Answer Sheet

Index No: 210204R

1. Homogeneous transformation matrix H_1^0 for 3.4.

$$\begin{bmatrix} 0 & -1 & 0 & 2 \\ 1 & 0 & 0 & 3 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

2. MATLAB code for 3.1 ~ 3.6.

```
%3.1

% Create a new figure
figure;

% Plot the default 3D coordinate frame {0}
hold on;
trplot(eye(3), 'frame', '0', 'color', 'b');  % Identity matrix for frame {0}

% Limit the plot area for X, Y, and Z to [-1, 2]
axis([0 4 0 4 0 3]);

% Enable the grid
grid on;
view(3)
```

```
% 3.2

R_0_in_1 = eye(3)*rotz(pi/2)
 t_0_in_1 = [2;3;1]
 q_in_0 = [2;3;1]
```

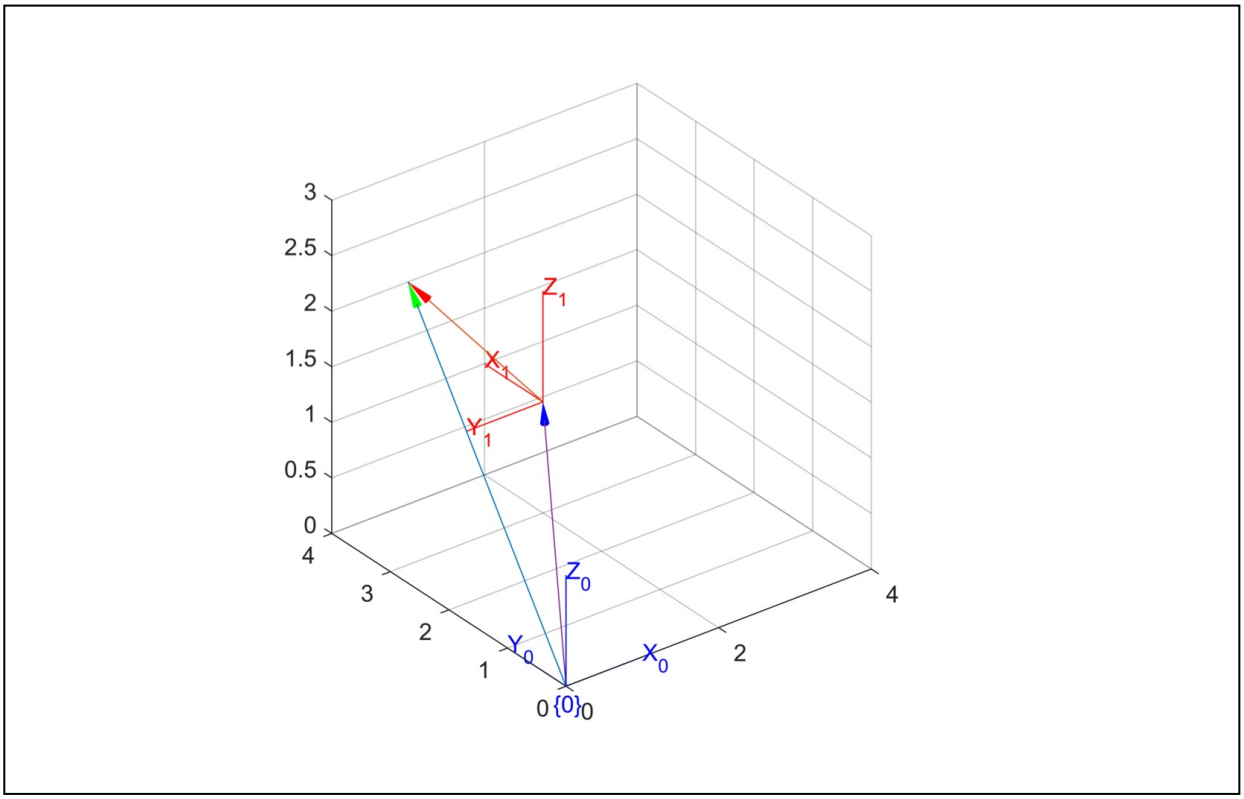
```
 % 3.3

 plot_arrow([0,0,0],[2,3,1], 'b')
```

```
% 3.4

H_0_in_1 = rt2tr(R_0_in_1,t_0_in_1)
 hold on;
 trplot(H_0_in_1, 'frame', '1', 'color', 'r');  % Identity matrix for frame {1}

 % Limit the plot area for X, Y, and Z to [-1, 2]
 axis([0 4 0 4 0 3]);

 % Enable the grid
 grid on;
 view(3)
```

```
 % 3.5

 p_in_1 = [1;1;1]
p_1_in_0 = H_0_in_1*e2h(p_in_1)
plot_arrow([0,0,0],h2e(p_1_in_0), 'g')
```

```
 % 3.6

 plot_arrow([2,3,1],h2e(p_1_in_0), 'r')
```

3. Final output MATLAB figure for the operations in 3.1 ~ 3.6.



4. Homogeneous transformation matrix H_0^1 for 3.8.

```
     0     1     0    -3
    -1     0     0     2
     0     0     1    -1
     0     0     0     1
```

5. t_0^1 for 3.10.

```
t_1_in_0 = 3×1
    -3
     2
    -1
```

6. MATLAB code for 3.7 ~ 3.11.

```
% 3.7

% Create a new figure
figure;

% Plot the default 3D coordinate frame {0}
hold on;
trplot(eye(3), 'frame', '1', 'color', 'r');  % Identity matrix for frame {0}

% Limit the plot area for X, Y, and Z to [-1, 2]
axis([-4 2 -1 3 -2 2]);

% Enable the grid
grid on;
view(3)

plot_arrow([0,0,0],[1,1,1], 'r')
```

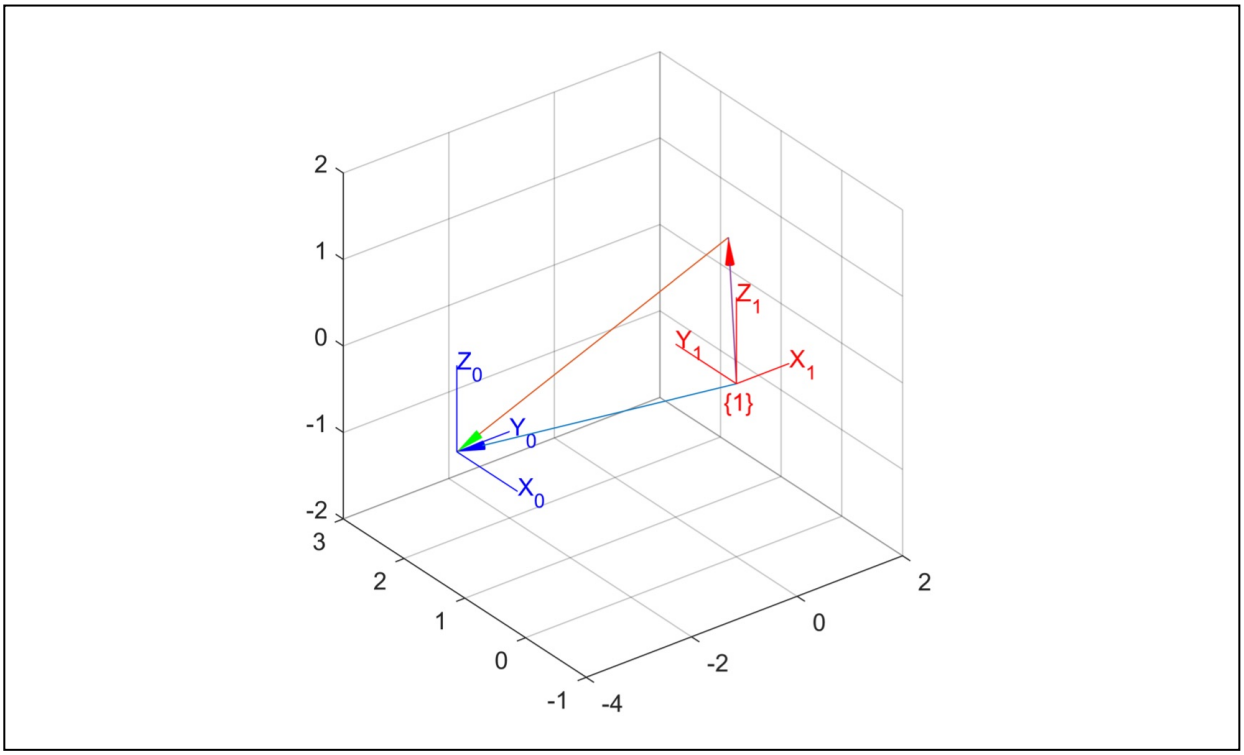
```
% 3.8

H_1_in_0 = inv(H_0_in_1)
```

```
% 3.9

% Plot the default 3D coordinate frame {0}
hold on;
trplot(H_1_in_0, 'frame', '0', 'color', 'b');  % Identity matrix for frame {1}

% Limit the plot area for X, Y, and Z to [-1, 2]
axis([-4 2 -1 3 -2 2]);

% Enable the grid
grid on;
view(3)
```

```
% 3.10
t_1_in_0 = H_1_in_0(1:3,4)

plot_arrow([0,0,0],t_1_in_0, 'b')
```

```
% 3.11
plot_arrow(p_in_1,t_1_in_0, 'g')
```

7. Final output MATLAB figure for the operations in 3.7 ~ 3.11.



8. Homogeneous transformation table.

Requirement	MATLAB script to satisfy the requirement	Homogeneous transformation matrix result

$o_0x_0y_0z_0$ to $o_1x_1y_1z_1$	`T_1_in_0 = rt2tr(eye(3), [0,1,1])`	`T_1_in_0 = 4×4`
		`1 0 0 0`
		`0 1 0 1`
		`0 0 1 1`
		`0 0 0 1`

$o_0x_0y_0z_0$ to $o_2x_2y_2z_2$	`trplot(T_1_in_0, 'frame', '1', 'color', 'b');`
	`T_2_in_0 = rt2tr(eye(3), [-0.5,1.5,1])`
		`T_2_in_0 = 4×4`
		`1.0000 0 0 -0.5000`
		`0 1.0000 0 1.5000`
		`0 0 1.0000 1.0000`
		`0 0 0 1.0000`

$o_0x_0y_0z_0$ to $o_3x_3y_3z_3$	`trplot(T_2_in_0, 'frame', '2', 'color', 'b');  % I`
	`T_3_in_0 = rt2tr(roty(pi)*rotz(pi/2),[-0.5,1.5,3])`
		`T_3_in_0 = 4×4`
		`0 1.0000 0 -0.5000`
		`1.0000 0 0 1.5000`
		`0 0 -1.0000 3.0000`
		`0 0 0 1.0000`