EGR 103L - Fall 2016

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.

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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 continous x domains that might suggest that the potential value stays same for a short peroiod 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

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

```

```
figure
subplot(2,2,1)
plot(x,y)
xlabel('x')
ylabel('y')
title('y vs x plot(cy111)')
grid on
hold on

y2=sign(y)
subplot(2,2,3)
plot(x,y2)
axis([-5,5,-1.1,1.1])
xlabel('x')
ylabel('sign of y')
title('sign of y vs x plot')
grid on
hold on

subplot(3,2,2)
root1x=linspace(-0.484,-0.474,1000)
x=root1x
y2=(x.^3-3.*x.^2+5.*x.*sin(pi.*x./4-5.*pi./4)+3)
plot(root1x,y2)
axis([-0.484,-0.474,-0.05,0.05])
xlabel('x')
ylabel('y')
title('First root : -0.479')
grid on

subplot(3,2,4)
root2x=linspace(1.1295,1.1395,1000)
x=root2x
y3=(x.^3-3.*x.^2+5.*x.*sin(pi.*x./4-5.*pi./4)+3)
plot(root2x,y3)
axis([1.1295,1.1395,-0.05,0.05])
xlabel('x')
ylabel('y')
title('Second root : 1.135')
grid on

subplot(3,2,6)
root3x=linspace(3.827,3.837,1000)
x=root3x
y4=(x.^3-3.*x.^2+5.*x.*sin(pi.*x./4-5.*pi./4)+3)
plot(root3x,y4)
axis([3.827,3.837,-0.05,0.05])
grid on
xlabel('x')
ylabel('y')
title('Third root : 3.832')
orient tall
print -depsc ThreeRoots
%-0.48000
%1.13400
```

```
%3.83200
%y
```

7.2 VoltageCalc.m

```
%[VoltageCalc.m]
%[Cemal Yagcioglu]
%[October 16,2016]
% I have adhered to all the tenets of the
% Duke Community Standard in creating this code.
% Signed: [cy111]
hold off
hold off
Time = linspace(0,4,9)
Voltage = [100,62,38,21,13,7,4,2,3]
subplot(3,1,1)
stem(Time,Voltage)
title('Change of Voltage over Time(cy111)')
xlabel('Time(s)')
ylabel('Voltage(V)')
axis([-0.5,4.5,-10,110])

subplot(3,1,2)
bar(Time,Voltage)
xlabel('Time(s)')
ylabel('Voltage(V)')
axis([-0.5,4.5,-10,110])

subplot(3,1,3)
stairs(Time,Voltage)
xlabel('Time(s)')
ylabel('Voltage(V)')
axis([-0.5,4.5,-10,110])
print -depsc VoltageCalc
```

7.3 WaterVelocity.m

```
%[WaterVelocity.m]
%[Cemal Yagcioglu]
%[October 16,2016]
% I have adhered to all the tenets of the
% Duke Community Standard in creating this code.
% Signed: [cy111]
S=0.0003
n=0.022
B=linspace(0.1,50,20)
H=linspace(0.1,50,21)
[B,H] = meshgrid(B,H)

U=(sqrt(S)./n).*(B.*H./(B+2.*H)).^(2/3)
surfc(B,H,U)
title('Altering Velocity of Water with Width and Depth(cy111)')
xlabel('Width(m)')
```

```
ylabel('Depth(m)')
zlabel('Velocity(m/s)')
grid on
colormap(cool)
colorbar
axis([0,50,0,50,0,6])

print -depsc WaterVelocity
```

7.4 TemperatureDistribution.m

```
%[TemperatureDistribution.m]
%[Cemal Yagcioglu]
%[October 16,2016]
% I have adhered to all the tenets of the
% Duke Community Standard in creating this code.
% Signed: [cy111]
X=linspace(0,1,30);
Y=linspace(0,1,30);
[x,y] = meshgrid(X,Y);
T=80.*exp(-1.*(x-1).^2).*exp(-3.*(y-1).^2)
figure(1)
surfc(X,Y,T)
grid on
bar1 = colorbar;
xlabel(bar1, 'Temperature(Kelvin)')
colormap(hot)
title('Temperature Distribution of Heated Square Metal Plate(cy111)')
xlabel('Distance in x Direction(m)')
ylabel('Distance in y Direction(m)')
zlabel('Temperature(K)')
print -depsc TemperatureDistribution

figure(2)
contour(X,Y,T,8)
grid on
colormap(hot)
title('Temperature Contours of Heated Square Metal Plate(cy111)')
xlabel('Distance in x Direction(m)')
ylabel('Distance in y Direction(m)')
zlabel('Temperature(K)')
print -depsc TemperatureContours

figure(3)
imagesc([0 1], [0 1], T)
colormap(hot)
bar2 = colorbar;
xlabel(bar2, 'Temperature(Kelvin)')
title('Temperature Image with Scaled Colors of Heated Square Metal Plate(cy111)')
xlabel('Distance in x Direction(m)')
ylabel('Distance in y Direction(m)')
T00=80*exp(-1)*exp(-3)
print -depsc TemperatureImage
%Ans = 1.4653 Kelvin
```

7.5 ElectricPotential.m

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

figure(1)
surfc(x,y,V)
colormap(autumn)
xlabel('x Location(m)')
ylabel('y Location(m)')
zlabel('Voltage(V)')
title('Electric Potential Distribution Surface(cy111)')
print -depsc ElectricPotentialSurface

figure(2)
meshc(x,y,V)
colormap(autumn)
xlabel('x Location(m)')
ylabel('y Location(m)')
zlabel('Voltage(V)')
title('Electric Potential Distribution Mesh(cy111)')
print -depsc ElectricPotentialMesh
```

7.6 ElectricPotential.m

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

```

```
figure(1)
surfc(x,y,V)
colormap(autumn)
xlabel('x Location(m)')
ylabel('y Location(m)')
zlabel('Voltage(V)')
title('Electric Potential Distribution Surface(cy111)')
print -depsc ElectricPotentialSurface

figure(2)
meshc(x,y,V)
colormap(autumn)
xlabel('x Location(m)')
ylabel('y Location(m)')
zlabel('Voltage(V)')
title('Electric Potential Distribution Mesh(cy111)')
print -depsc ElectricPotentialMesh
```

8 Figures

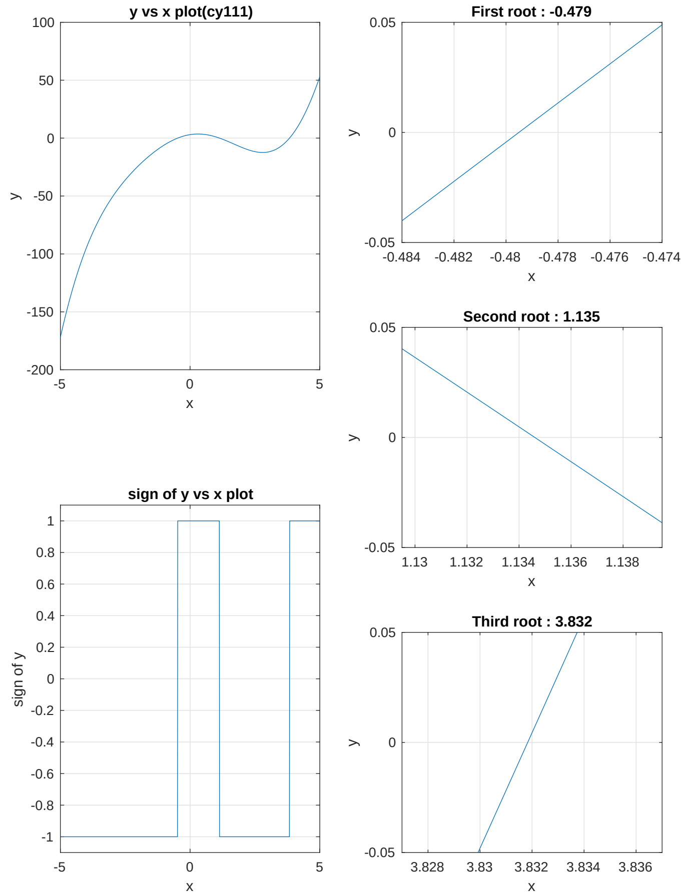

Figure 1: Palm Problem 5.3(a)

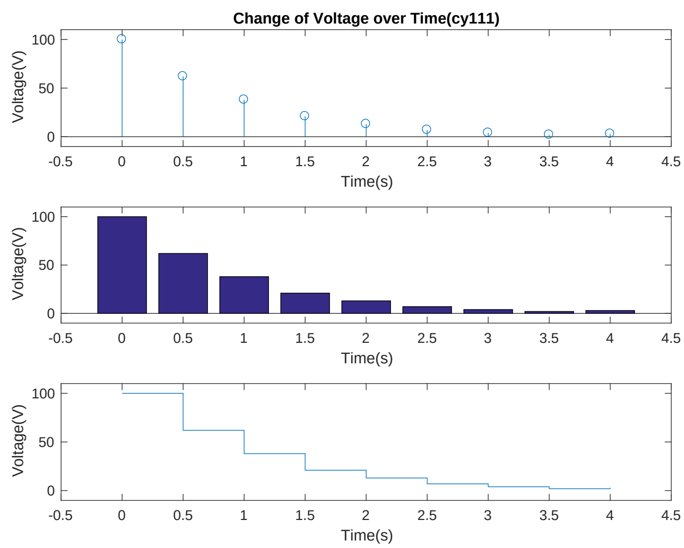

Figure 2: Palm Problems 5.21 and 6.7

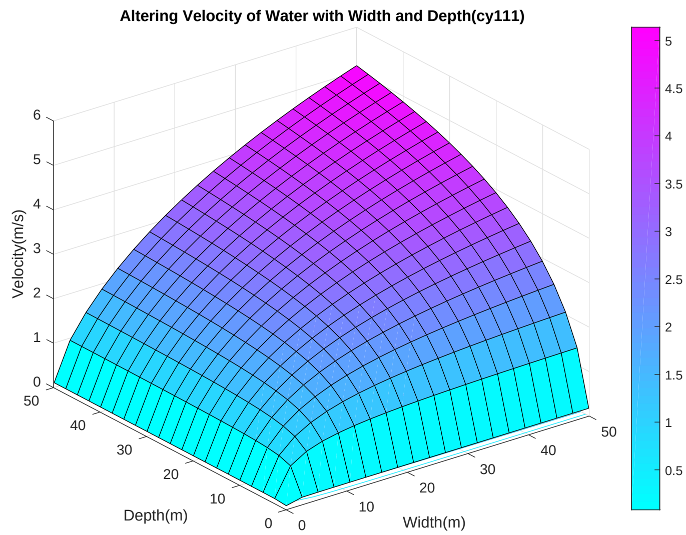

Figure 3: Chapra Problem 3.9

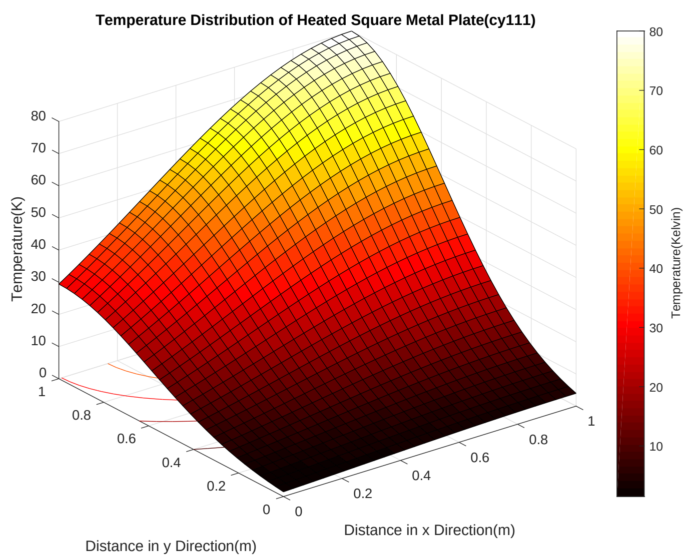

Figure 4: Palm Problem 5.33

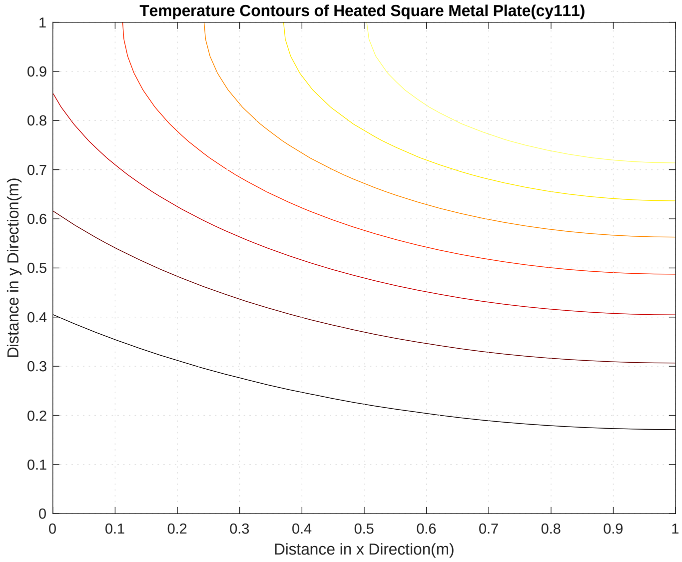

Figure 5: Palm Problem 5.33

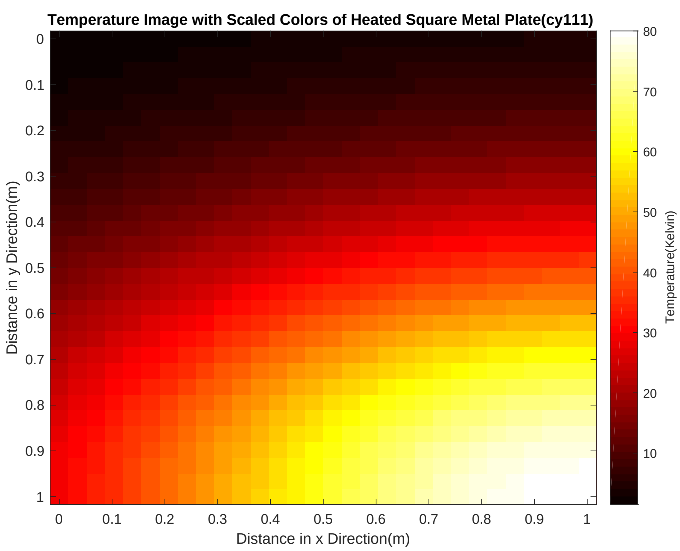

Figure 6: Palm Problem 5.33

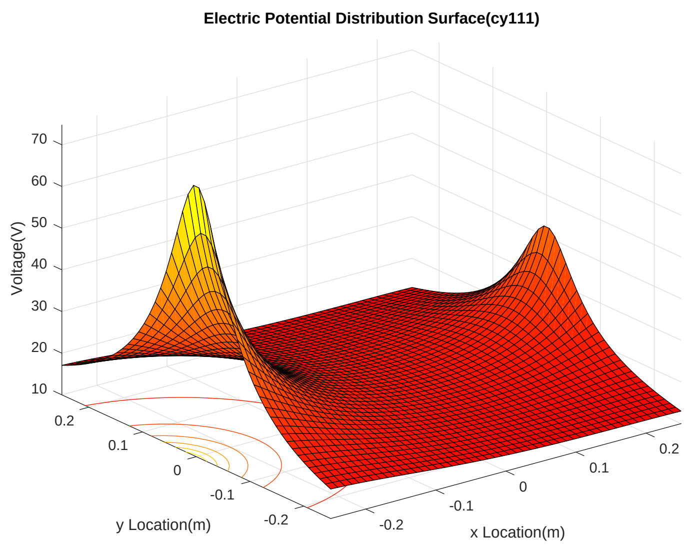

Figure 7: Palm Problem 5.36

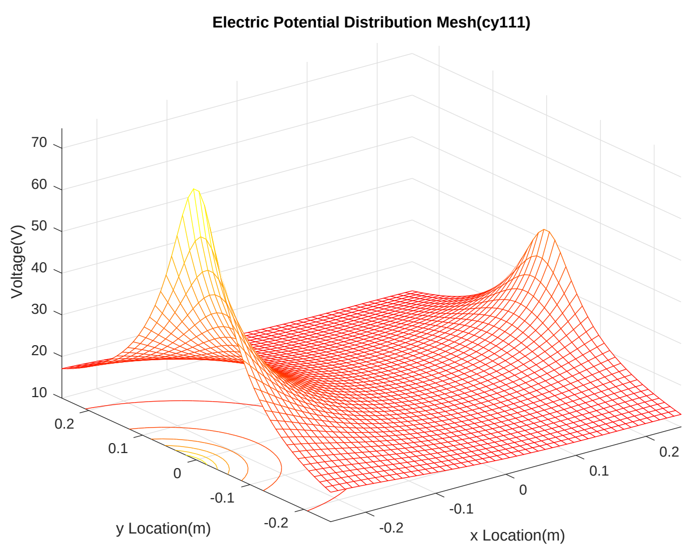

Figure 8: Palm Problem 5.36

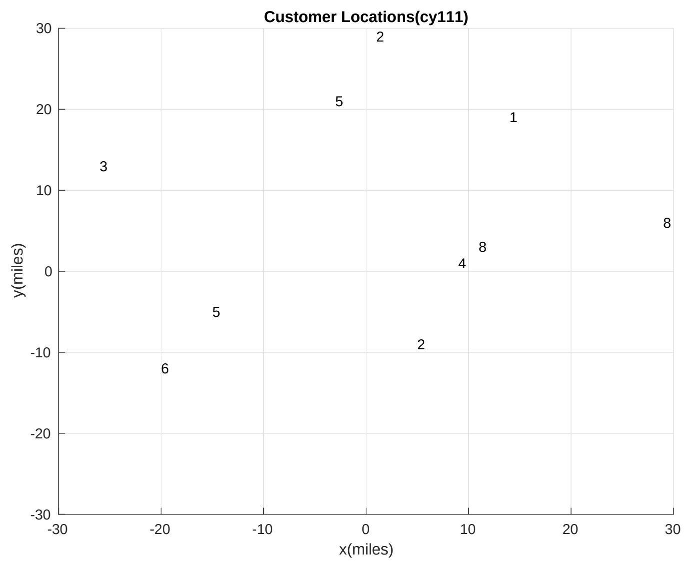

Figure 9: Palm Problem 4.28

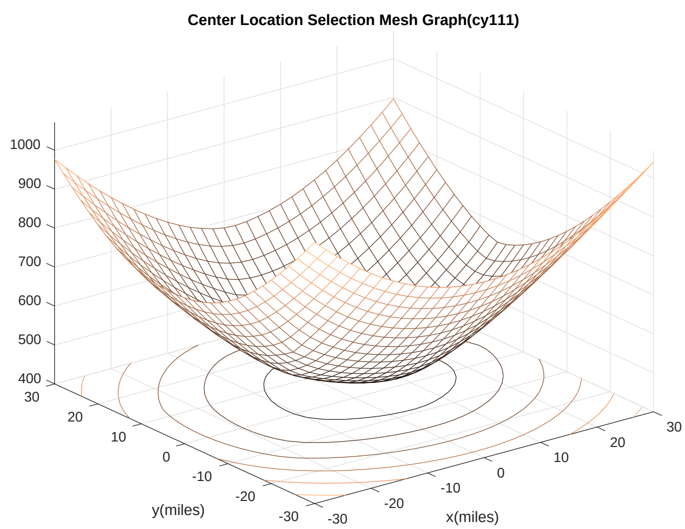

Figure 10: Palm Problem 4.28

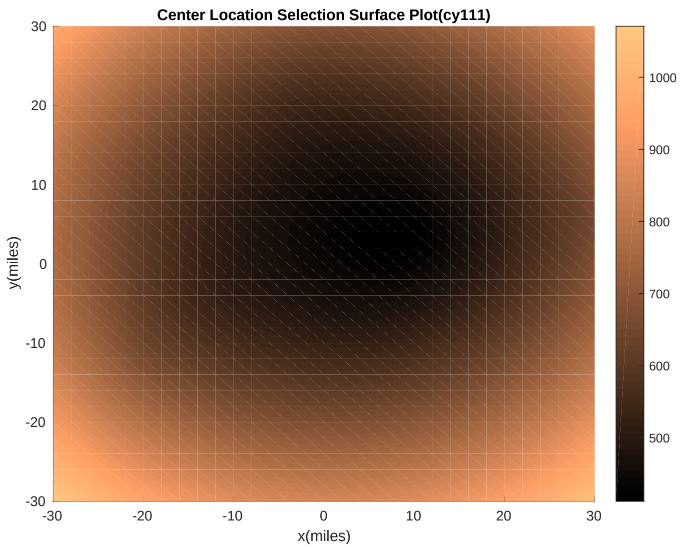

Figure 11: Palm Problem 4.28

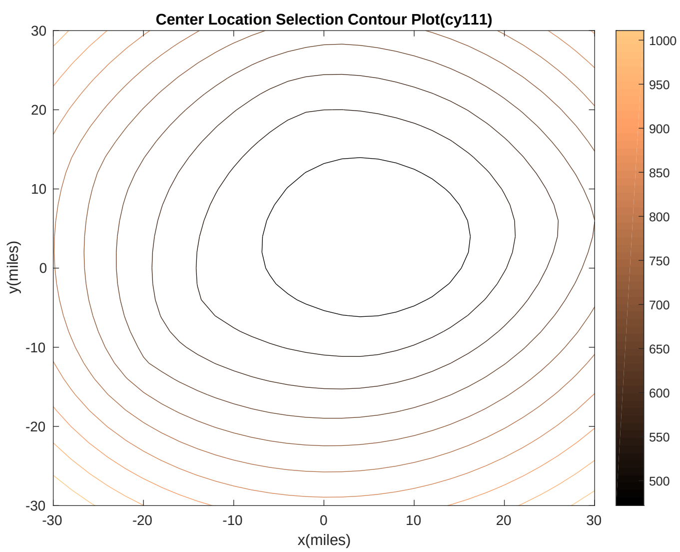

Figure 12: Palm Problem 4.28

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.