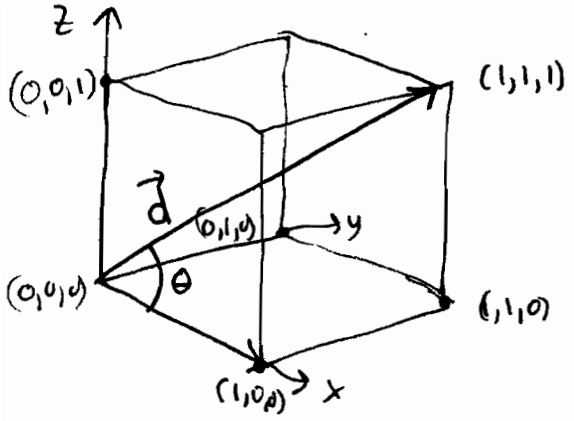
S12.2.51 Find the angle between a diagonal of a cube and one of its edges.



"size doesn't matter"
so we might as well use the unit cube.

$\vec{d} = \langle 1,1,1 \rangle$ diagonal

$|\vec{d}| = \sqrt{1+1+1} = \sqrt{3}$

$\hat{d} = \frac{1}{\sqrt{3}}\langle 1,1,1 \rangle$ unit vector

edge: $\hat{i} = \langle 1,0,0 \rangle$ unit vector already

$$\cos\theta = \hat{i} \cdot \hat{d} = \langle 1,0,0 \rangle \cdot \frac{\langle 1,1,1 \rangle}{\sqrt{3}} = \frac{1+0+0}{\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$$\theta = \arccos\left(\frac{1}{\sqrt{3}}\right) \approx 0.95530 \text{ radians}$$

$$\approx 54.734 \text{ degrees}$$