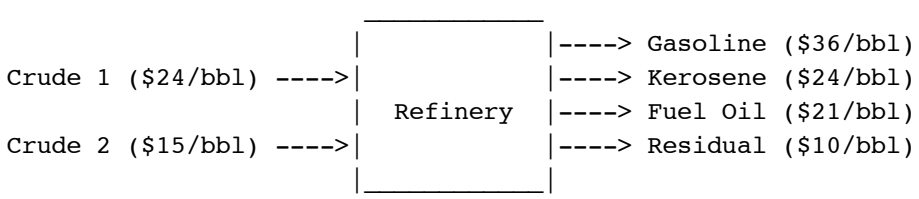
Example 19.03 Refinery Optimization

File: `Ch19_E03_sui.m`

Determine the optimal production schedule for the following process.



	Volumetric Yield		Capacity
	Crude #1	Crude #2	bbl/day
Gasoline	80%	44%	24,000
Kerosine	5%	10%	2,000
Fuel Oil	10%	36%	6,000
Processing Cost	$0.50/bbl	$1.00/bbl	

Contents

Script Requirments

- The `sui` toolset.

```
addpath('utilities');
```

Reduction to Two Variables

This example consists of six decision variables with four equality constraints. The four equalities can be used to eliminate four of the decision variables. Normally this exercise is unnecessary since linear programming software is sufficiently reliable to do these calculations. But in this instance, reducing the problem to two variables will allow us to explore the solution graphically and gain some interesting insights.

Parameters

```
Y = [0.80 0.44; 0.05 0.10; 0.10 0.36; 0.05 0.10];

gcap = 24000;
kcap =  2000;
fcap =  6000;
```

```
lb = [0;0];

prod_price = [36 24 21 10];
crude_price = [24 15];
process_cost = [0.5 1.0];
```

Optimal Solution

```
fc = prod_price*Y - crude_price - process_cost;
A = [Y(1:3,:)];

format bank
c = linprog(-fc,Y(1:3,:),[gcap;kcap;fcap],[],[],lb)
profit = fc*c
```

```
Optimization terminated.

c =

      26206.90
       6896.55


profit =

     286758.62
```

Interactive Solution

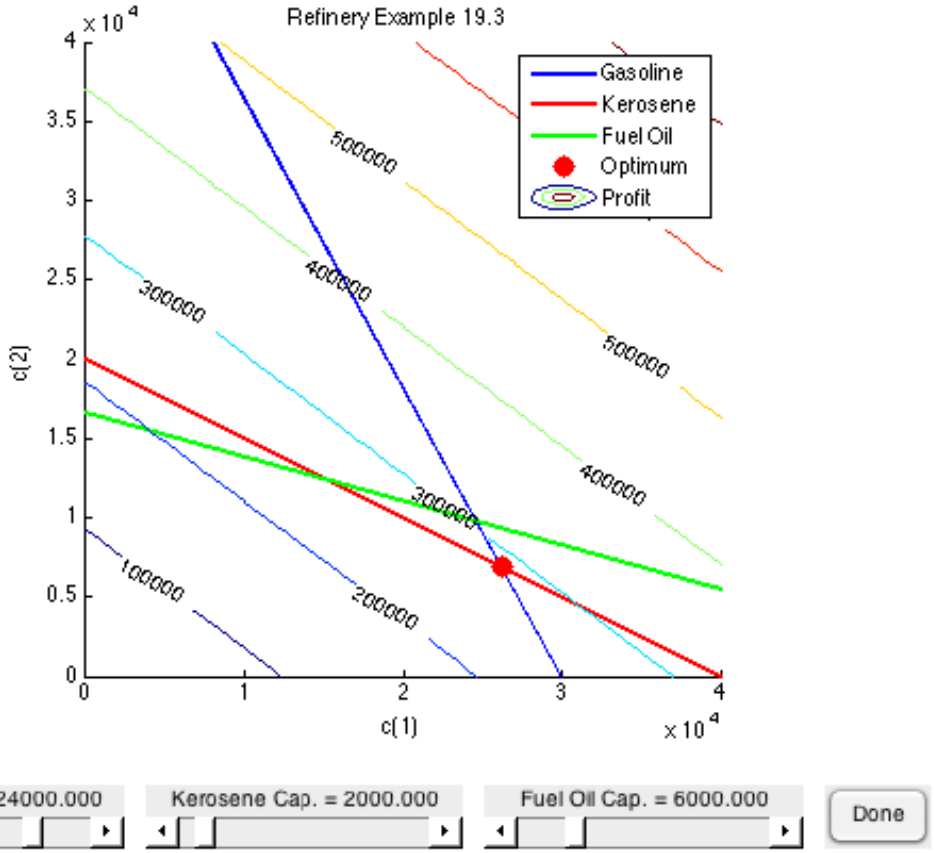
```
clf;
subplot(8,1,1:7);
[C1,C2] = meshgrid(0:1000:40000,0:1000:40000);
hold on;
    gasoline = plot([gcap/Y(1,1) 0],[0 gcap/Y(1,2)],'b','LineWidth',2);
    kerosene = plot([kcap/Y(2,1) 0],[0 kcap/Y(2,2)],'r','LineWidth',2);
    fuel_oil = plot([fcap/Y(3,1) 0],[0 fcap/Y(3,2)],'g','LineWidth',2);
    optimum = plot(c(1),c(2),'r.','Markersize',30);
    contour(C1,C2,fc(1)*C1+fc(2)*C2,'ShowText','on');
hold off;
legend({'Gasoline','Kerosene','Fuel Oil','Optimum','Profit'});
axis([0 40000 0 40000]);
axis('square');
xlabel('c(1)');
ylabel('c(2)');
title('Refinery Example 19.3');

update = @(gcap,kcap,fcap) { ...
    suiPlot(gasoline,[gcap/Y(1,1) 0],[0 gcap/Y(1,2)]);
    suiPlot(kerosene,[kcap/Y(2,1) 0],[0 kcap/Y(2,2)]);
    suiPlot(fuel_oil,[fcap/Y(3,1) 0],[0 fcap/Y(3,2)]);
```

```
    suiPlot(optimum,linprog(-fc,A,[gcap;kcap;fcap],[],[],lb,[])')};

[gcap,loc] = suiSlider(0,30000,gcap,'Gasoline Cap.',[10,10],150);
[kcap,loc] = suiSlider(0,30000,kcap,'Kerosene Cap.',loc.Right,150);
[fcap,loc] = suiSlider(0,30000,fcap,'Fuel Oil Cap.',loc.Right,150);
suiButton(@()close('all'),'Done',loc.Right,50);

suiUpdate(@()update(gcap(),kcap(),fcap()));
```



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