Verification 1 – Control

The control verification will evaluate the results of the simulation and the quality of the pseudocode.

Verification 1 will take place during lab 3 in week 5. Please read the checklist carefully, and be 100% prepared to describe the simulation results and pseudocode.

Comparison of open-loop, hybrid and closed-loop control (3 points)

a) Explore three possible control methods and choose the best control parameters for each of them. All the parameters you should change are in the folder *Setup Simulation* in the file *load_control_parameters.m*. Provide the list of parameters values that you have chosen (1 Point):

- Open-Loop Control: number of ticks measured by the reed switch before the robot has to turn, and how much time the robot uses to turn to face the channel. You should work on the parameters:
  - o c1_n_ticks_before_turn
  - o c1_total_time_turning

- Hybrid Control: number of ticks measured by the reed switch before the robot has to turn, how much time the robot uses to turn to face the channel, and the proportional gain used by the orientation feedback control. You should work on the parameters:
  - o c2_n_ticks_before_turn
 - o c2_total_time_turning
  - o c2_Kp

o <u>Closed-Loop Control:</u> Number of waypoints, position (x,y) of the waypoints, and proportional gain used by the orientation feedback control. You should work on the parameters:

- o `c3_position_desired_list`
- o `c3_Kp`
- o `c3_change_target_distance`

** For all the controller types, you should also work on the optimal on and off time for the piston. You can do that by working on the parameters:

- o `piston_time_on`
- o `piston_time_off`

b) The student provides the results of a statistical analysis comparing the simulated competition scores of the three control methods (i.e. 3 <u>t-tests</u>: open-loop vs hybrid, open-loop vs closed-loop, and hybrid vs closed-loop). For this part, use the scores of 20 simulations for each controller.

c) Plot the results of part b) using <u>bar plots</u> indicating the average value and standard deviation for each control method. Also indicate the p-values of your t-test like in the figure below.
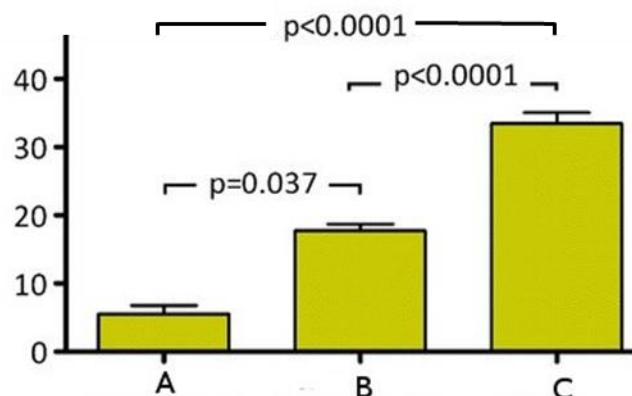
Pseudocode (1 point)

Using a [pseudocode](#) format, describe how you would program the Arduino to collect the data describing your robot's impulse response such that you can use it as an input in the simulation.

Presentation (1 point)

You presented your simulation results and pseudocode on time and within the allotted time given.