First Student ID: 11537608

Second Student ID: 14131209

x0​=(last digit of first student ID mod4)+1

x0=(8 mod4)+1=0+1=1

y0​=(last digit of second student ID mod4)+1

y0​=(9 mod4)+1=1+1=2

R=0.5+∣y0​−x0​∣

R=0.5+∣2−1∣=0.5+1=1.5

So, the obstacle is defined by:

(xo,yo,R) = (1,2,1.5)(x0, y0, R) = (1, 2, 1.5)(x0​,y0​,R) = (1,2,1.5)

Task 2.2

A math formula with black text

AI-generated content may be incorrect.

A white sheet with black and white text

AI-generated content may be incorrect.

A math equations on a white background

AI-generated content may be incorrect.

A black and white math equation

AI-generated content may be incorrect.

A math equations on a white background

AI-generated content may be incorrect.

A white background with black text

AI-generated content may be incorrect.

The relative degree of B with respect to control inputs a and ω is:2

**Why Do We Need a Higher-Order Control Barrier Function (HOCBF)?**

Because:

* Standard Control Barrier Functions (CBFs) are only suitable when the relative degree is 1, meaning control inputs appear in the first derivative of the barrier function.
* In our case, the inputs only show up in the second derivative ().

Therefore, to ensure that the system remains in the safe set B(x,y) ≥ 0, and to incorporate the control inputs aaa and ω into the safety condition, we must use a Higher-Order Control Barrier Function (HOCBF).

2.3

A math equations and formulas

AI-generated content may be incorrect.

A white background with black text

AI-generated content may be incorrect.

When both V1V\_1V1​ and V2V\_2V2​ approach 0, the robot reaches the goal position (), is oriented toward the goal direction, and moves at the nominal velocity of 1 m/s.

A math equations with black text

AI-generated content may be incorrect.

A math problem with equations

AI-generated content may be incorrect.

A white background with black text

AI-generated content may be incorrect.

A white paper with black text

AI-generated content may be incorrect.

A distance-only CLF is insufficient because it cannot stabilize both position and orientation.

The chosen V1V\_1V1​ incorporates orientation error and ensures the robot is aligned with the goal direction.