

COMP 206: MATHEMATICAL MODELING AND ALGORITHMIC THINKING

Answer to Question 1

A is number of lines of A
B is number of lines of B

$$A \leq 5000$$

$$B \leq 2000$$

$$A + B \leq 5500$$

$$A \geq 0$$

$$B \geq 0$$

$$5A + 2B \leq 48000$$

$$\max.f(x) = 200A + 175B$$

Answer to Question 2

F stands for female
M stands for male

$$F \leq 4$$

$$F \geq 0$$

$$M \leq 3$$

$$M \geq 0$$

$$4500 * F + 2700M \geq 10000$$

$$\min.f(x) = 2250F + 2160M$$

Answer to Question 3

MATLAB CODE OF FIRST QUESTION

```
v = 0:10:10000;
[x y] = meshgrid(v);
cond1 = x >= 0;
cond2 = y >= 0;
cond3 = x+y <= 5500;
cond4 = x <= 5000;
cond5 = y <= 2000;
cond6 = (5*x)+(2*y) <= 48000;
cond1 = double(cond1);
cond2 = double(cond2);
cond3 = double(cond3);
cond4 = double(cond4);
cond5 = double(cond5);
cond6 = double(cond6);
cond1(cond1 == 0) = NaN;
cond2(cond2 == 0) = NaN;
cond3(cond3 == 0) = NaN;
cond4(cond4 == 0) = NaN;
cond5(cond5 == 0) = NaN;
cond6(cond6 == 0) = NaN;
cond = cond1.*cond2.*cond3.*cond4.*cond5.*cond6;
surf(x,y,cond)
view(0,90)

prob = optimproblem('ObjectiveSense','max');
a = optimvar('a',2,1,'LowerBound',0);
prob.Objective = 200*a(1) + 175*a(2);
cond1 = a(1) >= 0;
cond2 = a(2) >= 0;
cond3 = a(1)+a(2) <= 5500;
cond4 = a(1) <= 5000;
cond5 = a(2) <= 2000;
cond6 = (5*a(1))+(2*a(2)) <= 48000;
prob.Constraints.cons1 = cond1;
prob.Constraints.cons2 = cond2;
prob.Constraints.cons3 = cond3;
prob.Constraints.cons4 = cond4;
prob.Constraints.cons5 = cond5;
prob.Constraints.cons6 = cond6;
show(prob)
sol = solve(prob);
sol.a
```

MATLAB CODE OF SECOND QUESTION

```
v = 0:1:10;
[x y] = meshgrid(v);
cond1 = x >= 0;
cond2 = y >= 0;
cond3 = x <= 4;
cond4 = y <= 3;
cond5 = (45*x) + (27*y) >= 100;
cond1 = double(cond1);
cond2 = double(cond2);
cond3 = double(cond3);
cond4 = double(cond4);
cond5 = double(cond5);
cond1(cond1 == 0) = NaN;
cond2(cond2 == 0) = NaN;
cond3(cond3 == 0) = NaN;
cond4(cond4 == 0) = NaN;
cond5(cond5 == 0) = NaN;
cond = cond1.*cond2.*cond3.*cond4.*cond5;
surf(x,y,cond)
view(0,90)

prob = optimproblem('ObjectiveSense','min');
a = optimvar('a',2,1,'LowerBound',0);
prob.Objective = 2250*a(1) + 2160*a(2);
cond1 = a(1) >= 0;
cond2 = a(2) >= 0;
cond3 = a(1) <= 4;
cond4 = a(2) <= 3;
cond5 = (4500*a(1)) + (2700*a(2)) >= 10000;
prob.Constraints.cons1 = cond1;
prob.Constraints.cons2 = cond2;
prob.Constraints.cons3 = cond3;
prob.Constraints.cons4 = cond4;
prob.Constraints.cons5 = cond5;
show(prob)
sol = solve(prob);
sol.a
```

Answer to Question 4

P: numbers of Plain breads
S: numbers of Sesame breads
 $\max f = 15P + 25S - 2P - 3.5S - 0.3P - 0.25S - 5P - 5S$
 $= \max f = 7.7P + 16.25S$
subject to
 $P + S \leq 1000$
 $P, S \geq 0$

Matlab Code

```
x = optimvar('x');  
y = optimvar('y');  
prob = optimproblem;  
prob.Objective = 2250 * x + 2160 * y;  
prob.Constraints.const1 = x + y ≤ 7;  
prob.Constraints.const2 = 4500 * x + 2700 * y == 10000;  
prob.Constraints.const3 = x ≤ 4;  
prob.Constraints.const4 = y ≤ 3;  
prob.Constraints.const5 = x ≥ 0;  
prob.Constraints.const2 = y ≥ 0;  
sol = solve(prob)
```

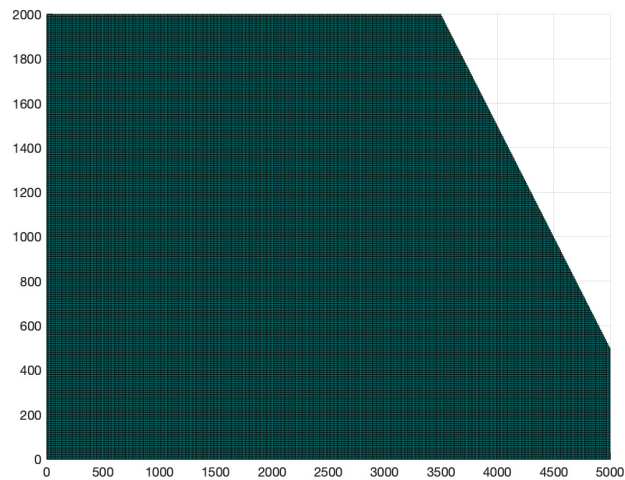


Figure 1: Plot of Question 1

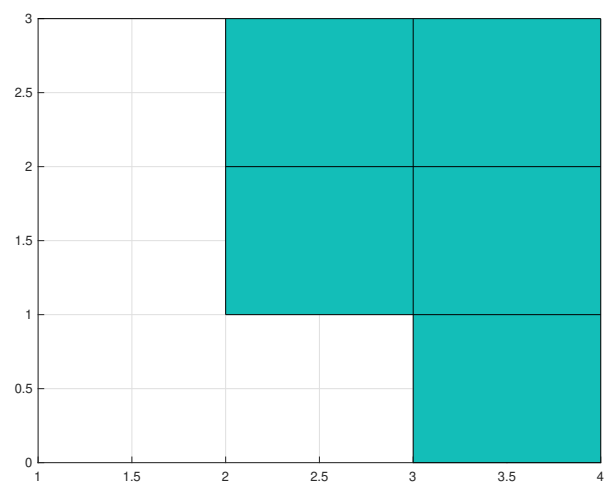


Figure 2: Plot of Question 2