

Laboratory 5 - Graphical Methods

CEMAL YAGCIOGLU (cy111)
Lab Section 5D, Wednesday 11.45AM - 2.35PM
16 OCTOBER, 2016

I understand and have adhered to all the tenets of the Duke Community Standard in completing every part of this assignment. I understand that a violation of any part of the Standard on any part of this assignment can result in failure of this assignment, failure of this course, and/or suspension from Duke University.

Contents

1	Palm Problem 5.3(a)	2
2	Palm Problems 5.21 and 6.7	2
3	Chapra Problem 3.9	2
4	Palm Problem 5.33	2
5	Palm Problem 5.36	2
6	Palm Problem 4.28	2
7	Codes and Output	2
7.1	ThreeRoots.m	2
7.2	VoltageCalc.m	4
7.3	WaterVelocity.m	4
7.4	TemperatureDistribution.m	5
7.5	ElectricPotential.m	6
7.6	ElectricPotential.m	6
8	Figures	8

List of Figures

1	Palm Problem 5.3(a)	8
2	Palm Problems 5.21 and 6.7	8
3	Chapra Problem 3.9	9
4	Palm Problem 5.33	9
5	Palm Problem 5.33	10
6	Palm Problem 5.33	10
7	Palm Problem 5.36	11
8	Palm Problem 5.36	11
9	Palm Problem 4.28	12
10	Palm Problem 4.28	12
11	Palm Problem 4.28	13
12	Palm Problem 4.28	13

1 Palm Problem 5.3(a)

Roots are -0.479,1.135,3.832.

2 Palm Problems 5.21 and 6.7

Bar and stairs graphs have continuous x domains that might suggest that the potential value stays the same for a short period of time and instantly drops. However, data does not suggest an instant change of potential. Thus, it rather makes more sense to have the stem graph with more accurate point data.

3 Chapra Problem 3.9

Increasing depth and width increases the velocity of water. Depth seems to have slightly more weight on velocity value. As depth and width increases, change in velocity (slope of the tangent plane) decreases.

4 Palm Problem 5.33

At point $x=y=0$, Temperature is 1.4653 Kelvin.

5 Palm Problem 5.36

Surface graph is drawn and added to the document.

6 Palm Problem 4.28

Coordinate for the lowest-cost distribution center is (8,2) and the cost for that location is 4.1180e+02.

Customer	xlocation(mi)	ylocation(mi)	Volume(tons/week)
1	29	6	8
2	-20	-12	6
3	9	1	4
4	1	29	2
5	-3	21	5
6	11	3	8
7	-15	-5	5
8	5	-9	2
9	-26	13	3
10	14	19	1

7 Codes and Output

7.1 ThreeRoots.m

```
1  %[ThreeRoots.m]
2  %[Cemal Yagcioglu]
3  %[October 16,2016]
4  % I have adhered to all the tenets of the
5  % Duke Community Standard in creating this code.
6  % Signed: [cy111]
7  %axis koy
8  x=linspace(-5,5,1000)
9  y=x.^3-3.*x.^2+5.*x.*sin(pi.*x./4-5.*pi./4)+3
10
```

```

11 figure
12 subplot(2,2,1)
13 plot(x,y)
14 xlabel('x')
15 ylabel('y')
16 title('y vs x plot(cy111)')
17 grid on
18 hold on
19
20 y2=sign(y)
21 subplot(2,2,3)
22 plot(x,y2)
23 axis([-5,5,-1.1,1.1])
24 xlabel('x')
25 ylabel('sign of y')
26 title('sign of y vs x plot')
27 grid on
28 hold on
29
30 subplot(3,2,2)
31 root1x=linspace(-0.484,-0.474,1000)
32 x=root1x
33 y2=(x.^3-3.*x.^2+5.*x.*sin(pi.*x./4-5.*pi./4)+3)
34 plot(root1x,y2)
35 axis([-0.484,-0.474,-0.05,0.05])
36 xlabel('x')
37 ylabel('y')
38 title('First root : -0.479')
39 grid on
40
41 subplot(3,2,4)
42 root2x=linspace(1.1295,1.1395,1000)
43 x=root2x
44 y3=(x.^3-3.*x.^2+5.*x.*sin(pi.*x./4-5.*pi./4)+3)
45 plot(root2x,y3)
46 axis([1.1295,1.1395,-0.05,0.05])
47 xlabel('x')
48 ylabel('y')
49 title('Second root : 1.135')
50 grid on
51
52 subplot(3,2,6)
53 root3x=linspace(3.827,3.837,1000)
54 x=root3x
55 y4=(x.^3-3.*x.^2+5.*x.*sin(pi.*x./4-5.*pi./4)+3)
56 plot(root3x,y4)
57 axis([3.827,3.837,-0.05,0.05])
58 grid on
59 xlabel('x')
60 ylabel('y')
61 title('Third root : 3.832')
62 orient tall
63 print -depsc ThreeRoots
64 %-0.48000
65 %1.13400

```

```

66  %3.83200
67  %y
68
69
70

```

7.2 VoltageCalc.m

```

1  %[VoltageCalc.m]
2  %[Cemal Yagcioglu]
3  %[October 16,2016]
4  % I have adhered to all the tenets of the
5  % Duke Community Standard in creating this code.
6  % Signed: [cy111]
7  hold off
8  hold off
9  Time = linspace(0,4,9)
10 Voltage = [100,62,38,21,13,7,4,2,3]
11 subplot(3,1,1)
12 stem(Time,Voltage)
13 title('Change of Voltage over Time(cy111)')
14 xlabel('Time(s)')
15 ylabel('Voltage(V)')
16 axis([-0.5,4.5,-10,110])
17
18 subplot(3,1,2)
19 bar(Time,Voltage)
20 xlabel('Time(s)')
21 ylabel('Voltage(V)')
22 axis([-0.5,4.5,-10,110])
23
24 subplot(3,1,3)
25 stairs(Time,Voltage)
26 xlabel('Time(s)')
27 ylabel('Voltage(V)')
28 axis([-0.5,4.5,-10,110])
29 print -depsc VoltageCalc

```

7.3 WaterVelocity.m

```

1  %[WaterVelocity.m]
2  %[Cemal Yagcioglu]
3  %[October 16,2016]
4  % I have adhered to all the tenets of the
5  % Duke Community Standard in creating this code.
6  % Signed: [cy111]
7  S=0.0003
8  n=0.022
9  B=linspace(0.1,50,20)
10 H=linspace(0.1,50,21)
11 [B,H] = meshgrid(B,H)
12
13 U=(sqrt(S)./n).*(B.*H./(B+2.*H)).^(2/3)
14 surf(B,H,U)
15 title('Altering Velocity of Water with Width and Depth(cy111)')
16 xlabel('Width(m)')

```

```

17 ylabel('Depth(m)')
18 zlabel('Velocity(m/s)')
19 grid on
20 colormap(cool)
21 colorbar
22 axis([0,50,0,50,0,6])
23
24 print -depsc WaterVelocity

```

7.4 TemperatureDistribution.m

```

1  %[TemperatureDistribution.m]
2  %[Cemal Yagcioglu]
3  %[October 16,2016]
4  % I have adhered to all the tenets of the
5  % Duke Community Standard in creating this code.
6  % Signed: [cy111]
7  X=linspace(0,1,30);
8  Y=linspace(0,1,30);
9  [x,y] = meshgrid(X,Y);
10 T=80.*exp(-1.*(x-1).^2).*exp(-3.*(y-1).^2)
11 figure(1)
12 surf(X,Y,T)
13 grid on
14 bar1 = colorbar;
15 xlabel(bar1, 'Temperature(Kelvin)')
16 colormap(hot)
17 title('Temperature Distribution of Heated Square Metal Plate(cy111)')
18 xlabel('Distance in x Direction(m)')
19 ylabel('Distance in y Direction(m)')
20 zlabel('Temperature(K)')
21 print -depsc TemperatureDistribution
22
23 figure(2)
24 contour(X,Y,T,8)
25 grid on
26 colormap(hot)
27 title('Temperature Contours of Heated Square Metal Plate(cy111)')
28 xlabel('Distance in x Direction(m)')
29 ylabel('Distance in y Direction(m)')
30 zlabel('Temperature(K)')
31 print -depsc TemperatureContours
32
33 figure(3)
34 imagesc([0 1], [0 1], T)
35 colormap(hot)
36 bar2 = colorbar;
37 xlabel(bar2, 'Temperature(Kelvin)')
38 title('Temperature Image with Scaled Colors of Heated Square Metal Plate(cy111)')
39 xlabel('Distance in x Direction(m)')
40 ylabel('Distance in y Direction(m)')
41 T00=80*exp(-1)*exp(-3)
42 print -depsc TemperatureImage
43 %Ans = 1.4653 Kelvin

```

7.5 ElectricPotential.m

```
1  %[ElectricPotential.m]
2  %[Cemal Yagcioglu]
3  %[October 16,2016]
4  % I have adhered to all the tenets of the
5  % Duke Community Standard in creating this code.
6  % Signed: [cy111]
7  hold off
8  X=linspace(-0.25,0.25,50)
9  Y=linspace(-0.25,0.25,50)
10 [x,y] = meshgrid(X,Y)
11 E= 8.854*(10^-12)
12 q1 = 2*10^(-10) %C
13 q2 = 4*10^(-10)
14 r1=sqrt((-0.3+x).^2+(y.^2))
15 r2=sqrt((+0.3+x).^2+(y.^2))
16 V = (1./(4.*pi.*E)).*((q1./r1)+(q2./r2));
17
18 figure(1)
19 surf(x,y,V)
20 colormap(autumn)
21 xlabel('x Location(m)')
22 ylabel('y Location(m)')
23 zlabel('Voltage(V)')
24 title('Electric Potential Distribution Surface(cy111)')
25 print -depsc ElectricPotentialSurface
26
27 figure(2)
28 meshc(x,y,V)
29 colormap(autumn)
30 xlabel('x Location(m)')
31 ylabel('y Location(m)')
32 zlabel('Voltage(V)')
33 title('Electric Potential Distribution Mesh(cy111)')
34 print -depsc ElectricPotentialMesh
```

7.6 ElectricPotential.m

```
1  %[ElectricPotential.m]
2  %[Cemal Yagcioglu]
3  %[October 16,2016]
4  % I have adhered to all the tenets of the
5  % Duke Community Standard in creating this code.
6  % Signed: [cy111]
7  hold off
8  X=linspace(-0.25,0.25,50)
9  Y=linspace(-0.25,0.25,50)
10 [x,y] = meshgrid(X,Y)
11 E= 8.854*(10^-12)
12 q1 = 2*10^(-10) %C
13 q2 = 4*10^(-10)
14 r1=sqrt((-0.3+x).^2+(y.^2))
15 r2=sqrt((+0.3+x).^2+(y.^2))
16 V = (1./(4.*pi.*E)).*((q1./r1)+(q2./r2));
17
```

```

18 figure(1)
19 surf(x,y,V)
20 colormap(autumn)
21 xlabel('x Location(m)')
22 ylabel('y Location(m)')
23 zlabel('Voltage(V)')
24 title('Electric Potential Distribution Surface(cy111)')
25 print -depsc ElectricPotentialSurface
26
27 figure(2)
28 meshc(x,y,V)
29 colormap(autumn)
30 xlabel('x Location(m)')
31 ylabel('y Location(m)')
32 zlabel('Voltage(V)')
33 title('Electric Potential Distribution Mesh(cy111)')
34 print -depsc ElectricPotentialMesh

```

8 Figures

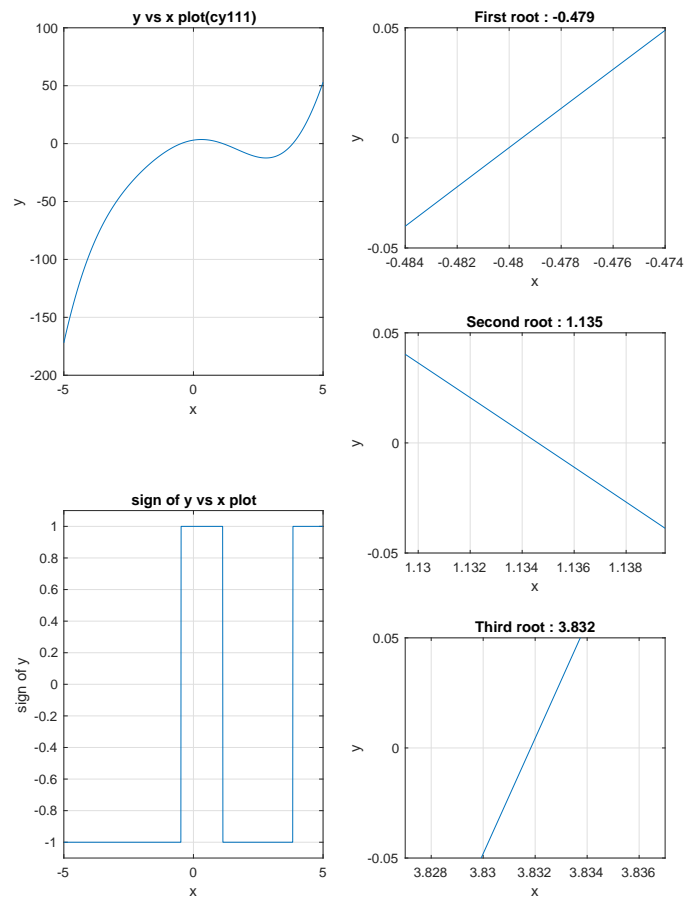


Figure 1: Palm Problem 5.3(a)

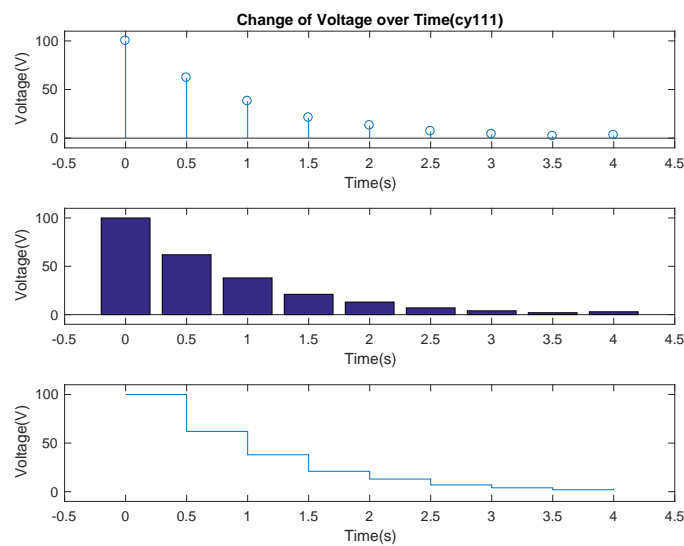


Figure 2: Palm Problems 5.21 and 6.7

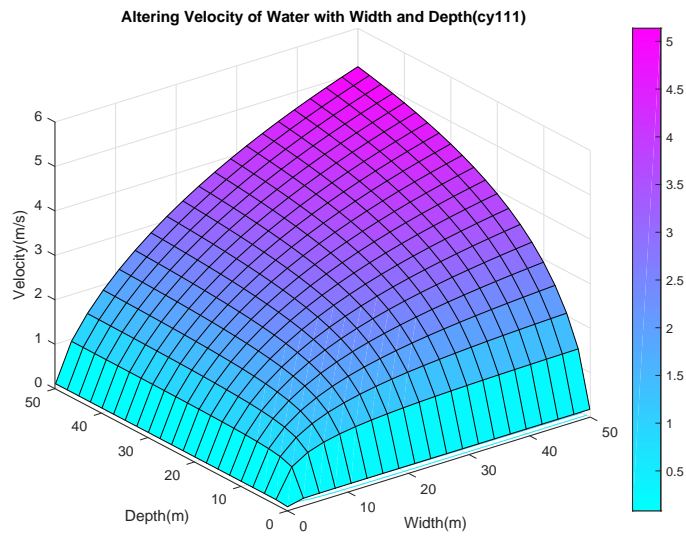


Figure 3: Chapra Problem 3.9

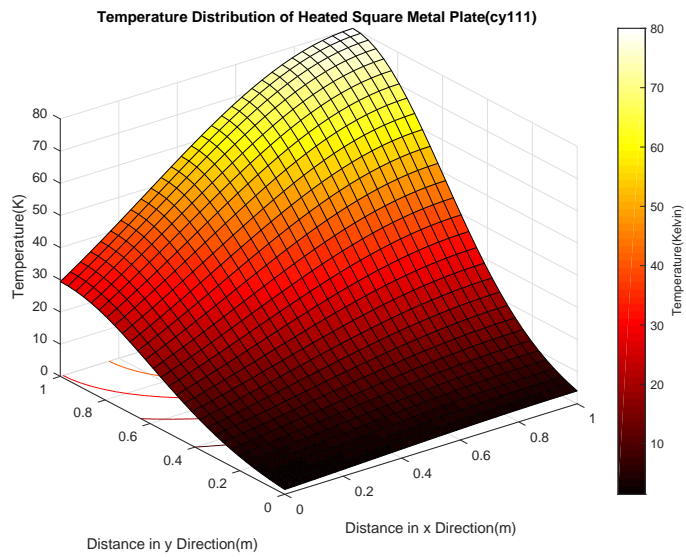


Figure 4: Palm Problem 5.33

References

- [1] Chapra, Steven C., *Applied Numerical Methods with MATLAB for Engineering and Scientists*. McGraw-Hill, New York, 3rd Edition, 2012.
- [2] Palm, William J., *Introduction to MATLAB for Engineers*. McGraw-Hill, New York, 3rd Edition, 2011.

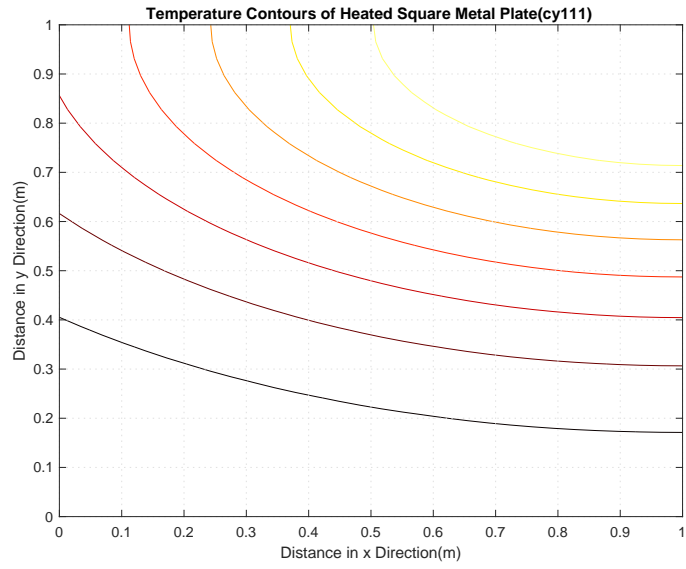


Figure 5: Palm Problem 5.33

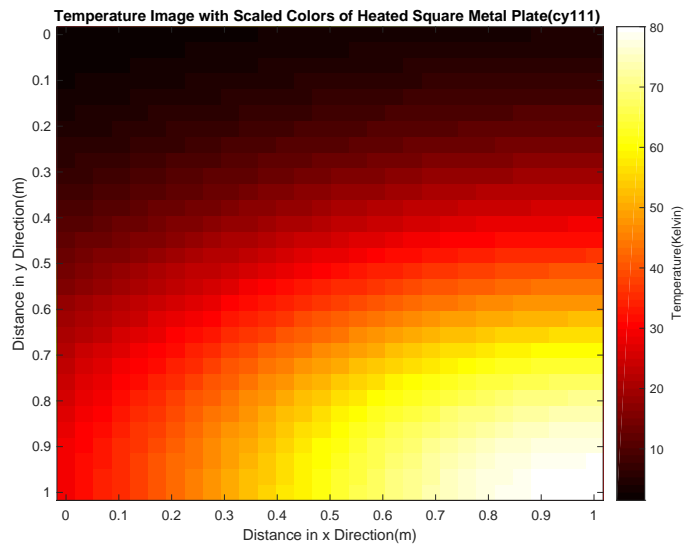


Figure 6: Palm Problem 5.33

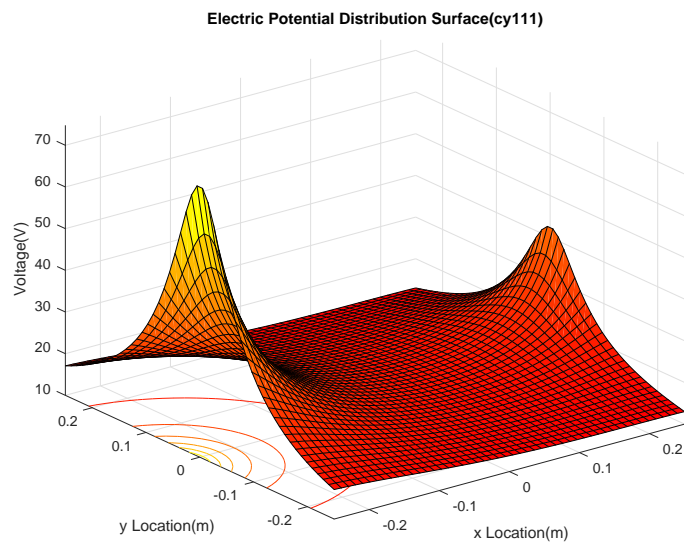


Figure 7: Palm Problem 5.36

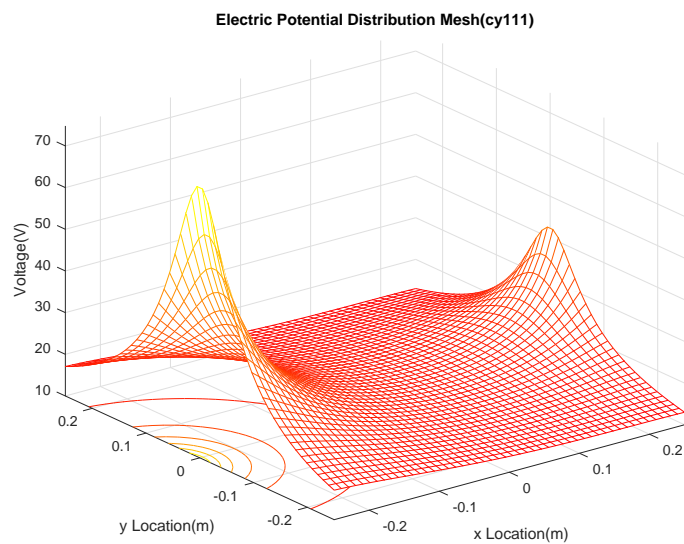


Figure 8: Palm Problem 5.36

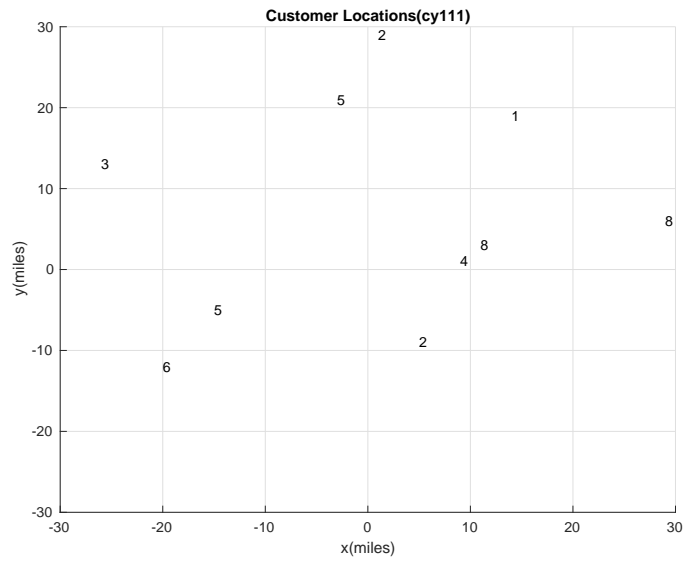


Figure 9: Palm Problem 4.28

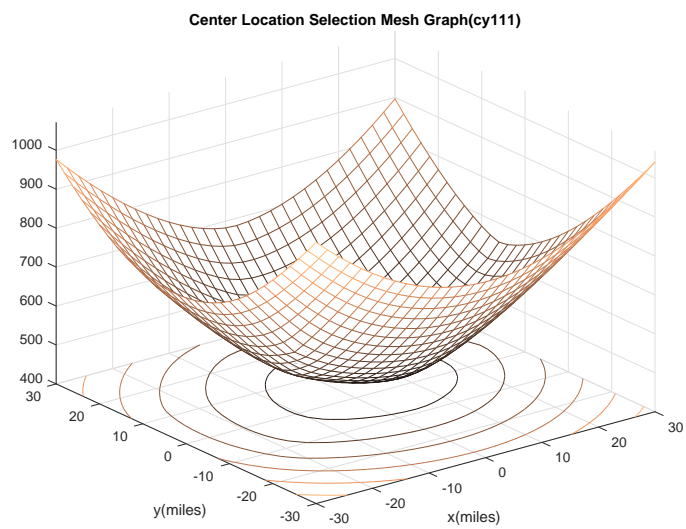


Figure 10: Palm Problem 4.28

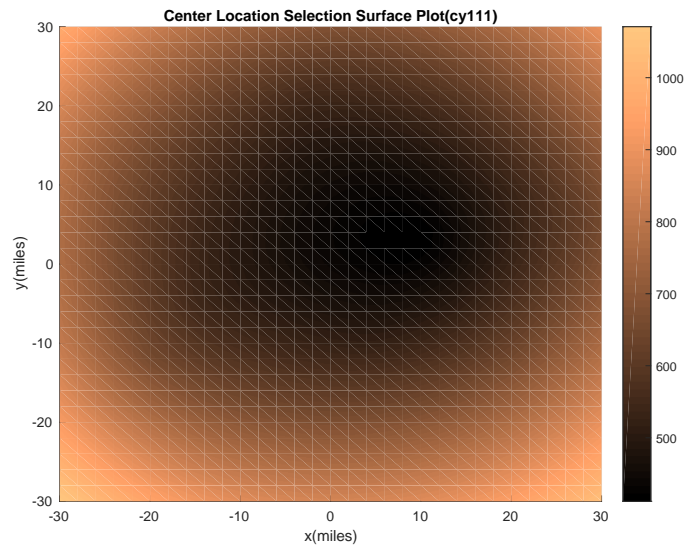


Figure 11: Palm Problem 4.28

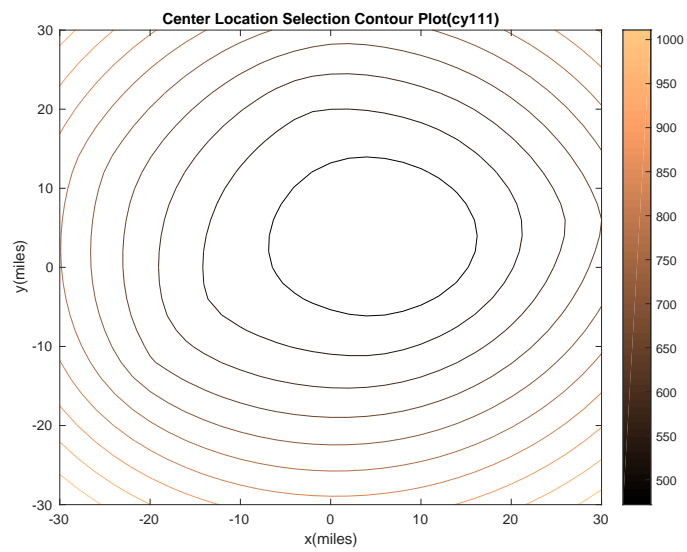


Figure 12: Palm Problem 4.28