Due: Monday, 9/10/01

1. Fill in the table of Denavit-Hartenburg parameters for the three-link spherical robot shown below.

Joint	q_I	d_i	a_i	α_i
1				
2				
3				

2. Use the results from the table above and the D-H matrix given on page 18 of your notes to write the three Denavit-Hartenburg transformation matrices (one for each joint) for the spherical robot shown below.

3. Find the overall transformation matrix which relates the final coordinates ($x_3y_3z_3$) to the "base" coordinates ($x_0y_0z_0$) for the spherical robot shown below.

4. Check the spherical robot in the following configurations and end-effector location

   a) $\theta_1 = 0°$, $d_1 = 3$, $\theta_2=90°$, $d_3 = 4$

   b) $\theta_1 = 90°$, $d_1 = 3$, $\theta_2=60°$, $d_3 = 4$

   c) $\theta_1 = 45°$, $d_1 = 3$, $\theta_2=120°$, $d_3 = 4$

$$\begin{bmatrix} x_3 \\ y_3 \\ z_3 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 0 \\ 1 \end{bmatrix}$$

"Checking" involves:

- substitute values into overall transformation matrix,
- sketch robot in configuration - either isometric or 3 orthographic views,
- identify position of final coordinate system,
- identify location of end-effector point $[x_3\, y_3\, z_3]^T$ in the base coordinates, $[x_0\, y_0\, z_0]^T$,
- identify direction cosines for final coordinate system.