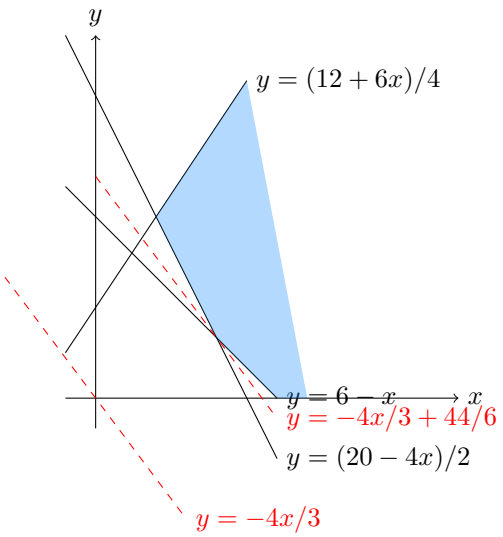
Assignment # 2 Solutions

due Friday, September 6th, 2019

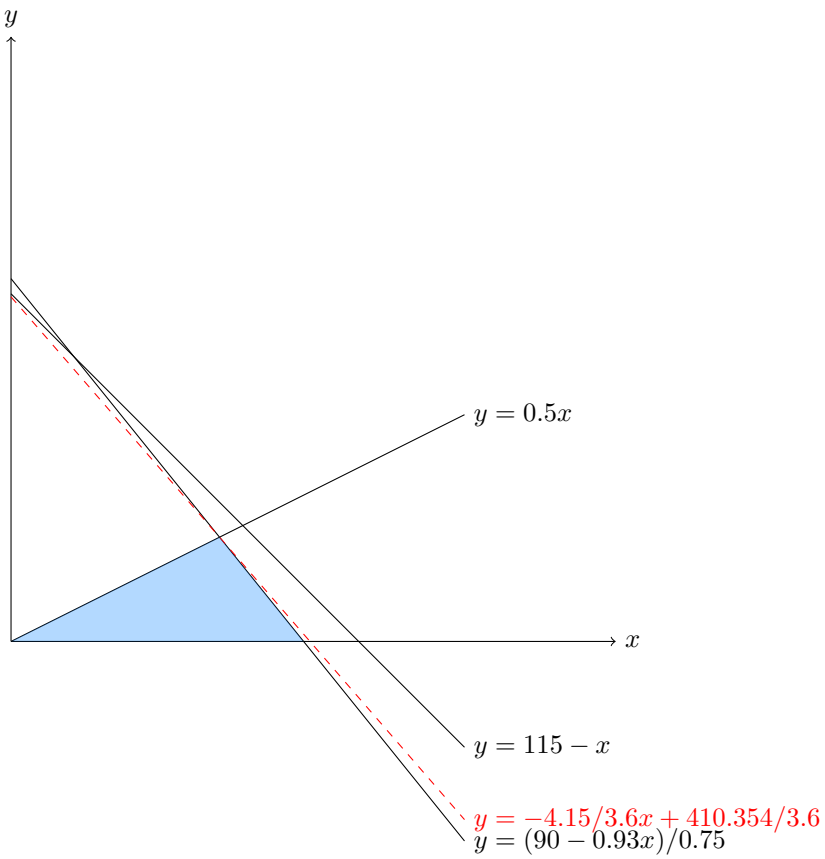
1 First, draw the feasible regions (shaded area). Then, find the minimum value by using level curve. The optimal solution is 44 with $(x, y) = (4, 2)$.



2 (a) Define x as gallons of ice cream sold each week, and y as gallons of frozen yogurt sold each week. Then the model is the following:

$$\begin{aligned} \max z &= 4.15x + 3.6y \\ s.t.\ & x + y \leq 115 \\ & 0.93x + 0.75y \leq 90 \\ & x - 2y \geq 0 \\ & x, y \geq 0 \end{aligned}$$

(b) First, draw the feasible regions (shaded area). From the figure, we can see that the maximum value is 410.34 with $(x, y) = (68.97, 34.48)$.



(c) Using Excel Solver, we find that the optimal value is 410.34 with $(x, y) = (68.97, 34.48)$, which is the same as part(b).

1	**Q2(c)**						
2	Products:	Ice cream	yogurt				
3	Profit per unit:	4.15	3.60				
4	Condition:			Usage	Constraint	Available	Left over
5	Condition 1	1.00	1.00	103.45	<=	115.00	11.55
6	Condition 2	0.93	0.75	90.00	<=	90.00	0.00
7	Condition 3	1.00	-2.00	0.00	>=	0.00	0.00
8							
9							
10	Poduction:						
11	Ice cream =	68.97					
12	Yogurt =	34.48					
13	Profit =	410.34					

3 Changing the first constraint to $x + y \leq 135$.

Using Excel Solver, we find that there is no change on the optimal profit.

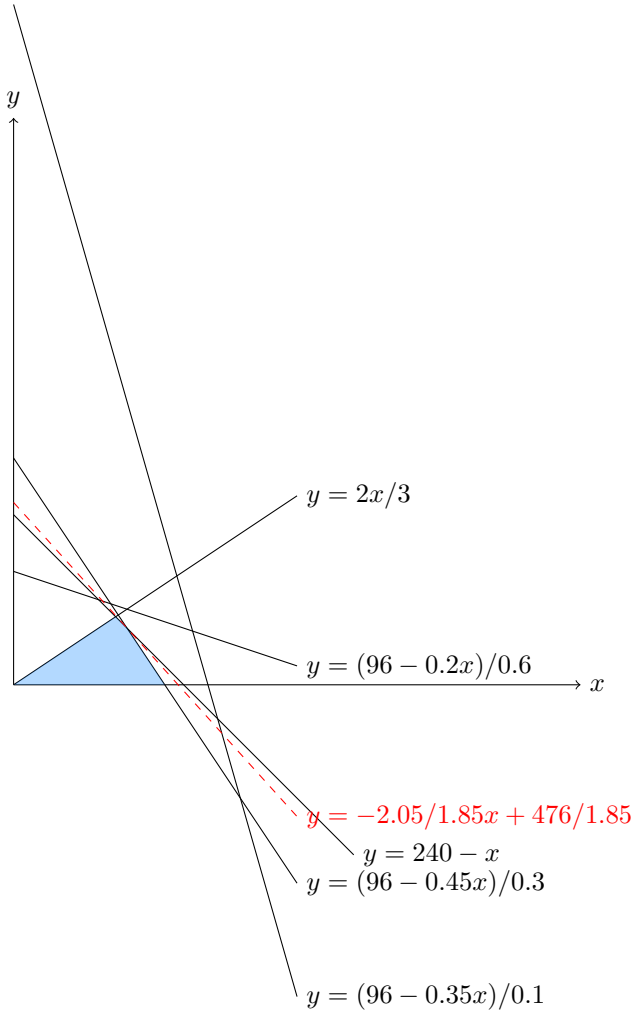
1	Q3						
2	Products:	Ice cream	yogurt				
3	Profit per unit:	4.15	3.60				
4	Condition:			Usage	Constraint	Available	Left over
5	Condition 1	1.00	1.00	103.45	<=	135.00	31.55
6	Condition 2	0.93	0.75	90.00	<=	90.00	0.00
7	Condition 3	1.00	-2.00	0.00	>=	0.00	0.00
8							
9							
10	Poduction:						
11	Ice cream =	68.97					
12	Yogurt =	34.48					
13	Profit =	410.34					

4

(a) Define x as number of 16-ounce cups of Pomona sold each day and y as number of 16-ounce cups of Coastal sold each day. Then the model is the following:

$$\begin{aligned} \max z &= 2.05x + 1.85y \\ s.t.\ x + y &\leq 30\frac{128}{16} = 240 \\ 0.2x + 0.6y &\leq 96 \\ 0.35x + 0.1y &\leq 96 \\ 0.45x + 0.3y &\leq 96 \\ x - 1.5y &\geq 0 \\ x, y &\geq 0 \end{aligned}$$

(b) The graph is as follows. From the figure, we can see that the maximum value is 476 with $(x, y) = (160, 80)$.



(c) Using Excel Solver, we find that the optimal value and optimal solutions are the same as part(b).

1	**Q4(c)**						
2	Products:	Pomona	Coastal				
3	Profit per unit:	2.05	1.85				
4	Condition:			Usage	Constraint	Available	Left over
5	Capacity constraint	1.00	1.00	240.00	<=	240.00	0.00
6	Colombia constraint	0.20	0.60	80.00	<=	96.00	16.00
7	Kenya constraint	0.35	0.10	64.00	<=	96.00	32.00
8	Indonesia constrain	0.45	0.30	96.00	<=	96.00	0.00
9	Sells 1.5 times more Pomona than Coastal each day.	1.00	-1.50	40	>=	0.00	40.00
10							
11	Poduction:						
12	Pomona =	160.00					
13	Coastal =	80.00					
14	Return =	476.00					

1. **5**

(a) If the coffee shop could get 1 more pound (= 16 ounces) of coffee, it should be Indonesian. In this case, the revenue will increase to \$492 using Excel Solver, as shown in the following table. By contrast, there is no change for the profit if we increase other two coffees.

1	**Q5(a)**						
2	Products:	Pomona	Coastal				
3	Profit per unit:	2.05	1.85				
4	Condition:			Usage	Constraint	Available	Left over
5	Capacity constraint	1.00	1.00	240.00	<=	240.00	0.00
6	Colombia constraint	0.20	0.60	48.00	<=	96.00	48.00
7	Kenya constraint	0.35	0.10	84.00	<=	96.00	12.00
8	Indonesia constrain	0.45	0.30	108.00	<=	112.00	4.00
9	Sells 1.5 times more Pomona than Coastal each day.	1.00	-1.50	240	>=	0.00	240.00
10							
11	Poduction:						
12	Pomona =	240.00					
13	Coastal =	0.00					
14	Return =	492.00					

If we increase its brewing capacity from 30 gallons to 40 gallons, the first constraint will be $x + y \leq 40\frac{128}{16} = 320$. The profit will increase by \$8.96.

1	**Q5(a)**						
2	Products:	Pomona	Coastal				
3	Profit per unit:	2.05	1.85				
4	Condition:			Usage	Constraint	Available	Left over
5	Capacity constraint	1.00	1.00	246.15	<=	320.00	73.85
6	Colombia constraint	0.20	0.60	88.62	<=	96.00	7.38
7	Kenya constraint	0.35	0.10	61.54	<=	96.00	34.46
8	Indonesia constrain	0.45	0.30	96.00	<=	96.00	0.00
9	Sells 1.5 times more Pomona than Coastal each day.	1.00	-1.50	0	>=	0.00	0.00
10							
11	Poduction:						
12	Pomona =	147.69					
13	Coastal =	98.46					
14	Return =	484.92					

(b) If the shop spent \$20 per day on advertising that would increase the relative demand for Pomona to twice that of Coastal, the fifth constraint will be $x - 2y \geq 0$. The optimal sales revenue will not change. So, it should not be done.

1	**Q5(b)**						
2	Products:	Pomona	Coastal				
3	Profit per unit:	2.05	1.85				
4	Condition:			Usage	Constraint	Available	Left over
5	Capacity constraint	1.00	1.00	240.00	<=	240.00	0.00
6	Colombia constraint	0.20	0.60	80.00	<=	96.00	16.00
7	Kenya constraint	0.35	0.10	64.00	<=	96.00	32.00
8	Indonesia constrain	0.45	0.30	96.00	<=	96.00	0.00
9	Sells 1.5 times more Pomona than Coastal each day.	1.00	-2.00	8.1185E-06	>=	0.00	0.00
10							
11	Poduction:						
12	Pomona =	160.00					
13	Coastal =	80.00					
14	Return =	476.00					