

Homework 2 - Jasen Carroll

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Question 1

Part i

```
clear
clc
syms x y % let x = theta and y = phi
Rz = [cos(x) -sin(x) 0; sin(x) cos(x) 0; 0 0 1]; % Rotation about the z axis
Rx = [1 0 0; 0 cos(y) -sin(y); 0 sin(y) cos(y)]; % Rotation about the y axis
R = Rz*Rx
```

```
R =
[ cos(x), -cos(y)*sin(x), sin(x)*sin(y)]
[ sin(x), cos(x)*cos(y), -cos(x)*sin(y)]
[ 0, sin(y), cos(y)]
```

Part ii

R = Rx*Rz % The resulting rotation matrix is not the same as the previous

```
R =
[ cos(x), -sin(x), 0]
[ cos(y)*sin(x), cos(x)*cos(y), -sin(y)]
[ sin(x)*sin(y), cos(x)*sin(y), cos(y)]
```

Part iii

```
x = 45*(pi/180);
y = 60*(pi/180);
Rz = [cos(x) -sin(x) 0; sin(x) cos(x) 0; 0 0 1];
Rx = [1 0 0; 0 cos(y) -sin(y); 0 sin(y) cos(y)];
R = Rz*Rx
```

```
R =
0.7071 -0.3536 0.6124
0.7071 0.3536 -0.6124
0 0.8660 0.5000
```

Question 2

```
clear
```

```
syms x y % let x = theta and y = phi
A = [cos(y) 0 sin(y) 1; sin(y)*sin(x) cos(x) -cos(y)*sin(x) 0;
-sin(y)*cos(x) sin(x) cos(y)*cos(x) 0; 0 0 0 1];
B = inv(A)
```

```
B =
[ cos(y),      cos(x - y)/2 - cos(x + y)/2, sin(x - y)/2 - sin(x + y)/2, -cos(y)]
[      0,      cos(x),      sin(x),      0]
[ sin(y), - sin(x - y)/2 - sin(x + y)/2, cos(x - y)/2 + cos(x + y)/2, -sin(y)]
[      0,      0,      0,      1]
```

Question 3

Transformation Matrix

```
clear
x = 90*(pi/180); % let x = theta
y = 180*(pi/180); % and y = phi
Ry = [cos(x) 0 -sin(x); 0 1 0; sin(x) 0 cos(x)]; % Rotation about the z axis
Rx = [1 0 0; 0 cos(y) -sin(y); 0 sin(y) cos(y)]; % Rotation about the y axis
T = Ry*Rx
```

```
T =
0.0000    -0.0000    1.0000
0    -1.0000   -0.0000
1.0000    0.0000   -0.0000
```

Ranges from x0, y0 and z0

```
Min = [ 2; -3; 5]
Max = [15; -20; 35]
% Therefore the reachable work space seems to be 15 in the positive x0
% direction, 20 in the negative y0 direction and 35 in the positive z0
% direction.
```

```
Min =
2
-3
5
Max =
15
-20
35
```

Question 4 - Fibonacci Series

References - Yahoo Answers, [Matlab Help Forum](#)

```
clear
```

First 10 values

```
length=10; %How long the series needs to be
F=zeros(length,1); %Creating vector for numbers
F(1)=0; % Establishing the first and second values of the vector being
F(2)=1; % F(0) = F(1) = 1
for i=3:length % for loop from the next needed vector until length
    F(i)=F(i)+F(i-1)+F(i-2); % Fibonacci Series itself
```

```
end
F % Prints F containing the first 10 numbers of the series
```

```
F =
    0
    1
    1
    2
    3
    5
    8
   13
   21
   34
```

Even Numbers

```
length=21; % The first 6 even numbers occur in the first 21 numbers of the
            % Fibonacci Series
F=zeros(length,1); %Creating vector for numbers
e=zeros(6,1); %Creating vector for even numbers
F(1)=0; % Establishing the first and second values of the vector being
F(2)=1; % F(0) = F(1) = 1
k=0; % will be used as a counter inside the loops
for i=3:length % for loop from the next needed vector until length
    F(i)=F(i)+F(i-1)+F(i-2); % Fibonacci Series itself
    if (mod(F(i),2)==0) % if the number is even
        e(1+k,1)=F(i); % it will get added to the even vector
        k=k+1; % counter used to put values in correct location of vector e
    end
end
e % Prints e containing the first 6 even values of the Fibonacci Series
```

```
e =
     2
     8
    34
   144
   610
  2584
```

Question 5 - Estimating PI

```
k = 0;
PI = 0;
for (k=0:1000000)
    k+1;
    PI = PI+4*(((-1)^k)/(2*(k)+1));
end
k
PI
```

```
k =
    1000000
PI =
    3.1416
```