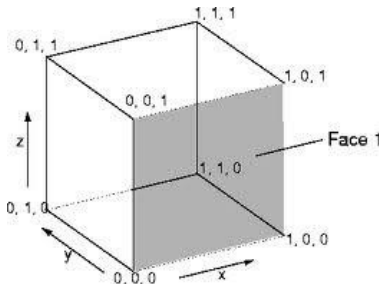
Simple 3D Object and Hidden Surface Removal

In this lab exercise, we will try to render a simple 3D cube on the screen.

1. The simplest method to render a cube on the screen is through rendering 6 Quad faces. Positions these 6 faces correctly according to the respective x, y and z position, it will forms a cube.
    a) Consider the following figure:



    b) Now, based on the vertices from the figure, complete the following code segment in your program.

```
glBegin(GL_QUADS);
// Face 1
glVertex3f(0.0f, 0.0f, 1.0f);
glVertex3f(1.0f, 0.0f, 1.0f);
glVertex3f(0.0f, 0.0f, 0.0f);
glVertex3f(1.0f,0.0f,0.0f);
// Face 2 …
glEnd();
```

    c) If your code are corrects, you should be able to see a square on the screen.
        i. If you don't see the square, try to translate it along -z-axis.

    d) Apply different color for different faces.
        i. Translate your cube along z-axis and observe.
        ii. Add in rotation to have a better view of the cube.

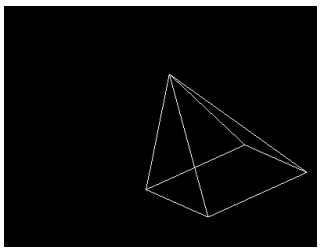
2. The depth buffer test discards the incoming fragment if a depth comparison fails.
    a) Review the 2 sample program given.
        i. Without Depth Test, the hidden surface will be shown.
        ii. With Depth Test, the hidden surface gets removed, thus we have a better view of the cube.

    b) `glEnable(GL_DEPTH_TEST)` This function is called to tell OpenGL to use the depth buffer to help remove hidden surface.
        i. Call `glEnable()` after initialization.

    c) `glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)`
        i. Extend the `glClear()` function to include the clearing of the depth buffer.

Practical Exercise 4A

1. Draw a 3D pyramid with lines (you decide which geometric primitive to use).

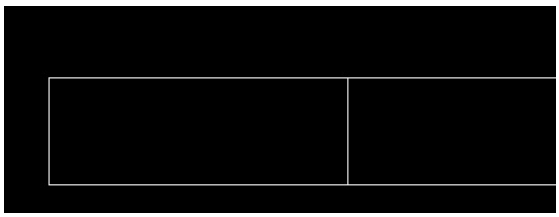


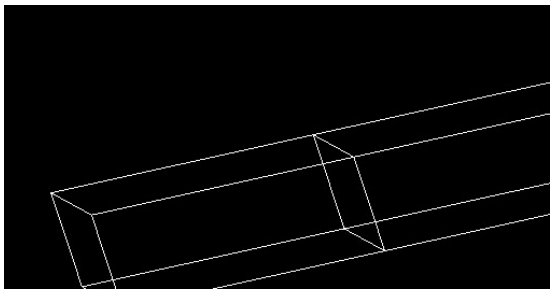
(2 marks)

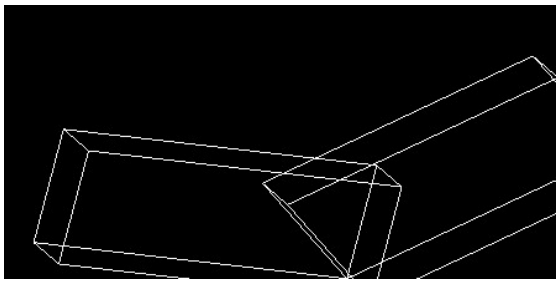
2. Modify question 1 with some interactive features:
    a. when user press "X", pyramid with rotate anti clock-wise at x -axis.
    b. when user press "Y", pyramid with rotate anti clock-wise at y -axis.
    c. when user press "Z", pyramid with rotate anti clock-wise at z -axis.

(3 marks)

3. Draw a robot arm which made form by 2 wireframe cubes. Perform the following :
    a. Upper arm will remain at the same location, lower arm will move up or down when user press UP/Down key. (4 marks)
    b. When user press RIGHT/LEFT button, rotate the whole arm. (2 marks)
    c. When user press SPACE, reset to initial stage. (1 mark)







[TOTAL: 12 marks]