Robotic HW 2 Chen Hao Cheng

ⓐ I would rather employ a discrete algorithm such as A^* algorithm for minimizing the number of turns between two locations in Boulder.

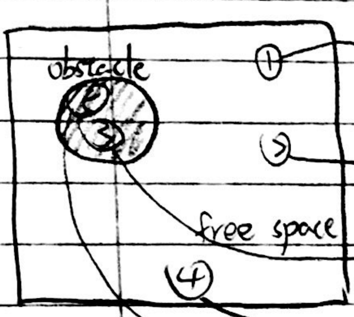
Because A^* algorithm is to pick the node according to a value f which is a parameter equal to the sum of two other parameters, g & h at each step. At each step it picks the node the lowest f and process that node.
Besides, the h is the estimated cost to move from that given node to the final destination. It's often referred to as the heuristic, which is guess.
We don't really know the actual distance and turns until we find the path, there can be many ways to calculate h function.

ⓑ

$A^* \Rightarrow f = l + t$

f: the cost of a node
g: is the cost of path to get to destination
t: the guess of number of turns (heuristic)
(trying to minimize)

② suppose we have an area (A total (including free space & obstacles) and a A_{free} (not including obstacles)



$\frac{1}{1}$ as I throw a dart in first shot

$\frac{2}{2}$ as the second shot

$\frac{2}{3}$ as the third shot

$\frac{3}{4}$ as the fourth

$\frac{3}{5}$ as the fifth

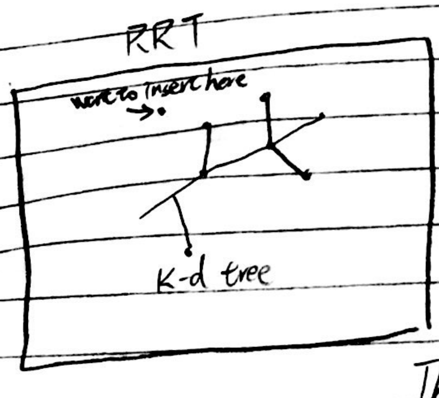
as I throw infinite shots, I would get $\frac{A_{free\ space}}{A_{total}}$ ratio.

③ K-d tree : find median and split into 2 children, repeat, for x and y

insertion for K-d tree:

worst case time : $O(n)$

average time : $O(\lg_2 n)$



since K-d is used, so the K-d tree is structu
, then the time complexity is $\boxed{O(\lg_2 n)}$
, then we want to find nearest-neighbor
, which is one node that's closest and the tree
size is N, meaning we need to run N time
to find neighbor.

Thus, this can be $O(n\lg_2 n)$ or $O(\lg_2 n)$

④ When we increase the range, the bandwidth of a ultra-sound would need to take more time to read back as the sound speed travels $\frac{300m}{1sec}$, besides, we need to times 2 because it's a round trip (go and back). In other words, when we increase distance, then the bandwidth also increase.

However, the laser range scanner doesn't because laser travels close to speed of light. Thus, it doesn't really affect and when the laser range scanner spins, it reflects back immedriatly.

Mayer if we increase the range to 300000 km, then it'll slow down too ??

⑤

$C = \frac{300m}{s}$ sense up = 15m

laser scanner = 10Hz

a) 15m away ÷ 300 m/s

$15m \times \frac{1s}{300m} = 0.05$ second (one way)

2×0.05 second = 0.1 second (get back) (10 Hz)

20
15|300
30
0.05
300|1500

b) 10 Hz = turning off 10 times in 1 second

laser scanner unit = milli second (according to Professor Nicklous)

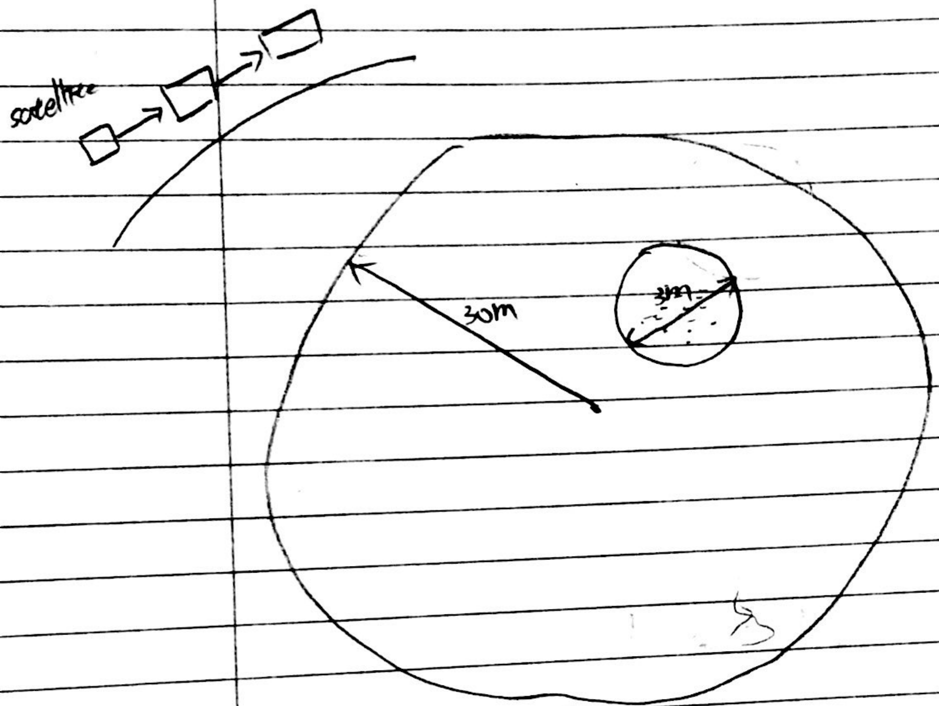
a bandwidth of 10 Hz

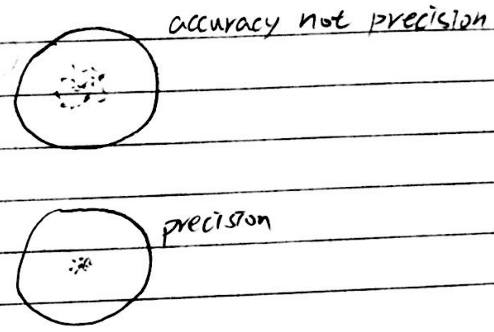
A frequency of 1 hertz means that something happens once a second

$Hz = \frac{1}{sec} \Rightarrow \frac{1}{Hz} = sec$

$10Hz = \frac{1}{sec} \Rightarrow \frac{1}{10Hz} = sec \Rightarrow 0.1\,sec$

⑥ a circle is 3m diameter
satellite's on the horizon' change and the center of this circle moves elsewhere





ⓐ As those sensor provide position within 3m diameter within 30 m radius, they are precision.
As the satellite moves, the 3m diameter circle moves too, then the 30m radius become accuracy.
However, in the long run, then 30m radius becomes accuracy because all 30 m radius have all positions.

⑤ sensor provide $= 18000 \frac{1}{hr}$

$$\frac{18000}{1hr} \times \frac{1hr}{60min} \times \frac{1min}{60sec} = 5 \frac{1}{sec}$$