0 0 0
1	1 0 0
2	1 1 0
3	0 1 0
4	0 0 1
5	1 0 1
6	1 1 1
7	0 1 1

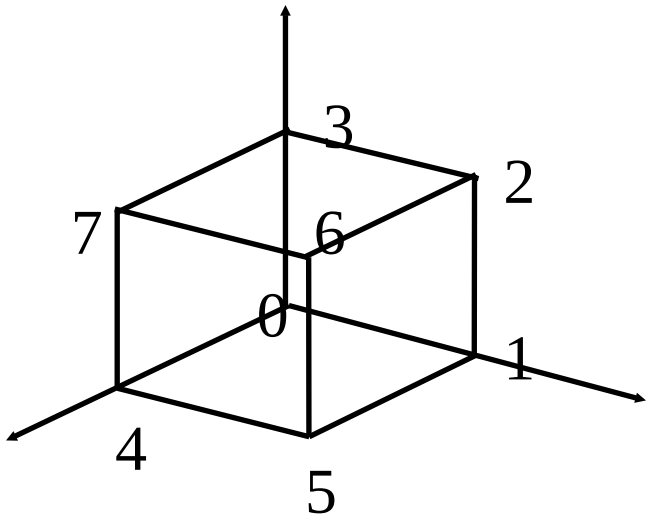
Normal list



Normal			
0	0	0	-1
1	1	0	0
2	0	0	1
3	-1	0	0
4	0	1	0
5	0	-1	0

0: Rear Face
1: Right Face
2: Front Face
3: Left Face
4: Top Face
5: Bottom Face

Face List



Face	Vertex List
0	0 3 2 1
1	1 2 6 5
2	4 5 6 7
3	0 4 7 3
4	2 3 7 6
5	0 1 5 4

0: Rear Face
1: Right Face
2: Front Face
3: Left Face
4: Top Face
5: Bottom Face

Data File

- 8 6 6 ← # Vertices # Normals # Faces
- 0 0 0 1 0 0 1 1 0 0 1 0 0 0 1
- 1 0 1 1 1 1 0 1 1
- 0 0 -1 1 0 0 0 0 1 1 0 0 0 1 0
- 0 -1 0
- 4 0 3 2 1 ← Faces
- 4 1 2 6 5
- 4 4 5 6 7
- 4 0 4 7 3
- 4 2 3 7 6
- 4 0 1 5 4

Vertices

Normals

Spatial Data Structures

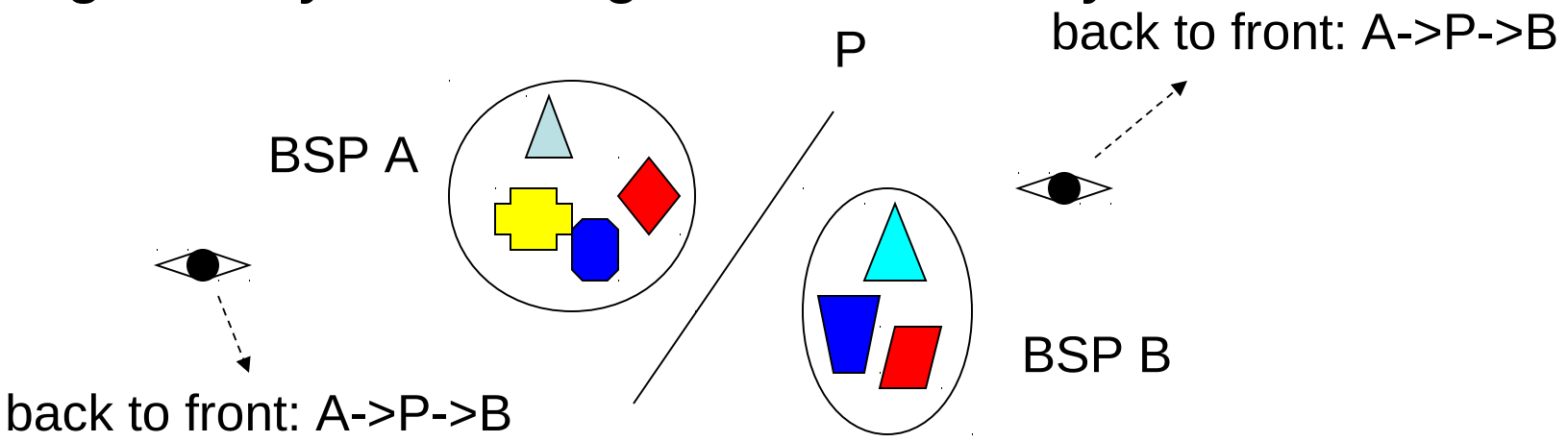
- Used to organize geometry in n-dimensional space (2 and 3D are of this course's interest)
- For accelerating queries – culling, ray tracing intersection tests, collision detection
- They are mostly hierarchy by nature
- Topics:
  - Bounding Volume Hierarchies (BVH)
  - Binary Space Partitioning Trees (BSP trees)
  - Octrees

Anwendungen für Objekthierarchien

- Culling
- Raytracing
- Radiosity
- Navigation

Binary Space Partitioning (BSP) Trees

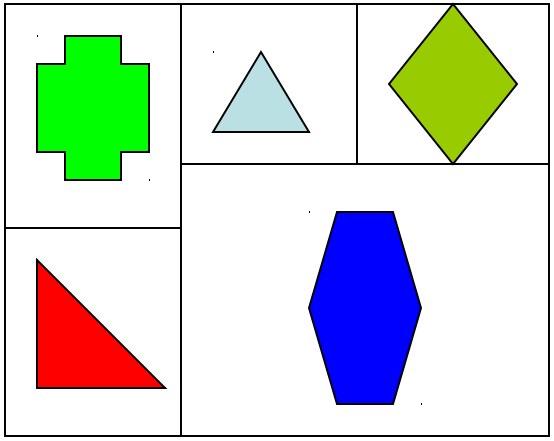
- Main purpose – depth sorting
- Consisting of a dividing plane, and a BSP tree on each side of the dividing plane (note the recursive definition)
- The back to front traversal order can be decided right away according to where the eye is



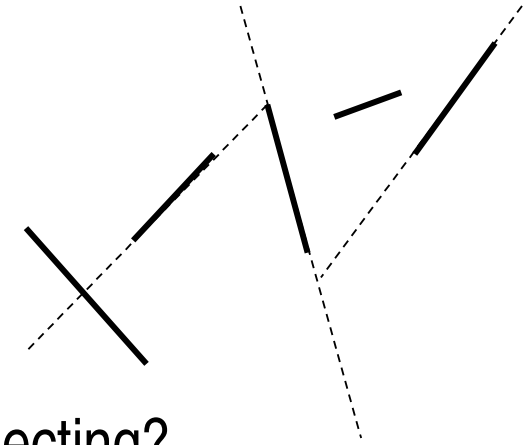
BSP Trees (cont'd)

- Two possible implementations:

Axis-Aligned BSP



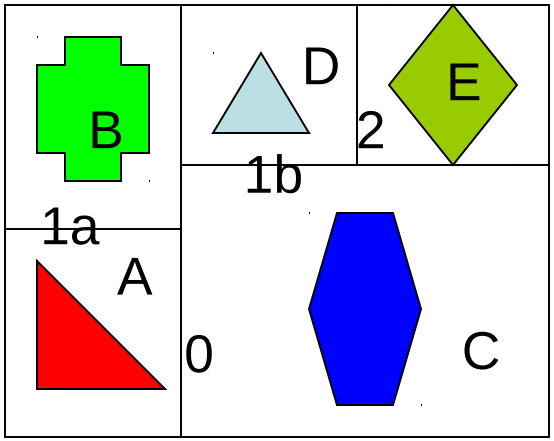
Polygon-Aligned BSP

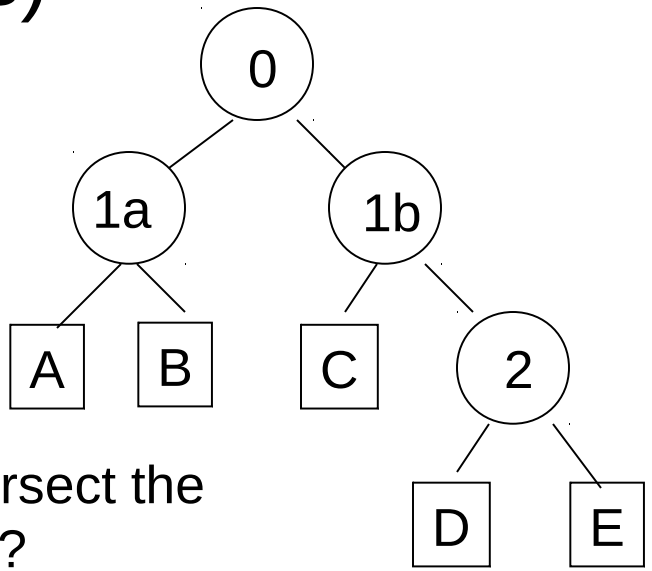


Intersecting?

Axis-Aligned BSP Trees

- Starting with an AABB
- Recursively subdivide into small boxes
- One possible strategy: cycle through the axes (also called k-d trees)

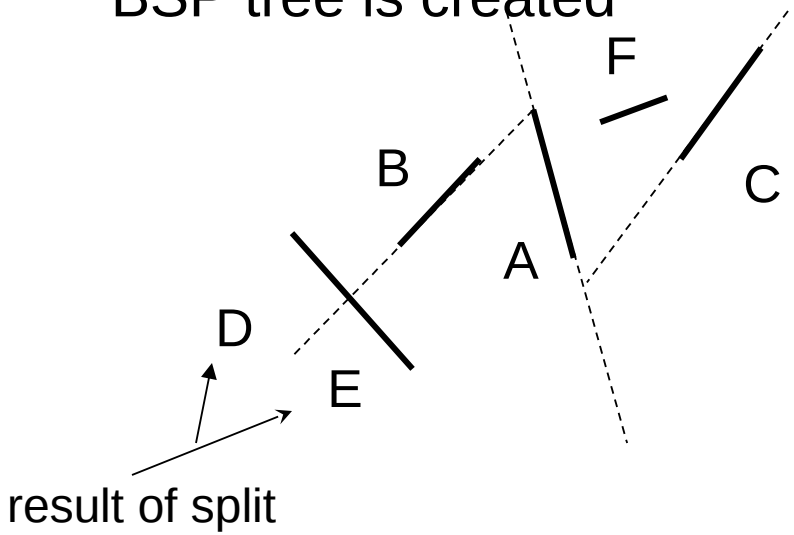


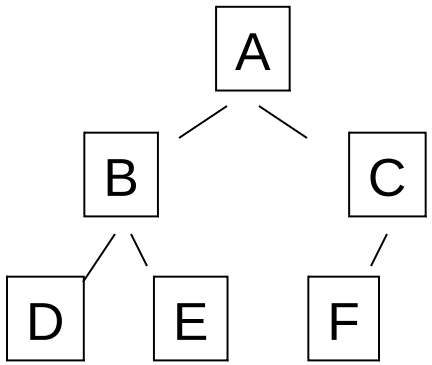


Q: objects intersect the boundaries?

Polygon-Aligned BSP Trees

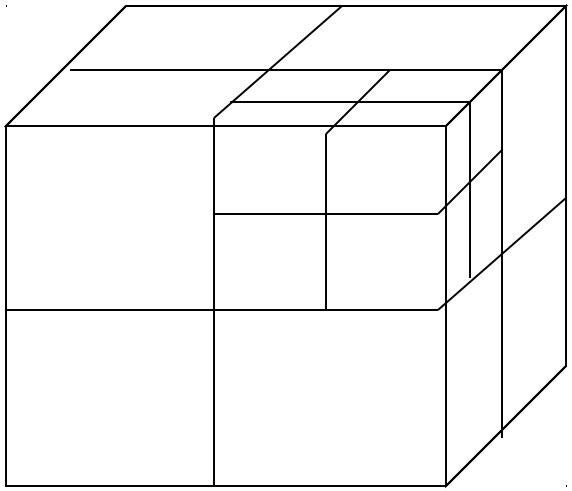
- The original BSP idea
- Choose one divider at a time – any polygon intersect with the plane has to be split
- Done recursively until all polygons are in the BSP trees
- The back to front traversal can be done exact
- The dividers need to be chosen carefully so that a balanced BSP tree is created





Octrees

- Similar to Axis-Aligned BSP trees
- Each node has eight children



- A parent has 8 (2x2x2) children
- Subdivide the space until the number of primitives within each leaf node is less than a threshold
- Objects are stored in the leaf nodes