SOLUTION TO HW#1

Problem 1.1

\( P1.1 \)

(a) \( n = 6 \)

- turning pairs, 5 ;
- sliding pair, 1 ;
- rolling pair, 1 \( (\delta_1 = 5 + 1 + 1 = 7) \)
- 2 dot pairs, \( (\delta_2 = 0) \)

\[ m = 3(n-1) - 2\delta_1 - \delta_2 \]
\[ = 3(6-1) - 2 \times 7 = 1 \]

Problem 1.2a & 1.2b

\( P1.2 \)

(a) \( n = 4, \delta_1 = 4, \delta_2 = 0 \)

\[ m = 3(n-1) - 2\delta_1 - \delta_2 \]
\[ = 3(4-1) - 2 \times 4 = 1 \]

(b) \( n = 6, \delta_1 = 7, \delta_2 = 0 \)

\[ m = 3(n-1) - 2 \times 7 = 1 \]
Problem 1.5a

(a) \( n = 4 \)

- turning pairs, 3;
- sliding pairs, 0;
- rolling pairs, 2 \( (j_1 = 3 + 0 + 2 = 5) \)
- 2 dot pairs, 0 \( (j_2 = 0) \)

\[
m = 3(n-1) - 2j_1 - j_2 \\
= 3(4-1) - 2 \times 5 - 0 = -1
\]

- however, the above calculation incorporates two redundant constraints
- distances between base pivots of links 2 and 3, and between base pivots of links 3 and 4 are accounted for twice (once by rolling pairs between links 2 and 3, and between links 3 and 4; and then again by base pivots of links 2 and 3, and base pivots of links 3 and 4).
- by inspection, \( m = 1 \).