

## Homework #11

Imagine that you have been hired to work at a small refinery. You would like to blend the following gasoline components to maximize your profit subject to the constraints on quality, blend stock availability, and product sales.

Blending Component	Max Available (gal)	Cost (\$ / gal)
Butane	25,000	1.10
Straight Run Naptha	50,000	1.10
Isomerase	0	1.75
Reformate (Low Octane)	0	2.40
Reformate (High Octane)	35,000	2.80
FCC Naptha	50,000	1.75
Alkylate	12,000	2.00

Product	Volume Required (gal)		Octane Number		RVP (psi)		Value (\$ / gal)
	Lower	Upper	Lower	Upper	Lower	Upper	
Regular	75,000		89			15.0	2.00
Premium		40,000	92			15.0	2.20

Blending Component	Straight Run Naptha	Isomerase	Low Octane Reformate	High Octane Reformate	Cat Cracked Naptha	Alkylate	NC4
Gravity, °API	81.8	83.0	44.2	32.8	52.1	72.3	110.8
Aromatics, vol%	2.2	1.6	61.1	94.2	35.2	0.5	0
Olefins, vol%	0.9	0.1	1.0	0.6	32.6	0.2	0
Saturates, vol%	96.9	98.3	37.9	5.1	32.2	99.3	100
Benzene, vol%	0.73	0.00	1.17	0.00	1.06	0.00	0
RVP, psi	10.8	8.0	3.2	1.0	4.3	4.6	52
RON	63.7	78.6	97.3	109.3	93.2	93.2	93.8
MON	61.2	80.5	86.7	100.4	81.0	91.2	89.6
Sulfur, ppmw	325	10	9	10	321	15	

1. Assume that octane numbers can be blended linearly. How much of each product should be made? How much of each blending component should be used to make each product? What is the profit? What are the constraints hit for this problem?
2. Repeat #1 using the non-linear octane blending model. How do the results change?
3. (Start with all assumptions for #1.) The RVP limits listed are for the winter months. During the summer months the RVP limit is 9.0 psi. Now how much of each product should be made? How much of each blending component should be used to make each product? What is the profit? What are the constraints hit for this problem? Does our profit increase or decrease?
4. (Start with all assumptions for #1.) We have an option to process the Straight Run Naptha to Isomerase. This will eliminate the Straight Run Naptha in favor of Isomerase, but there only be 95% of the volume available. What is the change in profit? Should this be done?
5. (Start with all assumptions for #1.) We have an option to reduce the severity of the Reformate to Low Octane Reformate. This will add 15% to the volume available. What is the change in profit? Should this be done?