Assignment #10 Solutions

due Friday, October 30th, 2020

Problem 1 (25 points) Using Excel solver, the optimal solution is $(x_1, x_2) = (9.99, 45)$ with profit $= 212.50$.

1	**Evergreen Fertilizer Company**					
2						
3	*Variables:*					
4	Colonial Paneling (x1)	9.9999999				
5	Western Paneling (x2)	45				
6						
7	Profit:	212.50001				
8						
9	*Constraints*	x1	x2	Used	Constraint	Allowed
10	available potassium	3	6	300 =		300

Problem 2

(a) **(15 points)**

Let $x_1 =$ weekly subscription price
$x_2 =$ weekly advertisement price
$q_1 =$ weekly subscriptions
$q_2 =$ number of advertising pages sell per week
Note that

$$q_2 = 350 - \frac{50}{100}(x_2 - 250)$$
$$= 475 - 0.5x_2$$
$$q_1 = 80000 - \frac{5000}{0.1}(x_1 - 1.5) + \frac{1000}{50}(q_2 - 350)$$
$$= 148000 - 50000x_1 + 20q_2$$
$$= 157500 - 10x_2 - 50000x_1$$

Then the weekly profit $x_1 q_1 + x_2 q_2$ can be written as t

$$x_1(157500 - 10x_2 - 50000x_1) + x_2(475 - 0.5x_2) = -50000x_1^2 + 157500x_1 - 10x_1x_2 + 475x_2 - 0.5x_2^2$$

Then the model is the following

$$max - 10000x_1^2 - 4000x_1 + 100x_1x_2 + 475x_2 - 0.5x_2^2$$
$$s.t. \quad x_i \geq 0, \quad \text{for } i = 1, 2$$

Using Excel solver, the optimal solution is $(x_1, x_2) = (1.53, 459.71)$ with profit $= 229592.09$.

1	Local Newspaper					
2						
3	*Variables:*					
4	weekly subscription price (x1)	1.529027764				
5	weekly advertisement price (x2)	459.7097041				
6						
7	Profit:	229592.0921				
8						
9	*Constraints*	x1	x2	Used	Constraint	Allowed
10						

(b) **(10 points)**

Let x_1 = weekly subscription price
x_2 = weekly advertisement price
The model is the following,

$$max - 10000x_1^2 - 4000x_1 + 100x_1x_2 + 475x_2 - 0.5x_2^2$$
$$s.t. \quad x_2 \leq 400$$
$$x_i \geq 0, \quad \text{for } i = 1, 2$$

Using Excel solver, the optimal solution is $(x_1, x_2) = (1.535, 400)$ with profit $= 227811.25$.

1	Local Newspaper					
2						
3	*Variables:*					
4	weekly subscription price (x1)	1.535				
5	weekly advertisement price (x2)	400				
6						
7	Profit:	227811.25				
8						
9	*Constraints*	x1	x2	Used	Constraint	Allowed
10	advertisement price	0	1	400	<=	400

Problem 3 (25 points)

1	Problem 3			
2	Data		Bin	Frequency
3	137		136	0
4	139		138	3
5	141		140	2
6	137		142	4
7	144		144	4
8	141		146	0
9	139			
10	137			
11	144			
12	141			
13	143			
14	143			
15	141			

Problem 4 (25 points) The histogram may or may not look similar. It is not a viable method for telling whether different articles were written by different authors.