

Homework 2

1.

a. I would use a discrete algorithm such as A* instead of a sampling based algorithm. It is easier to convert a map that is based on a grid system into a discrete representation. Additionally, they are typically more efficient than sampling based algorithms when computing GPS/mapping routes.

b. $\text{Cost}(x) = l + \log(x)$ where l = length and x = number of turns.

2. As the number of points sampled increases, so too does the number of points in the tree. The limiting behavior of this ratio will be the total number of points in the tree.

3. $O(\log n)$

4. For ultra-sound sensors, they rely on a sound pulse, which can travel at a maximum of 300m/s.

As the dynamic range increases, it takes a longer amount of time for the pulse to bounce off a surface and return to the sensor. The sensor has to wait until the first pulse is received before it can send another one, which results in lower bandwidth.

This is not as much of a factor with laser range scanners, because the speed of light is much faster (300,000km/s), and the sensor can use multiple lasers to measure the distance of an object.

5.

a. It will take $15/300\text{m/s} = 0.05\text{s}$ for the sound pulse to hit the object, and $15/300\text{m/s} = 0.05\text{s}$ for the pulse to return for a total time of 0.1s.

- b. You cannot measure the time it takes with a laser scanner because the speed of light is too fast considering a bandwidth of 10hz. The bandwidth would need to increase in order to measure an obstacle with a distance of 15m.
- 6.
 - a. Accuracy = 30m radius
Precision = circle of 3m diameter
 - b. $18000 \text{ readings/hour} = 300 \text{ readings/min} = 5 \text{ readings/sec}$, which is 5hz.