

## Homework 2

1.) A driving route where we consider turns can be represented in a grid. A discrete Algorithm such as Dijkstra's would prove to be more efficient as sampling/connecting nodes when the layout is already gridlike, is not optimal.

b.)  $\text{Cost}(t) = \log(t) + l$  ] Keeping track of distance  
 $t = \text{turns}$  } variable  
 $l = \text{length}$  } fixed

2.)  $\lim_{p \rightarrow \infty} \left( \frac{\# \text{ of points in tree}}{\# \text{ of points sampled}} \right)$  - As points sample increases, so does the # of points in the tree, therefore the number of points in the tree reflect the limiting behavior

3.) Example RRT (dist from goal, dist to neighbor)  
 (10, 2)      so if we want to insert  
   /        \        (2, 1) } at the goal it would  
 (8, 3)    (9, 4)    be worst case  $O(\log n)$  for  $n$  nodes  
   /        \        before it can be inserted  
 (6, 1)

4.) Ultrasound distance bandwidth decreases when increasing dynamic range since the speed of sound is dramatically slower than light (343 m/s). It takes much longer to reach its goal surface and bounce off. (bandwidth is the response time)

5.) a.)  $c = 300 \text{ m/s}$

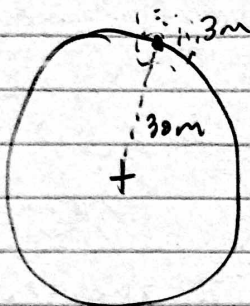
$d = 15 \text{ m}$

$\text{total} = 30 \text{ m}$

$300 = \frac{30}{t} = \frac{30}{.1} = \boxed{.1 \text{ seconds}}$

b.) The speed of light would require a higher bandwidth.

6.)



Precision =  $3 \text{ m}$

Accuracy =  $30 \text{ m}$

b.) 18000 readings per hour

$\frac{18000}{(60)(60)} = 5 \text{ readings per second}$

$\boxed{= 5 \text{ Hz}}$