In-Class Test (#1)

Name _____
Student Number _____

ROBOTICS 4K03/6K03

INSTRUCTOR NAME: Fengjun Yan

DURATION OF EXAMINATION: 50 MINS

Oct. 04th, 2021

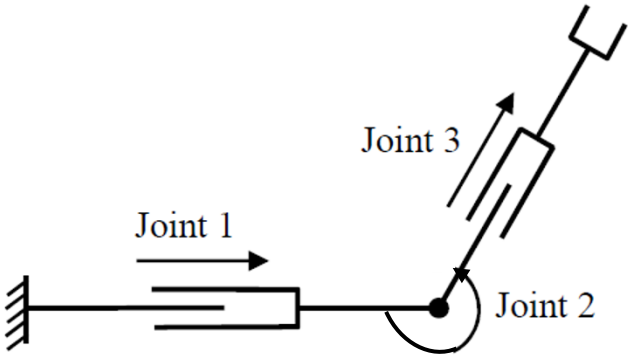
THIS EXAMINATION PAPER INCLUDES 1 PAGES AND 3 QUESTIONS. YOU ARE RESPONSIBLE FOR ENSURING THAT YOUR COPY OF THE PAPER IS COMPLETE. BRING ANY DISCREPANCY TO THE ATTENTION OF YOUR INVIGILATOR.

Use of Casio FX-991 calculator. This paper must be returned with your answers.

Questions:
1. (20 points) Give the definitions of the following terms in robotics.

1) End effector
2) Repeatability
3) Dextrous workspace
4) Major axes

2. (35 points) Draw the workspace for a planar PRP robot with the following properties: range of first joint is 0.5m-2m, range of second joint is 210° to 300°, range of third joint is 0.5m to 1m.



3. (45 points)
(a) Calculate the transformation matrix representing a series of transformations:
Step 1. a rotation of -45° about the Y-axis of reference frame,
Step 2. a translation of [2, -4, 5] along the X, Y, and Z axes of the current frame,
Step 3. a rotation of 60° about X-axis of reference frame.
(b) In Step 3, to achieve the same transformation (same physical movement), what is the transformation matrix relative to the current frame in step 3? (Note: For question (b), the symbolic solution is ok.)