CSCI 4360/5360 Intelligent Robot Systems
Homework # 9 **Name _____**

The sonar sensor has the maximum detection range of 12 feet, a field of view angle 40^o, (i.e., β is 20^o), and a tolerance range 0.5 feet. MAX_OCCUPIED = 0.98.

At time t_1, the sensor reading is 4 feet:

(a) calculate **$P(occupied|S_{t1})$ and $P(empty|S_{t1})$** for
   - <1> a grid element (element A) that is 4.2 feet away from the robot, and has an angle of 5^o to the center axis,
   - <2> a grid element (element B) that is 2.5 feet away from the robot, and has an angle of 10^o from the center axis.

(b) At time t_2, the robot moves to location 2, and the new sensor reading is 3. At this time element A is 2.2 feet away from the robot, and has an angle of 10^o. Element B is 3 feet away from the robot, and has an angle of 15^o.

(c) At time t_3, the robot moves to a new location, and the sensor reading is 8. At this time element A is 8.5 feet away from the robot, and has an angle of 5^o. Element B is 3 feet away from the robot, and has an angle of 12^o.

(d) At time t_4, the robot moves to the final location, and the sensor reading is 8. At this time element A is 18 feet away from the robot, and has an angle of 5^o. Element B is 3 feet away from the robot, and has an angle of 30^o.

Compute **$P(occupied \mid S_{t4}, S_{t3}, S_{t2}, S_{t1})$** and **$P(empty \mid S_{t4}, S_{t3}, S_{t2}, S_{t1})$** for both element A and element B using the Bayesian approach, assuming we know in advance the space is 40% occupied with obstacles.