```matlab
% MEC529 Matlab Midterm Problem 2 Question (d): grasp an ellipsoid. Codes Created by Yongxin Guo
addpath('/Users/guoyongxin/Desktop/Assignment_Academics/Senior_Second semester/MEC529/Myfunctions');

close all
clear
clc

%-------------------------part 1: Question(b)----------------------------
% assign variable

% ellipsoid
a = 0.01;
b = 0.03;
c = 0.02;
ellipsoid_para = [a;b;c];

% axis of rotation
w_1 = [1;0;0];
w_2 = [1/sqrt(2);-1/sqrt(2);0];
w_3 = [1/sqrt(2);1/sqrt(2);0];
joint_axis = [w_1,w_1,w_2,w_2,w_2,w_3,w_3,w_3];

% base points
base_1 = [0;0;0];
base_2 = [0.02;0.03;0.01];
base_3 = [0;0.03;0];
base_pts = [base_1,base_2,base_3];

% joint types
joint_types = ["R";"R";"R";"R";"R";"R";"R";"R"];

% body constants.
L1_1 = 0.05;
L2_1 = 0.03;
L1_2 = 0.03;
L2_2 = 0.03;
L3_2 = 0.02;
L1_3 = 0.03;
L2_3 = 0.03;
L3_3 = 0.02;
body_consts = [L1_1;L2_1;L1_2;L2_2;L3_2;L1_3;L2_3;L3_3];

% q points.
q1_1 = [0;0;0];
q2_1 = [0;0;L1_1];
q1_2 = [0.02;0.03;0.01];
q2_2 = [0.02;0.03;0.01+L1_2];
q3_2 = [0.02;0.03;0.01+L1_2+L2_2];
q1_3 = [0;0.03;0];
q2_3 = [0;0.03;L1_3];
q3_3 = [0;0.03;L1_3+L2_3];
q_joint = [q1_1,q2_1,q1_2,q2_2,q3_2,q1_3,q2_3,q3_3];


% body configurations
I = eye(3);
P = [0.01;0.015;0.06];
T = [I,P;[0 0 0],1];

% joint_angles
theta1_1 = pi/3;
theta2_1 = pi/4;
theta1_2 = pi/5;
theta2_2 = pi/4;
theta3_2 = pi/8;
theta1_3 = pi/4.5;
theta2_3 = pi/6.4;
theta3_3 = pi/5.7;
theta = [theta1_1;theta2_1;theta1_2;theta2_2;theta3_2;theta1_3;theta2_3;theta3_3];

% get contact points expressed in {O} and {P} along with information about
% contacting.
[contact_pts_O, contact_pts_P,msg] = getFingerContactPt(theta,joint_axis,q_joint,joint_types,T,body_consts,base_pts,ellipsoid_para);
disp("-------------------------part 1: Question(b)---------------------------");
disp(contact_pts_P);
disp(contact_pts_O);
disp(msg);


%-------------------------part 2: Question(c)----------------------------

% rpy for three finger frame {Fi}
rpy_1 = [0;0;0];
rpy_2 = [0;0;-45*pi/180];
rpy_3 = [0;0;45*pi/180];
rpy = [rpy_1,rpy_2,rpy_3];
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phi_2 = pi;%theta1_2 + theta2_2 + theta3_2 + pi/2; % third input parameter of RRR planar manipulator in addition to y and z.
phi_3 = pi;%theta1_3 + theta2_3 + theta3_3 + pi/2; % third input parameter of RRR planar manipulator in addition to y and z.
RRR_phi = [phi_2;phi_3];


[joint_angles_1,joint_angles_2,joint_angles_3] = getFingerAngles(contact_pts_O,T,base_pts,rpy,body_consts,RRR_phi);
disp("-------------------------part 2: Question(c)--------------------------");
disp("The required joint angles for thumb (Finger 1)");
disp(joint_angles_1);
disp("The required joint angles for F1 (Finger 2)");
disp(joint_angles_2);
disp("The required joint angles for F2 (Finger 3)");
disp(joint_angles_3);
```

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-------------------------part 1: Question(b)--------------------------
         0   -0.0272    0.0473
   -0.0723   -0.0172   -0.0173
    0.0172    0.0343    0.0308

   -0.0100   -0.0372    0.0373
   -0.0873   -0.0322   -0.0323
   -0.0428   -0.0257   -0.0292

Thumb (finger 1): No Contact!
F1 (finger 2): No Contact!
F2 (finger 3): No Contact!

-------------------------part 2: Question(c)--------------------------
The required joint angles for thumb (Finger 1)
    1.0472    1.6262
    0.7854   -0.7854

The required joint angles for F1 (Finger 2)
    0.5911    1.5913
    1.0002   -1.0002
   -0.0205    0.9797

The required joint angles for F2 (Finger 3)
    0.6244    1.3542
    0.7297   -0.7297
    0.2166    0.9464
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