

Scenario Full

First 5 seconds

home → pick 1

Second 5 seconds

pick 1 → home

Third

0-5 seconds

✓ home → pick 1

5-10 seconds

✓ pick 1 → place 1

10-15 seconds

✓ place 1 → home

15-20 seconds

✓ home → pick 2

20-25 seconds

✓ pick 2 → place 2

25-30 seconds

✓ place 2 → home

30-35 seconds

home → pick 3

35-40 seconds

pick 3 → place 3

40-45 seconds

place 3 to home

Have 7 important positions

1. pick 1

2. pick 2

3. pick 3

4. place 1

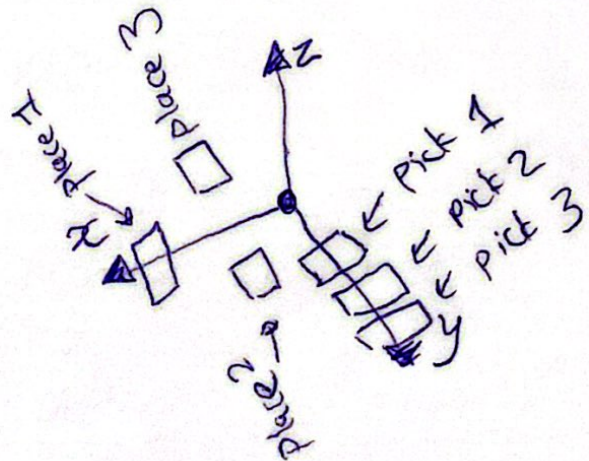
5. place 2

6. place 3

7. home

→ could on back

Must output PO & P for each one



1. home position

$$l_1 = 0.044 \quad l_3 = 0.134 \\ l_2 = 0.14 \quad l_4 = 0.09$$

$$x = -0.25 \quad y = -0.05354 \quad z = 0.2711$$

$$q = [0.2110, 0.4222, 0.7983, -0.2849]$$

2. pick 1 position

$$x = 0 \quad y = -0.1 \quad z = 0.01$$

$$q = [1.5708 - 0.1756, 2.4252, 0.661, 0.65] = [1.5708 - 0.1756, 2.4252, 0.661, 0.65]$$

3. pick 2 position

$$x = 0 \quad y = -0.2 \quad z = 0.01$$

$$q = [1.5708, 0.4530, 1.7031, 0.6804]$$

4. pick 3 position

$$x = 0 \quad y = -0.3 \quad z = 0.01$$

$$q = [1.5708, 0.9165, 1.1561, 0.1522] = [1.5708, 0.9165, 1.1561, 0.1522]$$

5. place 1 position

$$x = -0.3 \quad y = 0 \quad z = 0.01$$

$$q = [0, 0.9119, 1.2321, -0.0232]$$

6. place 2 position

$$x = -0.1 \quad y = -0.1 \quad z = 0.01$$

$$q = [0.7854, 0.1237, 2.138, 0.6458]$$

7. place 3 position

$$x = -0.1 \quad y = 0.1 \quad z = 0.01$$

$$q = [-0.7854, 0.0975, 2.1816, 0.5691]$$

① home → pick 1 (0-5 seconds)

$$q_{\text{home}} = [0.2110, 0.4222, 0.7983, -0.2849]$$

$$q_{\text{pick1}} = [1.5708, -0.1756, 2.4252, 0.661]$$

$$C_0 = \begin{bmatrix} 0.2110 \\ 0.4222 \\ 0.7983 \\ -0.2849 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} 0.1632 \\ -0.0717 \\ 0.1952 \\ 0.1135 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} -0.0288 \\ 0.0096 \\ -0.0265 \\ -0.0151 \end{bmatrix}$$

② pick 1 → place 1 (5-10 seconds)

$$q_{\text{pick1}} = [1.5708, -0.1756, 2.4252, 0.661]$$

$$q_{\text{place1}} = [0, 0.9119, 1.2321, -0.0232]$$

$$C_0 = \begin{bmatrix} 1.5708 \\ -0.1756 \\ 2.4252 \\ 0.6610 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} -0.1885 \\ 0.1305 \\ -0.1432 \\ -0.0821 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} 0.0251 \\ -0.0174 \\ 0.0191 \\ 0.0169 \end{bmatrix}$$

③ place 1 → home (10-15 seconds)

$$q_{\text{place1}} = [0, 0.9119, 1.2321, -0.0232]$$

$$q_{\text{home}} = [0.2110, 0.4222, 0.7983, -0.2849]$$

$$C_0 = \begin{bmatrix} 0 \\ 0.9119 \\ 1.2321 \\ -0.0232 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} 0.0253 \\ -0.0558 \\ -0.0521 \\ -0.0314 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} -0.0034 \\ 0.0078 \\ 0.0069 \\ 0.0042 \end{bmatrix}$$

④ home → pick 2 (15-20 seconds)

$$q_{\text{home}} = [0.2110, 0.4222, 0.7983, -0.2849]$$

$$q_{\text{pick2}} = [1.5708, 0.4530, 1.7031, 0.6804]$$

$$C_0 = \begin{bmatrix} 0.2110 \\ 0.4222 \\ 0.7983 \\ -0.2849 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} 0.1632 \\ 0.0037 \\ 0.1086 \\ 0.1158 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} -0.0218 \\ -4.928 \times 10^{-4} \\ -0.0145 \\ -0.0154 \end{bmatrix}$$

⑤ pick 2 → place 2 (20-25 seconds)

$$q_{pick2} = [1.5708, 0.4530, 1.7031, 0.6804]$$

$$q_{place2} = [0.7854, 0.1237, 2.138, 0.6458]$$

$$G = \begin{bmatrix} 1.5708 \\ 0.4530 \\ 1.7031 \\ 0.6804 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} -0.0942 \\ -0.0395 \\ 0.0522 \\ -0.0043 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} 0.0126 \\ 0.0053 \\ -0.007 \\ 5.526e^{-4} \end{bmatrix}$$

⑥ place 2 → home (25-30 seconds)

$$q_{place2} = [0.7854, 0.1237, 2.138, 0.6458]$$

$$q_{home} = [0.2110, 0.4222, 0.7983, -0.2849]$$

$$G = \begin{bmatrix} 0.7854 \\ 0.1237 \\ 2.1380 \\ 0.6458 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} -0.0689 \\ 0.0358 \\ -0.1608 \\ -0.1117 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} 0.0092 \\ -0.0048 \\ 0.0214 \\ 0.0149 \end{bmatrix}$$

⑦ home → pick 3 (30-35 seconds)

$$q_{home} = [0.2110, 0.4222, 0.7983, -0.2849]$$

$$q_{pick3} = [1.5708, 0.9165, 1.1561, 0.1522]$$

$$G = \begin{bmatrix} 0.2110 \\ 0.4222 \\ 0.7983 \\ -0.2849 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} 0.1632 \\ 0.0593 \\ 0.0429 \\ 0.0525 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} -0.0218 \\ -0.0079 \\ -0.0057 \\ -0.007 \end{bmatrix}$$

⑧ pick 3 → place 3 (35-40 seconds)

$$q_{pick3} = [1.5708, 0.9165, 1.1561, 0.1522]$$

$$q_{place3} = [-0.7854, 0.0975, 2.1816, 0.5691]$$

$$G = \begin{bmatrix} 1.5708 \\ 0.9165 \\ 1.1561 \\ 0.1522 \end{bmatrix}$$

$$C_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C_2 = \begin{bmatrix} -0.2827 \\ -0.0983 \\ 0.1231 \\ 0.0500 \end{bmatrix}$$

$$C_3 = \begin{bmatrix} 0.0377 \\ 0.0131 \\ -0.0164 \\ -0.0067 \end{bmatrix}$$

⑨ place 3 → home (40-45 seconds)

$$q_{place3} = [-0.7854, 0.0975, 2.1816, 0.5691]$$

$$q_{home} = [0.2110, 0.4222, 0.7983, -0.2849]$$

$$G = [-0.7854, 0.0975, 2.1816, 0.5691]^T$$

$$C_2 = [0.1916, 0.0391, -0.1601, -0.1025]^T$$

$$C_3 = [-0.0159, -0.0052, 0.0022, 0.017]^T$$