CSCI 3302

Lab 3

1.

```
10 cm = 3.25

20 cm = 4.43

30 cm = 5.61

40 cm = 10.43

10 cm:

12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,1
2,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12
,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,12,13,13,13,
13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,13,14,1
4,14,14,14,14,14,14,14,14,14,15,15,15,15,15,15,15,15,15,15,15,15,15
,15,15,16,16,16,16,17,18,19

20 cm:

25, 25, 25, 25, 25, 24, 24, 24, 24, 24, 24, 24, 23, 23, 24, 25, 24,
24, 24, 25, 25, 25, 25, 25, 24, 24, 24, 24, 24, 24, 24, 24, 24, 24,
24, 24, 24, 25, 25, 25, 23, 25, 25, 25, 25, 24, 24, 24, 24, 24, 24,
24, 24, 24, 24, 24, 25, 25, 24, 25, 25, 24, 25, 25, 25, 24, 24, 24,
24, 24, 24, 24, 24, 23, 23, 24, 25, 24, 24, 25, 25

30 cm:

35, 35, 35, 34, 34, 34, 35, 35, 35, 46, 34, 34, 34, 34, 34, 34, 35,
35, 35, 36, 35, 35, 35, 32, 35, 35, 32, 35, 35, 35, 34, 34, 34, 35,
35, 35, 46, 34, 34, 34, 34, 34, 34, 35, 35, 35, 36, 35, 35, 35, 32,
35, 35, 32

40 cm:

43, 42, 49, 49, 56, 49, 42, 46, 46, 46, 46, 41, 46, 43, 42, 49, 49,
56, 49, 42, 46, 46, 46, 46, 41, 46, 43, 42, 49, 49, 56, 49, 42, 46,
46, 46, 46, 41, 46
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a.

$$x = \left(\frac{L^2+r_1^2-r_2^2}{2L}\right)$$

$$y = \pm\sqrt{\left(r_1^2 - \left(\frac{L^2+r_1^2-r_2^2}{2L}\right)^2\right)}$$

b.

2. The variance of both x and y should increase as L increases.

3. I would rely on the position estimate only if the odometry estimate was unavailable because 1) the US sensor appears to be far more inaccurate, and 2) provides data that appears to be more erratic than that of the line sensors. That being said, if there is no

line in which to follow, the line following algorithm will be useless. Additionally, only the US sensor accounts for dynamic obstacles, therefore if obstacles are present in the environment, it will be necessary to include implementation of the US sensor for position.

4. Both the line following sensor and the US sensor can calculate bearing/theta in different ways. For line following, it is calculated by either incrementing or decrementing theta as the wheels turn in opposing directions. For the US sensor, theta with respect to an obstacle can be found by observing the amount of offset an obstacle appears on the US readings from center (obstacle directly ahead would have offset of 0 degrees, obstacle at 45 degrees ahead would show a reading of 45 degrees theta). Finding an accurate bearing would be a matter of taking each respective theta calculation from the line following sensor and US sensor, and finding the average of both. This would give you the most accurate bearing.