CS100433
Computer Graphics

Assignment 1

Questions

1 What is a graphics pipeline? Why is it called a pipeline?

2 Why should the graphics pipeline be programmable?

3 What are vertex, primitive and fragment?

4 What are geometry and topology?

Questions

5 What happens when the viewport is reduced? Why?

6 What happens when the clipping window is reduced? Why?

7 Is virtual camera exactly the same as the real camera? Why?

8 Describe the pros and cons of mesh-based solid modeling

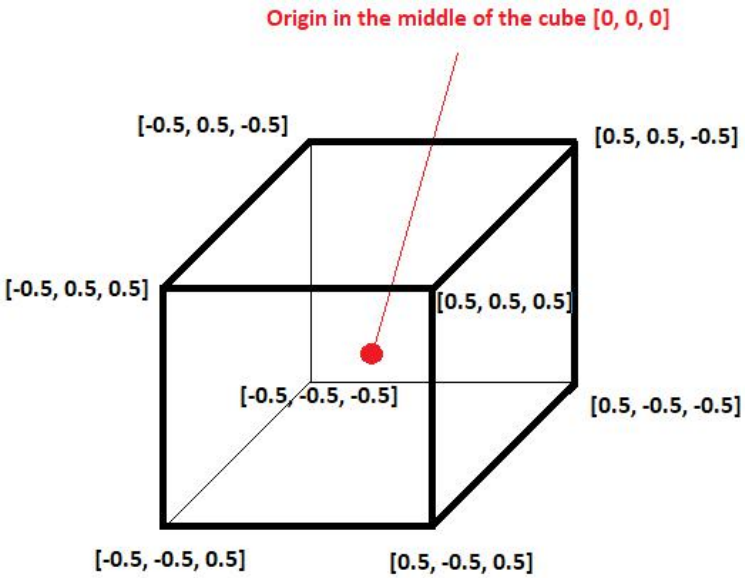
Questions

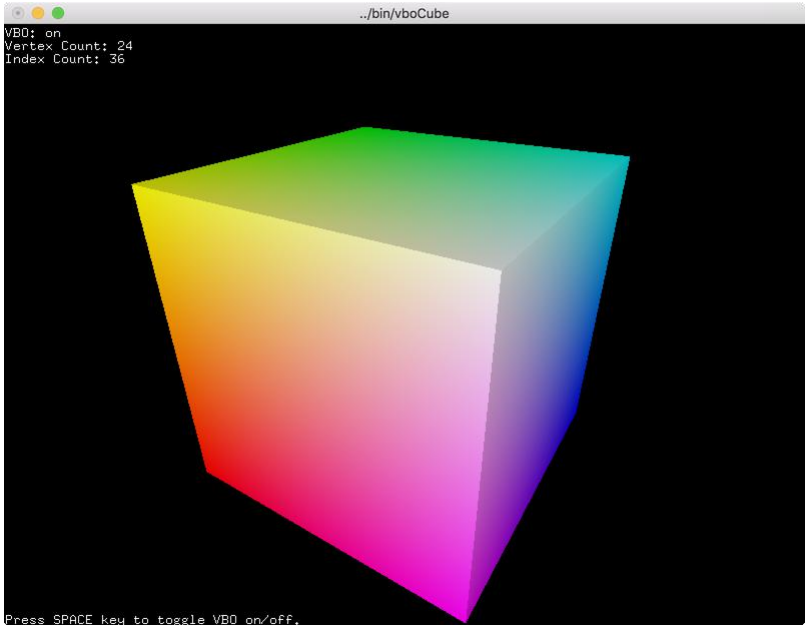
- 9 Describe the pros and cons of voxel-based solid modeling

- 10 Describe the pros and cons of point cloud-based solid modeling.

Programming

- Draw a Cube with Colors like this:



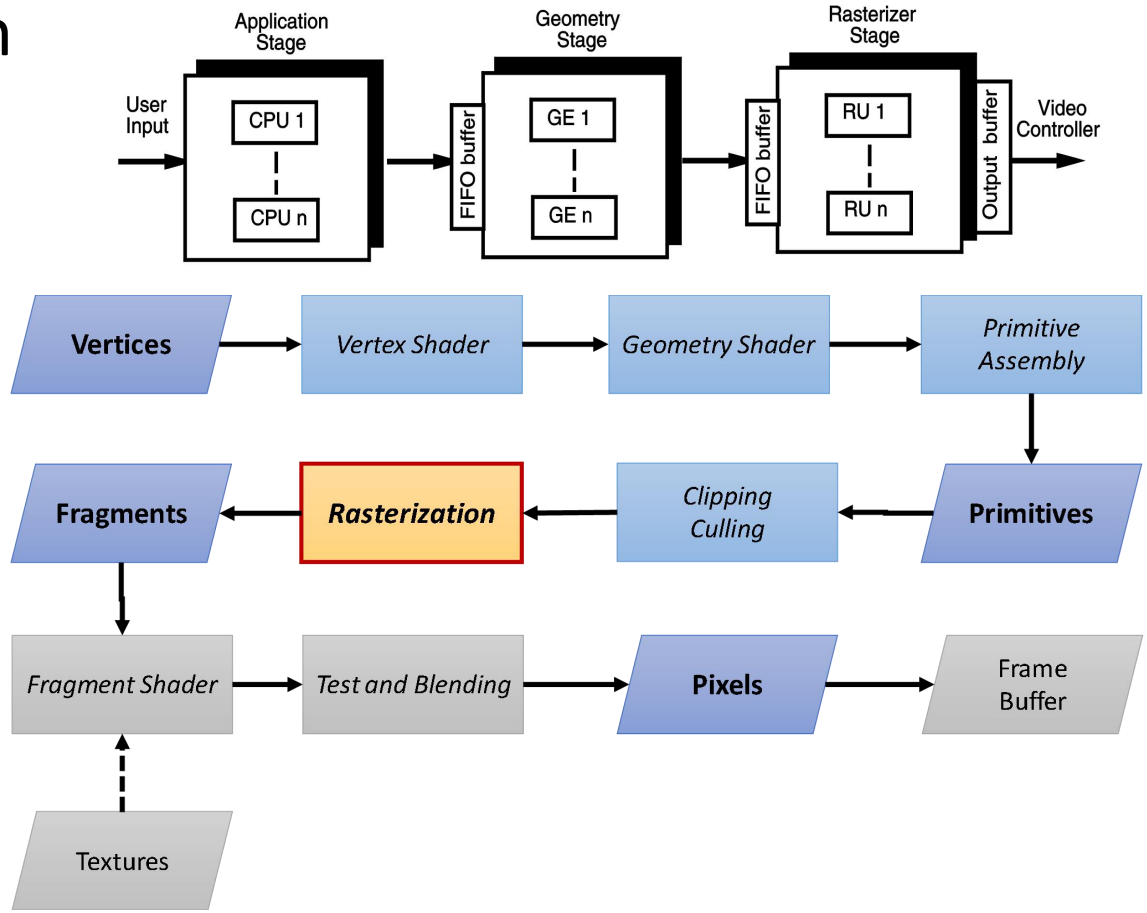


- Can you animate the color of the cube? To approximate a neon light.

Answers

1 What is a graphics pipeline?

- Both



Answers

- 2 Why should the graphics pipeline be programmable?
  - Allow programmer and artist to define the vertex and fragment (and geometry) processing
  - Utilizing the parallel processing capability of modern GPU
  - Fixed pipeline is restrictive

Answers

3 What are vertex, primitive and fragment?

- A vertex is a point/node in the space, represented by its coordinate and properties, e.g. color, normal, texture coordinate etc.

A primitive is the basic element of geometric shapes and rendering, it is composed of vertices. It can be points, lines, polygons or polyhedrons.

A fragment is the output data of the geometry shader in rasterization stage. The fragment contains the data necessary to generate a single pixel in the frame buffer, e.g. color, depth, normal, texture coordinate etc.

Answers

4 What are geometry and topology?

- Geometry is a subject researching the structure and nature of a space. Topology is the study of the properties of geometry or space that remain unchanged even after continuous change in shape.
- In geometric modeling, geometry is represented by vertices and topology is represented by the combinatorial structure of vertices.

Answers

5 What happens when the viewport is reduced? Why?

- The object will be shrinked, since the viewport defines the area where the scene is displayed on the screen.

6 What happens when the clipping window is enlarged? Why?

- The object will look bigger because the clipping window defines the extent of the visible scene and a greater visible scene is mapped to the same area of the screen defined by the viewport.

Answers

7 Is virtual camera exactly the same as the real camera? Why?

- no, the virtual camera dose not model the refraction of lens in general.

8 Describe the pros and cons of mesh-based solid modeling

- Pros: Easy for rendering and lightweight for representation
- Cons: Can only represent the surface and is difficult to be closed

Answers

- 9 Describe the pros and cons of voxel-based solid modeling
  - Pros: can represent the interior (3D)
  - Cons: subject to the discretization artefacts

- 10 Describe the pros and cons of point cloud-based solid modeling.
  - Pros: easy to obtain using lidar
  - Cons: no topology

Programming

- Draw a Cube with Colors like this: