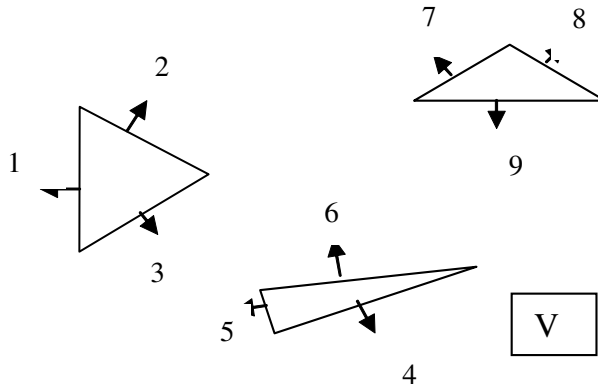
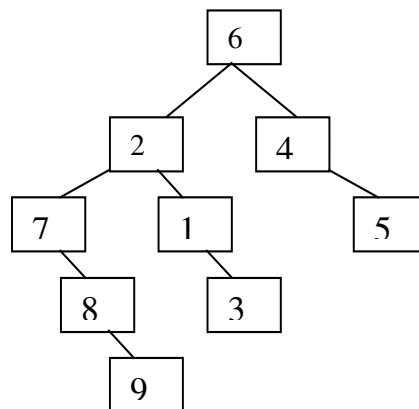


**Review questions for Final Exam**  
**CSE 167, Winter 2003**  
 Date: Mar. 13, 03

**Questions:**



- 1.** Consider the above configuration of triangles. Suppose the front faces of each edge points in the direction shown. Assume that, if extended, no edge intersects another triangle.
- Build a BSP tree which uses the lines containing the edges to partition the 2-D space. Insert the edges into this tree.
  - Which edge would be drawn first if the viewer is at the location marked V?
  - Which edge would be drawn last?
  - If using backface culling, which edge would be removed?
  - If using z-buffer algorithm, which edges would need to be rendered?



- One possible tree:
- Given the above tree, and the viewpoint, the rendering order would be 7,8,9,2,1,3,6,5,4. Therefore the first edge to be rendered would be 7. Note the rendering order can change if amongst edges which don't occlude each other (w/respect to viewpoint). For example drawing either 7,8,1 or 2 first would not matter. On the other hand, 9 has to be drawn after 7 and 8 regardless of

tree configuration. What's important to note is that the output on the framebuffer is independent of tree configuration.

- c) The last one to be rendered would be 4.
- d)** 7,8,1,2,5,6 would not be rendered
- e) all edges would be rendered.

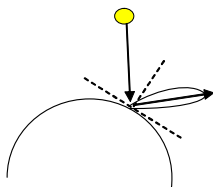
2. Given that you have a light with the following properties:

Ambient: R/G/B (.1,.1,.1)

Diffuse: (.05,.5,.3)

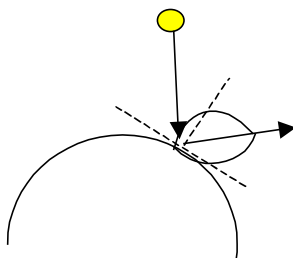
Specular: (.7, 0, .5);

- a. What material coefficients would result in a shiny blue surface with a red highlight?
- b. Suppose the following diagram represents incident and reflected light off a point on a surface. Also suppose the arc diagrammed accurately represents the distribution of specularly reflected light intensity for a shininess coefficient of .9 (on a scale from 0 to 1), approximately sketch what the distribution would look like with a coefficient of .5.

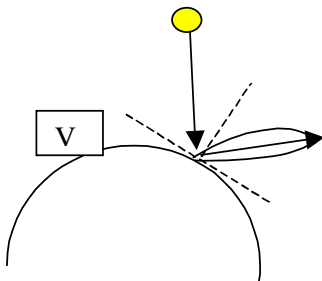


- c. In the above diagram, as it is shown originally, indicate where a viewer would have to be to see no significant highlight, but still be able to see the surface at that point? Note, the viewer cannot be inside the surface.

- a. Example of material coefficients would be: ambient=(0.0,0.0,.2), diffuse=(0.0,0.0,0.5) and specular=(1.0,0.0,0.0) with shininess coefficient=100.
- b. With a coefficient of .5 the diagram qualitatively would look like:



- c. One possible position for the viewer is:



3. Consider the following code.

```
glLightfv(GL_LIGHT0, GL_AMBIENT, light_ambient);
glLightfv(GL_LIGHT0, GL_DIFFUSE, light_diffuse);
glLightfv(GL_LIGHT0, GL_SPECULAR, light_specular);
glEnable(GL_LIGHT_0);

glShadeModel(GL_FLAT);
glPolygonMode(GL_FRONT_AND_BACK, GL_FILL);
glLightfv(GL_LIGHT0, GL_POSITION, light_position);

glBegin(GL_TRIANGLES)

glVertex3f(.3, .2, .4);
glVertex3f(.1, .9, .2);
glVertex3f(.5, .3, .2);
glEnd()
```

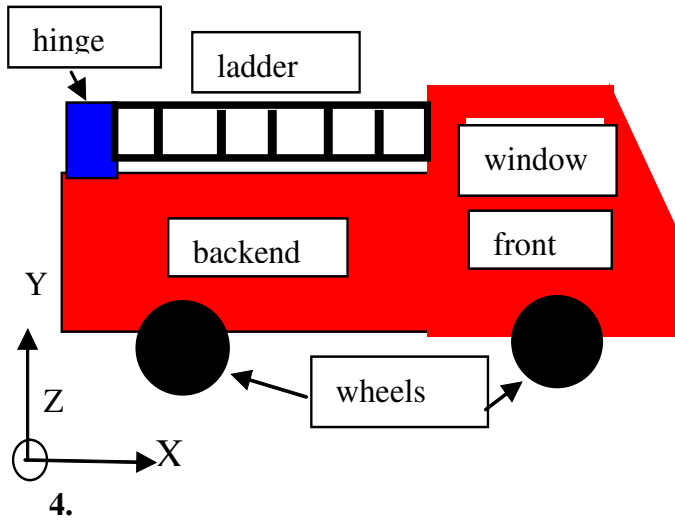
Add one line between the glBegin() and glEnd() to actually render the polygon.

The line would be: glNormal3f(n(1)/|n|,n(2)/|n|,n(3)/|n|); such that n is:

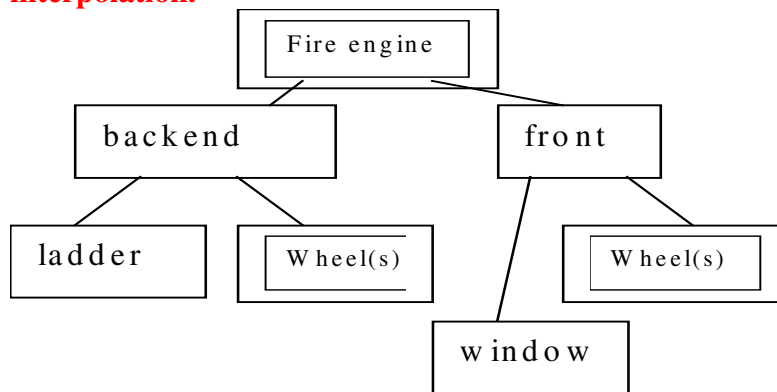
$$P1 = \begin{bmatrix} .3 - .1 \\ .2 - .9 \\ .4 - .2 \end{bmatrix} = \begin{bmatrix} .2 \\ -.7 \\ .2 \end{bmatrix} \text{ and}$$

$$P2 = \begin{bmatrix} .3 - .5 \\ .2 - .3 \\ .4 - .2 \end{bmatrix} = \begin{bmatrix} -.2 \\ -.1 \\ .2 \end{bmatrix} \text{ and}$$

$$n = P1 \times P2 = \begin{bmatrix} -.12 \\ -.08 \\ -.16 \end{bmatrix}$$



- a. Create a scene graph containing the labeled parts of the above fireengine. Assume the following properties for the components: front and backend are red, wheels are black, window is transparent, ladder is blue. Also, the wheels rotate and the ladder rotates at the hinge.
- b. Suppose at time = 0 the ladder is at its rest position (as shown) and at time  $t=1$  it is rotated at the hinge by positive 90 degree around Z-axis. Draw the orientation of the ladder at  $t=.5$  assuming linear interpolation.



At time=.5 the ladder would be oriented 45 degrees (rotated around the z-axis by 45 degrees).