

## Lab 5: Scan Matching

Instructor: INSTRUCTOR

Name: STUDENT NAME, StudentID: ID



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**Course Policy:** Read all the instructions below carefully before you start working on the assignment, and before you make a submission. All sources of material must be cited. The University Academic Code of Conduct will be strictly enforced.

**THIS IS A GROUP ASSIGNMENT.** Submit one from each team.

## 1 Theoretical Questions

1.  $M_i = \begin{pmatrix} 1 & 0 & p_{i0} & -p_{i1} \\ 0 & 1 & p_{i1} & p_{i0} \end{pmatrix}$

- (a) Show that  $B_i := M_i^T M_i$  is symmetric.

**Solution:**

Answer here

- (b) Demonstrate that  $B_i$  is positive semi-definite

**Solution:**

Answer here

2. The following is the optimization problem:

$$x^* = \operatorname{argmin}_{x \in \mathbb{R}^4} \sum_{i=1}^n \|M_i x - \pi_i\|_2^2 \quad \text{s.t.} \quad x_3^2 + x_4^2 = 1$$

- (a) Find the matrices  $M$ ,  $W$  and  $g$  which give you the formulation

$$x^* = \operatorname{argmin}_{x \in \mathbb{R}^4} x^T M x + g^T x \quad \text{s.t.} \quad x^T W x = 1$$

**Solution:**

Answer here

(b) Show that  $M$  and  $W$  are positive semi definite. **Solution:**

Answer here