

Pset 1

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Problem 1

Closeup:



Figure 1: Closeup picture

Orthographic Projection:

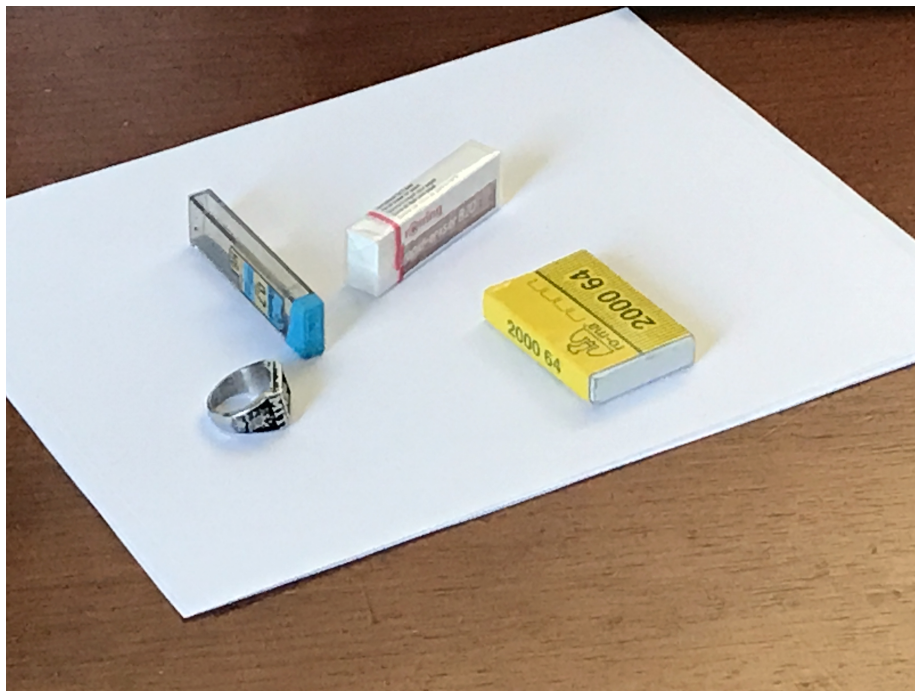


Figure 2: Orthographic Projection

We can easily see that the lines in all the rectangular objects (lead holder, eraser and yellow staple box) are much more parallel in the second case than in the first one.

Problem 2

$$x = X \quad (1)$$

$$y = \cos(\theta)Y - \sin(\theta)Z \quad (2)$$

When projecting a 3D picture in 2D, from a view point perpendicular to a line on the Y-Z plane, we will see be perpendicular to the X axis and thus see it unchanged. Hence $x = X$. On the other hand, both the Y and Z axis will be linearly combined in the new y axis depending on the viewpoint angle, θ . In specific, since the angle θ is measured from the Z axis, its 2D projection will be $\sin(\theta)Z$ downwards and the the 2D projection of the Y axis will be $\sin(90 - \theta)Y = \cos(\theta)Y$ upwards. Thus, adding the two components, we get:

$$y = \cos(\theta)Y - \sin(\theta)Z$$

Problem 3

a) Vertical Edge

Similarly to computing the derivative of Y, the derivative of Z along the edge will be:

$$\frac{\partial Z}{\partial y} = -\frac{1}{\sin(\theta)}$$

b) Horizontal Edge

A horizontal 3D edge will be constant, thus

$$\frac{\partial Z}{\partial t} = 0$$

Where t is the tangent to the edge.

c) Second Derivative Constraints

$$\frac{\partial^2 Z}{\partial^2 x} = 0$$

$$\frac{\partial^2 Z}{\partial^2 y} = 0$$

$$\frac{\partial^2 Z}{\partial x \partial y} = 0$$

Problem 4

The two lines changed are the following:

```
Aij(:, :, c) = -ny*[-1, 0, 1; -2, 0, 2; -1, 0, 1]/8+nx*[-1 -2 -1; 0 0 0; 1 2 1]/8;
Aij(:, :, c) = 0.1*[0, -1, 0; 0, 2, 0; 0, -1, 0];
```

Problem 5

Please see below the attached outputs for images 1 and 2 for 2 different outputs:

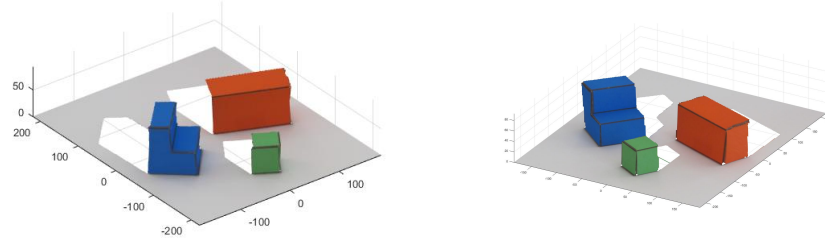


Figure 3: Image 1

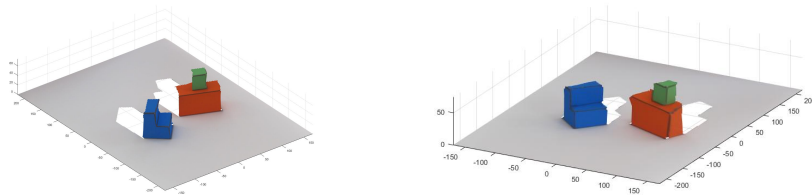


Figure 4: Image 2

Problem 6

The two last images provided (image 3 and 4 fail in the reconstruction. Attached are the fail reconstructions of image 3 in 2 viewpoints:

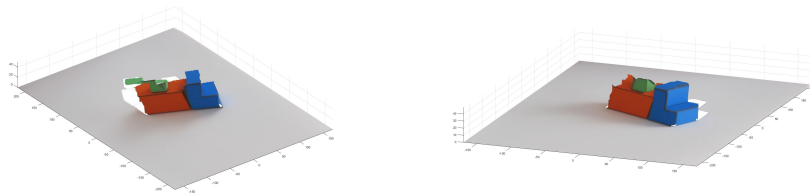


Figure 5: Failed reconstruction of Image 3

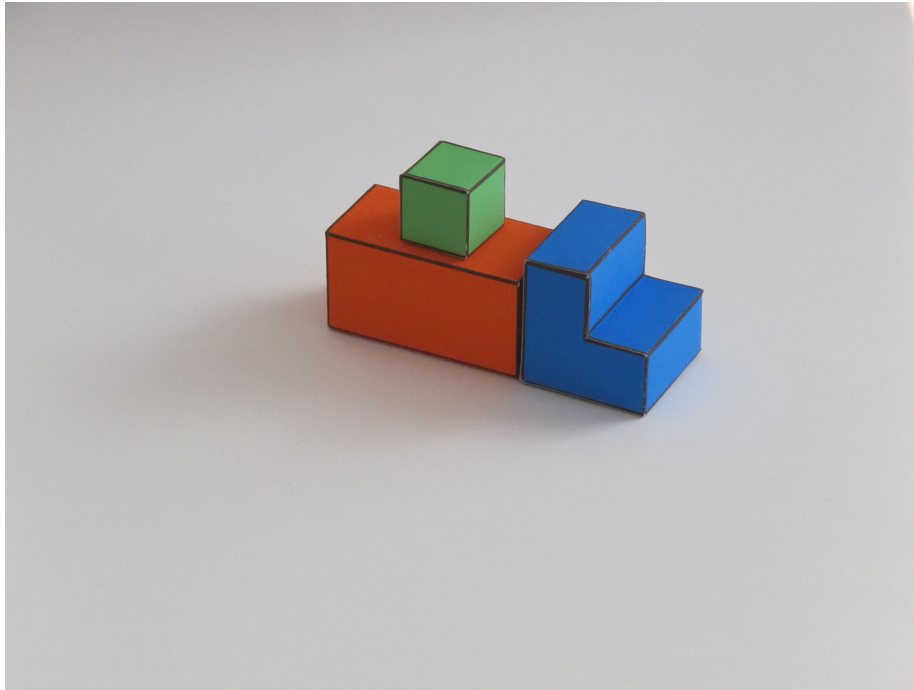


Figure 6: original Image 3

This image has not been reconstructed properly because it is not a orthographic projection. In other words, all the edges are not parallel to each other.