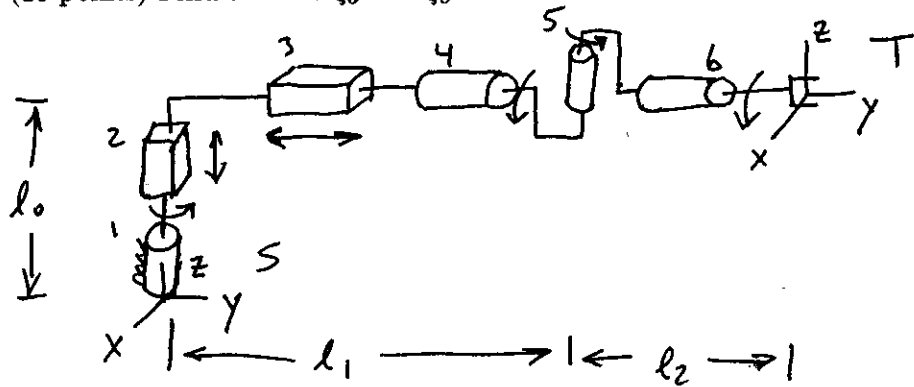


EE1 B10E 125 PRACTICE PROBLEMS <sup>2005</sup>

- 1a. (10 points) For the manipulator shown, find the twist coordinates  $\xi_i$  and  $g_{st}(0)$  using the product of exponentials approach. Use the base and tool frames shown.
- b. (10 points) Find  $e^{\xi_i \theta_i}$  for  $\xi_3$  and  $\xi_5$ .



- 2a. (15 points) Show how you would solve for the inverse kinematics of the manipulator shown in Problem 1, given a desired  $g_d$ . Use subproblems (including subproblem 5) or geometric arguments as you wish. How many solutions are possible (ignoring physically impossible solutions, i.e., negative displacements)?
- b. (5 points) Suppose the sequence of twists 3 and 4 were reversed, i.e., joint 3 became revolute and joint 4 became prismatic (but both still about y axis). Would this change your solution from part (a)? Why or why not?



3. FIND THE BODY JACOBIAN FOR PROBLEM 1 FROM MIDDLEM 2