Problem 1) Nickel 200 and steel alloy 4340 can satisfy the requirement. However, aluminum alloy 1100 cannot keep the elongation less than 0.1%.

1. Clearly understanding these problems: What exactly are your being asked for? What will a good answer look like? How do you expect the elongation of these bars to change as 𝑑 increases? What information that is given to you is relevant? Are there pieces of information you will need to determine from other source(s)?

* The problem (1) is to find a material that is stiff enough to take the pressure on each of the three bars when P is in the range [0, 50] kN, and d is in the range [0,16] m without being stretched over 0.1%. The problem (2) is to compare the elongation of each bar to determine when all of the bars have the same elongation.
* When d increases, the elongation of AD, BE, and CG will decrease, decrease, and increase respectively.
* The length of each bar, distance between each hinge.
* Still needs to find the elastic modulus of each material.

1. Devise plans to solve these problems: How do you plan to use MATLAB to solve these two problems? What basic steps might your solution script have? What types of plots might be helpful to support your answers?

* In problem (1), using MATLAB to simulate each scenario when P is in the range [0, 50] kN, and d is in the range [0,16] m. In problem (2), using MATLAB to find the elongation of each bars and try to find a point that three lines of the elongation function intersect which means the elongation of three bars are the same.
* Create a for loop with variable P and a for loop in the previous one with variable d. Compare the percent elongation of each bars with 0.1%.
* At different P, the elongation percentage of each three of the bars verses different d.

1. Carry out your plans: Turn your basic steps into MATLAB code. Test and verify your code for a simple situation (i.e., Does it work when 𝑃 is zero? Does it give you the expected results when 𝑑 is large (16 m) or small (zero)? When 𝑑 is 10 m are the results correct? Does the sum of the forces in the vertical bars equal to what you would expect for all values of 𝑑?)

* The magnitude of sum of the forces AD, BE and CG is always equal to the magnitude of force P.
* The code can work in the range of P and d.

1. Look back: Did you solve the problems that were asked? Have your adequately supported your conclusions? Do the results of the numeric computation make sense? What other considerations did you have to take into account?

Appendix: Code related the problem

%---------beginning of the code-----------

E = 68.9e9 ;

%Aluminum Alloy 1100: 68.9e9 GPa

%Nickel 200: 200e9 GPa

%Steel Alloy 4340: 200e9 GPa

p1 = 50;%plot choice, the weight of P

AD = true;

BE = true;

CG = true;

Fad = [,];

Fbe = [,];

Fcg = [,];

dLab = [,];

dLbe = [,];

dLcg = [,];

i = 0;

j = 0;

A = [1 1 1;0 10 16; 24/(E \* 4e-4) -80/(E \* 4e-4) 20/(E \* 4e-4)];

for p = 1:50

    i = i + 1;

    j = 0;

    for d\_01 = 1:160

        j = j + 1;

        B = [p \* 1000;d\_01 / 10.0 \* p \* 1000;0];

        solution = A\B;

        Fad(i,j) = solution(1,1);

        Fbe(i,j) = solution(2,1);

        Fcg(i,j) = solution(3,1);

        dLad = solution(1,1) \* 4 / (E \* 4e-4);

        dLbe = solution(2,1) \* 5 / (E \* 4e-4);

        dLcg = solution(3,1) \* 2 / (E \* 4e-4);

        dLadp(i,j) = dLad / 4.0;

        dLbep(i,j) = dLbe / 5.0;

        dLcgp(i,j) = dLcg / 2.0;

        if dLad / 4 > 0.001

           AD = false;

        end

        if dLbe / 5 > 0.001

           BE = false;

        end

        if dLcg / 2 > 0.001

           CG = false;

        end

    end

end

x = linspace(0,16,160);

plot(x, dLadp(p1,:))

hold on

plot(x, dLbep(p1,:))

plot(x, dLcgp(p1,:))

grid on

legend('Lad%','Lbe%','Lcg%')

if AD && BE && CG

   true

else

   false

end

%---------end of the code-----------