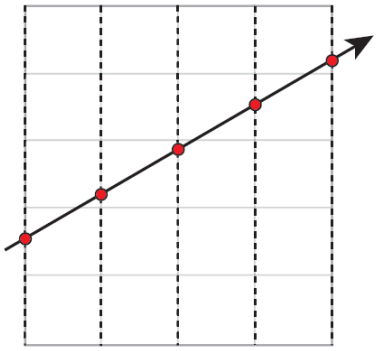
CS 419: Production Rendering Fall 2018
In-class Worksheet 4

Uniform Grids

1. To test a ray against objects stored in a uniform grid, we need to follow the path of a ray through the cells. One way to do this is to loop over all the intersections of the ray with the grid cell walls. Each time a new cell is entered the cell index is computed and the cell contents can then be accessed.



We need to compute the spacing in the parameter t between successive intersections of cell walls in the x,y, and z directions. For this problem, consider just the x-direction:
$dt_x = (t_{max} - t_{min})/n_x$
where n_x is the number of cells in the x direction.

With a partner, describe in words how you could compute t_{max} and t_{min}.

```
double a = 1.0 / dx;
        if (a >= 0) {
                tx_min = (x0 - ox) * a;
                tx_max = (x1 - ox) * a;
        }
        else {
                tx_min = (x1 - ox) * a;
                tx_max = (x0 - ox) * a;
        }
```

2. Suppose you have uniform grid with a minimum corner at (0.0, 0.0, 0.0) and maximum corner at (100.0, 50.0, 50.0). The grid has 10 cells along the X axis, 5 cells along the Y axis and 5 cells along the Z axis. How would you calculate the (i,j,k) index of the cell containing the point (10.5, 5.0, 25.0)?

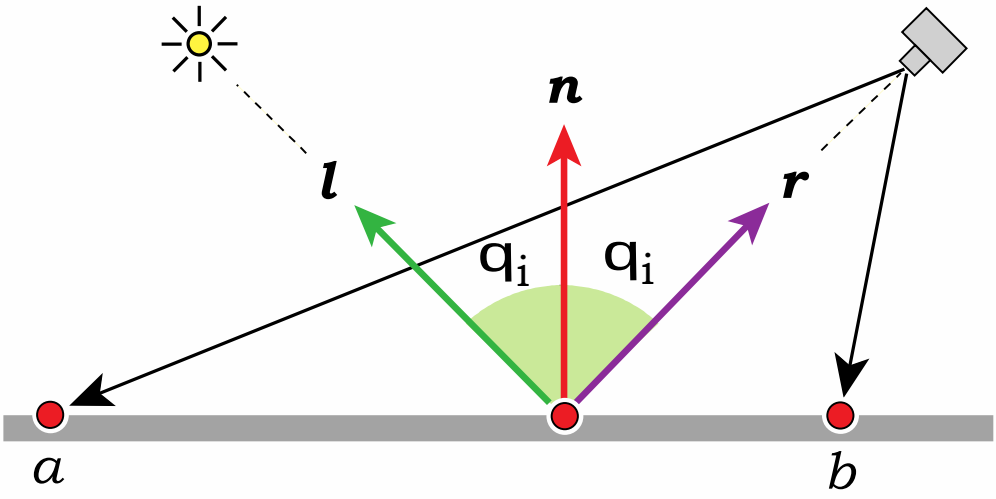
Each cell is 10x10x10 so the point would fall into (1,0,2)

3. What is the Morton code for the cell with index (8, 12, 5)?

8=1000
12=1100
5=0101

Interleaved = 110011000001

Specular Reflection



Sketch **l**, **n**, **r**, ω_o, and α at the hit points a and b above.
Which ray returns the most specular radiance to the camera?

point b, in which the reflection direction is closest to the view vector