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ECE 498 - Matlab

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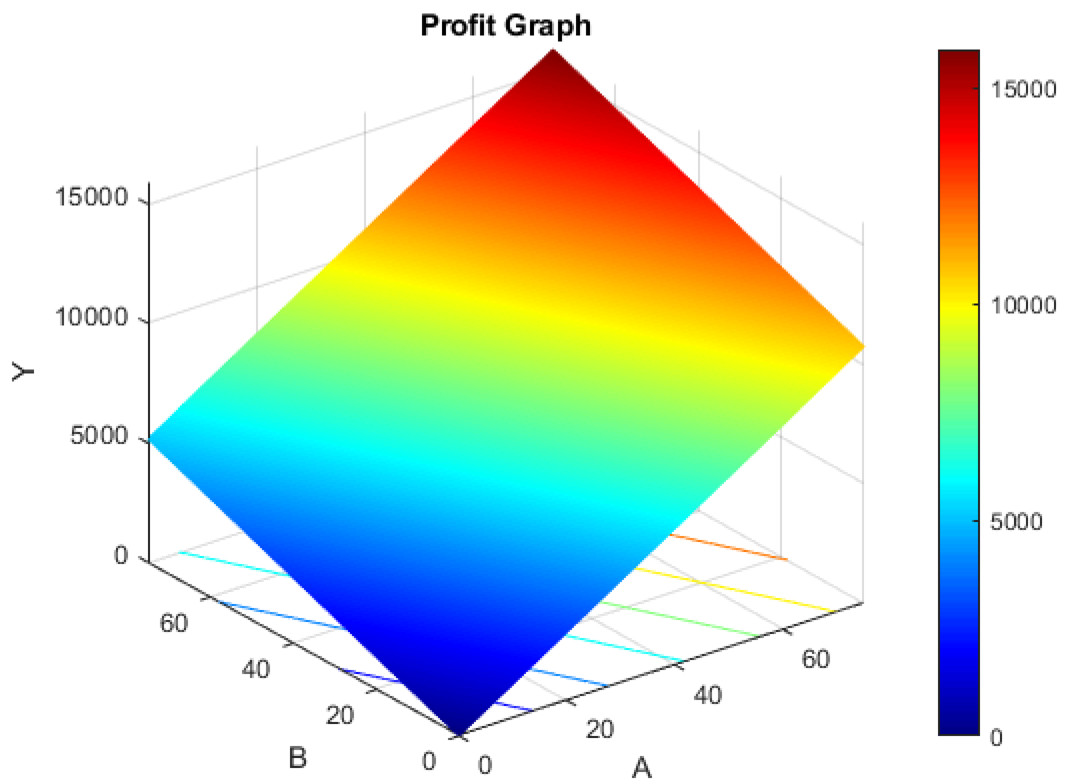
```
clear;
clc;
close all;
```

Question 1: Maximizing Profit of Crops

```
% 75 Acres to Plant
% P(x,y)=143x+69y
% 110x+30y#4000
% 120x+210y#15000
% x#0, y#0, x+y#75

% This is the profit.
p = [143; 69];

% These are the coefs of x and y.
A = [110 30
    120 210
    1 1];

% These are the RHS to the inequalities.
b = [4000; 15000; 75];

% Lower bounds
lb = zeros(2,1);

% Use linear programmingto find the optimal solution.
[val, fval, exitflag, output, lambda] = linprog(-p,A,b,[],[],lb);
fprintf("Crop A acres: %d\nCrop B acres: %d\n", val(1), val(2));

[A, B] = meshgrid(0:0.05:75);
Y = 143 * A + 69 * B;

% Visually Verify.
figure(1);
meshc(A,B,Y);
title('Profit Graph');
```

```
colormap jet
colorbar
xlabel('A');
ylabel('B');
zlabel('Y');
```

```
Optimal solution found.

Crop A acres: 2.187500e+01
Crop B acres: 5.312500e+01
```

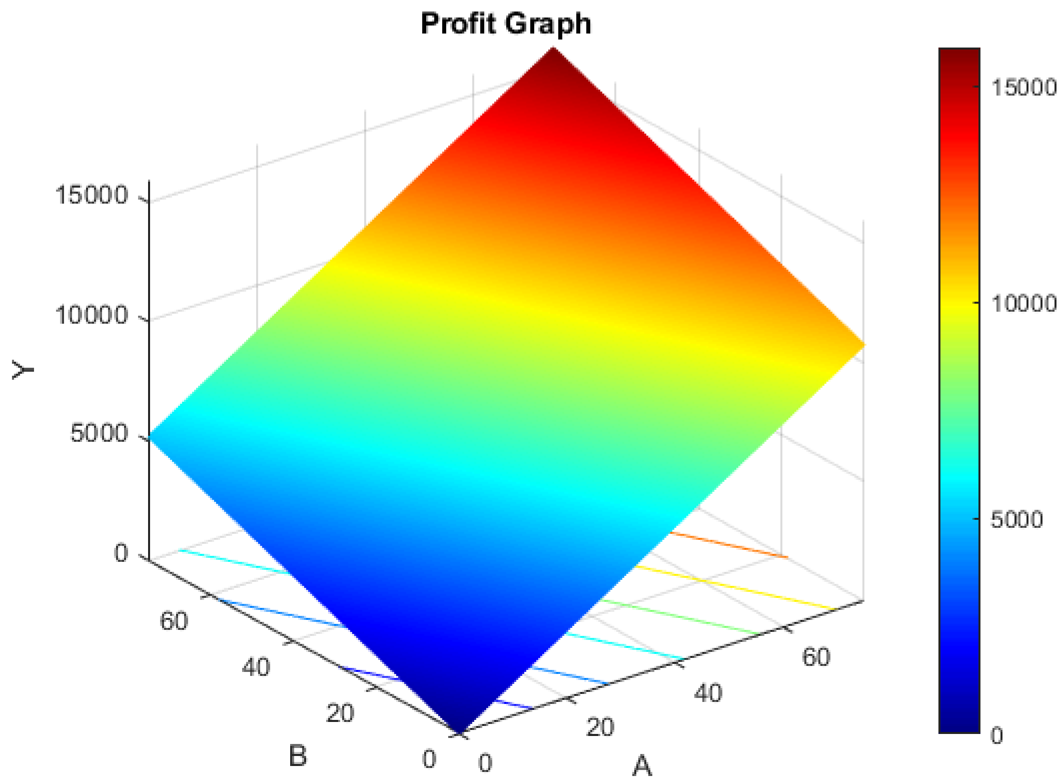


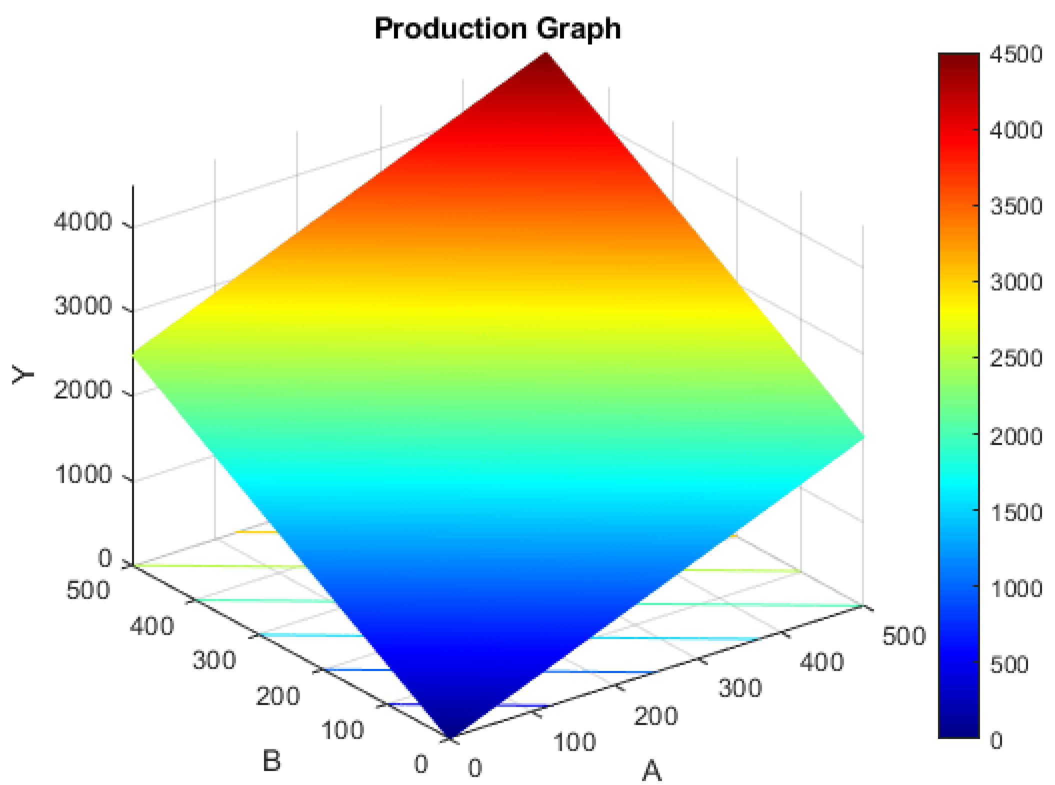
Question 2: Production Planning

```
% Profit(A,B) = 4A + 5B
% A + B < 200
% 1.25A + 0.75B < 200
% Upper bounds: A->none B->150

% This is the profit.
p = [4; 5];

% These are the coefs of A and B.
A = [1 1
    1.25 0.75];
```

```
% These are the RHS to the inequalities.
b = [200; 200];

% Upper bounds.
ub = [inf; 150];

% Use linear programmingto find the optimal solution.
[val, fval, exitflag, output, lambda] = linprog(-p,A,b,[],[],[],ub);
fprintf("Number of product A: %d\nNumber of Product B: %d\n", val(1),
 val(2));

[A, B] = meshgrid(0:0.5:500);
Y = 4 * A + 5 * B;

% Visually Verify.
figure(2);
meshc(A,B,Y);
title('Production Graph');
colormap jet
colorbar
xlabel('A');
ylabel('B');
zlabel('Y');
```

```
Optimal solution found.

Number of product A: 5.000000e+01
Number of Product B: 150
```


Profit Graph
Y
15000
10000
5000
0
B
60
40
20
0
A
0
20
40
60
15000
10000
5000
0


Production Graph
Y
4000
3000
2000
1000
0
B
500
400
300
200
100
0
A
0
100
200
300
400
500
4500
4000
3500
3000
2500
2000
1500
1000
500
0

Question 3: Minimizing Multi-Variable Function

```
% f(x,y,z)=(x2+y2)2#x2#y+z2

% Find the minimum value of the function.
x0 = [0 0 0];
f = @(x) (x(1)^2 + x(2)^2)^2 - x(1)^2 - x(2) + x(3)^2;
[x,fval] = fminunc(f,x0);

fprintf('Min Value %d at X=%d, Y=%d, Z=%d\n', fval,x(1),x(2),x(3));
```

```
Local minimum found.

Optimization completed because the size of the gradient is less than
the value of the optimality tolerance.

Min Value -4.724704e-01 at X=4.143080e-08, Y=6.299605e-01,
 Z=-4.125933e-08
```

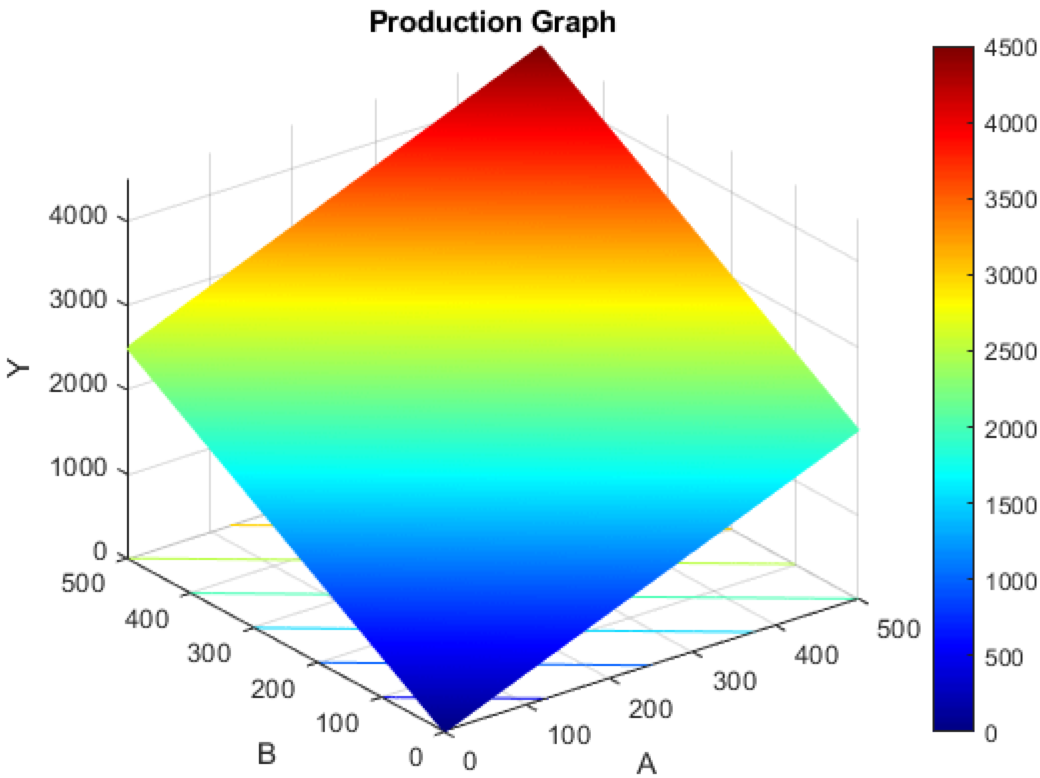
Question 4: Minimaizing Mult-Variable Function Again.

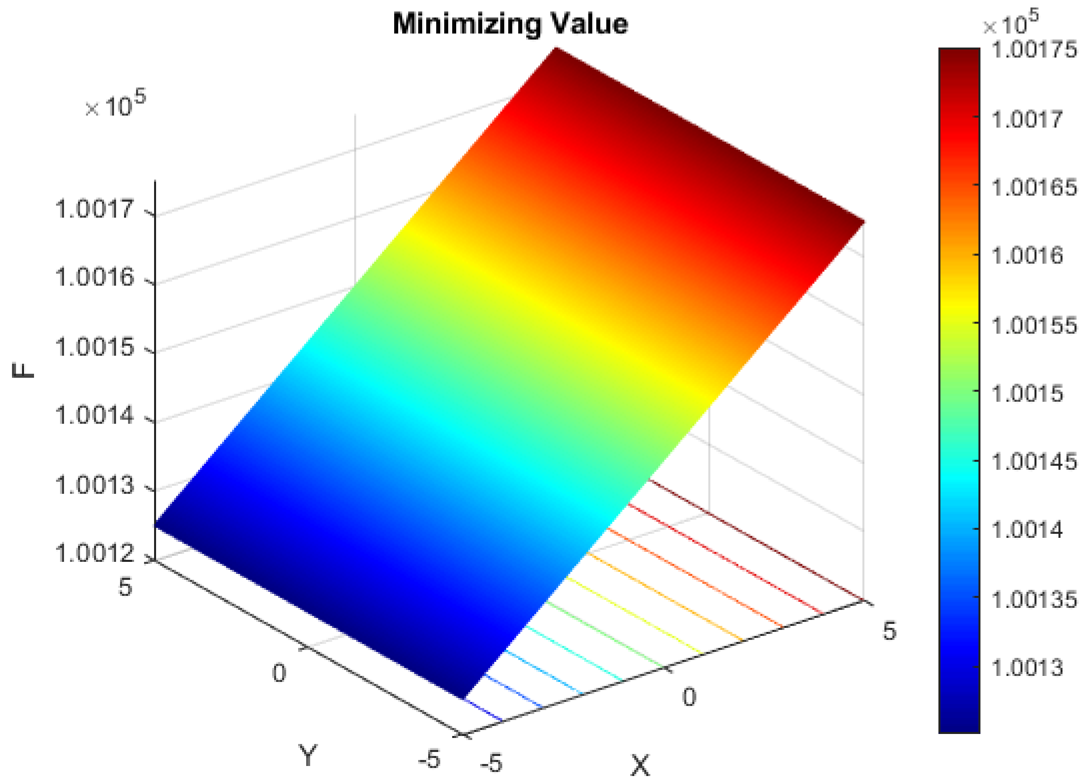
```
% f(x1,x2)=2x^2+20y^2+6xy+5x
% x - y = -2

% Find the minimum value of the function.
x0 = [0 0];
f = @(x) 2*x(1)^2 + 20*x(2)^2 + 6*x(1)*x(2) + 5*x(1);

% This is the constraint.
A = [1 -1];
b = -2;

[x, fval] = fmincon(f, x0, A, b);
fprintf('Min Value %d at X=%d, Y=%d\n', fval,x(1),x(2));

[x, y] = meshgrid(-5:0.005:5);
f = 2*x^2 + 20*y^2 + 6*x*y + 5*x;

% Visually Verify.
figure(3);
meshc(x,y,f);
title('Minimizing Value');
colormap jet
colorbar
xlabel('X');
ylabel('Y');
zlabel('F');
```

Local minimum found that satisfies the constraints.

Optimization completed because the objective function is non-decreasing in
feasible directions, to within the value of the optimality tolerance,
and constraints are satisfied to within the value of the constraint tolerance.

Min Value -4.008928e+00 at X=-1.732144e+00, Y=2.678574e-01





Published with MATLAB® R2020a