

Question An architect has come up with an award-winning “twisted-tower” design as shown in Fig 1. You are commissioned to generate a 3D graphic model for visualizing such a design. You will use a `glutWireCube` as the only building primitive. The requirement is that there must be 60 floors. Each floor is in the shape of a rectangular box where the ratio of length to width to height is 100:10:1. The twisted tower must complete two full (360°) counterclockwise rotation from the 1st floor to the 60th floor. The tower is to be centered at the global origin, with the length aligned with the global x axis and the width aligned with the global y axis (for the 1st floor). The view point must be in the first quadrant, elevated above the tower, and looking down. Recall that `glutWireCube` generates a cube of size 1 centered at the global origin.

There are at least two ways to do it: (1) Each floor is treated totally independently. That is, each floor is scaled, translated, and rotated by itself relative to the global coordinate system, or (2) the construction is to be incremental. That is, each floor is to be rotated and translated relative to the floor just beneath it, and only the 1st floor is constructed relative to the global system. Fill in the the missing detail in the following program snippets for both methods, including the parameters for the `gluLookAt`.



Figure 1: A twisted tower design.

```
glMatrixMode(GL_MODELVIEW);
glLoadIdentity();
gluLookAt(eye, center, up);
// each floor is constructed independently in the global system
glutWireCube(); // you can use glutWireCube multiple times if needed
```

```
glMatrixMode(GL_MODELVIEW);
glLoadIdentity();
gluLookAt(eye, center, up);
// each floor is constructed relative to the floor just beneath it
glutWireCube(); // you can use glutWireCube multiple times if needed
```

Question If you have a mobile device that is capable of 2^{12} color combination per pixel (instead of 2^{24} color combination, with 8 bits for red, 8 bits for green, and 8 bits for blue).

a) How many colors can the mobile device display per pixel?

b) How can you display a true-color image (with 2^{24} color combination) on such a display without blowing the image up (one pixel in the image is displayed as one pixel on the screen)? Your scheme must work for any kind of photographs without knowing any special color content requirements.

c) If you know that the pictures you are going to display contain close-up facial shots, which color channel(s) should you give more number of bits and which color channel(s) should you give fewer number of bits? Explain your answers briefly.

d) If you know that the pictures you are going to display are images of a camping trip up in a verdant mountain, which color channel(s) should you give more number of bits and which color channel(s) should you give fewer number of bits? Explain your answers briefly.