

**CM3450**  
**Fall 2008**  
**Drill 3**

**1. Linear Programming using Excel**

(based on H. Adidharma and V. Temyanko, p.99)

Given five types of crude oil with products of the following composition:

	Gasoline	Heating Oil	Jet Fuel	Lube Oil
Crude 1	60%	20%	10%	0%
Crude 2	50%	20%	20%	0%
Crude 3	30%	30%	30%	0%
Crude 4	40%	30%	20%	0%
Crude 5	40%	10%	20%	20%
Price	\$105/bbl	\$95/bbl	\$61/bbl	\$140
Max Weekly Demand	170,000 bbl	85,000 bbl	75,000 bbl	30,000 bbl

	Cost (\$/bbl)	Operating Cost (\$/bbl)	Availability (bbl/week)
Crude 1	45	12	80,000
Crude 2	43	20	100,000
Crude 3	40	17	100,000
Crude 4	52	7.50	100,000
Crude 5	65	6.50	65,000

**Problem:** Find the weekly production of each crude to maximize profit per week.

**Solution:**

1. Set up the spreadsheet as in Figure 1.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		Composition						bbl/wk		Max Avail	Cost/bbl	O Cost/bbl	Cost/Wk	
2	Gasoline	0.6	0.5	0.3	0.4	0.4	Crude 1			80000	45	12	0	
3	Heat Oil	0.2	0.2	0.3	0.3	0.1	Crude 2			100000	43	20	0	
4	Jet Fuel	0.1	0.2	0.3	0.2	0.2	Crude 3			100000	40	17	0	
5	Lube Oil	0	0	0	0	0.2	Crude 4			100000	52	7.5	0	
6							Crude 5			60000	65	6.5	0	
7														
8											Total Cost/Wk		0	
9														
10								bbl/wk		Mx Demand		Price/bbl	\$/Wk	
11							Gasoline			170000		105	0	
12							Heat Oil			85000		95	0	
13							Jet Fuel			75000		61	0	
14							Lube Oil			30000		140	0	
15														
16												Total \$/Wk	0	
17														
18												Profit/Wk	0	

Figure 1. Setup for Crude Oil optimization.

2. Name the matrices:
  - a) **B2:F5** as **Comp**
  - b) **I2:I6** as **Crude**
  - c) **K2:K6** as **MaxAvail**
  - d) **I11:I14** as **Products**
  - e) **K11:K14** as **MaxDemand**
  - f) **N18** as **Profit**

- Fill in the necessary formula: both normal formulas and matrix formulas

	H	I	J	K	L	M	N
1		bbl/wk	Max Avail	Cost/bbl	O Cost/bbl	Cost/Wk	
2	Crude 1	1	80000	45	12	57	
3	Crude 2	1	100000	43		63	
4	Crude 3	1	100000				
5	Crude 4	1	100000			59	
6	Crude 5	1	60000	65	6.5	71.5	
8						/Wk	308
10		bbl/wk	Mx Demand			\$/Wk	
11	Gasoline	2.2	170000		105	231	
12	Heat Oil	1.1	85000		95	104	
13	Jet Fuel	1	75000				
14	Lube Oil	0.2	30000			28	
16						Total \$/Wk	424.5
17							
18						Profit/Wk	116.5

Formulas shown in callouts:

- $=I2*(L2+M2)$  (Cell M2)
- $=SUM(N2:N6)$  (Cell N6)
- $=I11*M11$  (Cell M11)
- $=N16-N8$  (Cell N16)
- $=SUM(N11:N14)$  (Cell N14)
- $\{=MMULT(Comp, Crude)\}$  (Cell I11)

Figure 2. Fill in the formulas

- Use SOLVER to maximize Profit.

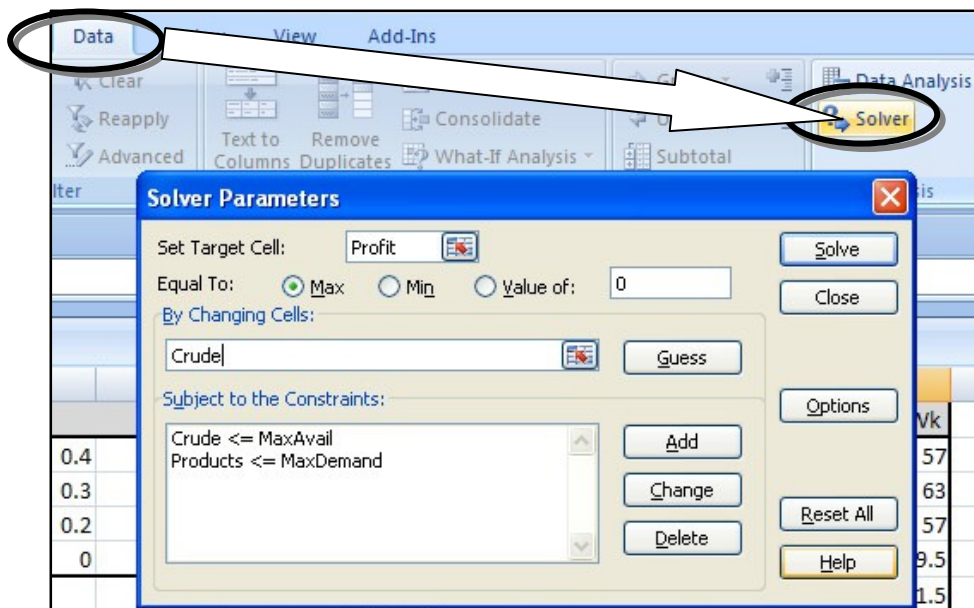


Figure 3. Implement SOLVER.