

## NATCOR - Xpress case study (advanced)

Margaret Oil produces three products: gasoline, jet fuel, and heating oil. The average octane levels must be at least 8.5 for gasoline, 7 for jet fuel, and 4.5 for heating oil. To produce these products, Margaret can purchase two types of crude oil: crude 1 (at £12 per barrel) and crude 2 (at £10 per barrel). Each day, at most 10000 barrels of each type of oil can be purchased.

Before crude can be used to produce products for sale, it must be distilled. Each day, at most 15000 barrels of oil can be distilled. It costs £0.10 to distill a barrel of oil. Each barrel of crude 1 yields 0.3 barrel of distilled 1, 0.1 barrel of distilled 2, and 0.6 barrel of naphtha. Each barrel of crude 2 yields 0.2 barrel of distilled 1, 0.4 barrel of distilled 2, and 0.4 barrel of naphtha. Distilled naphtha can be used only to produce gasoline or jet fuel. Distilled oil can be used to produce heating oil or it can be sent through the catalytic cracker (at a cost of £0.15 per barrel).

Each day, at most 5000 barrels of distilled oil can be sent through the cracker. Each barrel of distilled 1 sent through the cracker yields 0.8 barrel of cracked 1 and 0.2 barrel of cracked 2. Each barrel of distilled 2 sent through the cracker yields 0.7 barrel of cracked 1 and 0.3 barrel of cracked 2. Cracked oil can be used to produce gasoline and jet fuel but not to produce heating oil.

The octane level of each type of oil is as follows: distilled 1, 4; distilled 2, 5; naphtha, 8; cracked 1, 9; cracked 2, 6. All gasoline produced can be sold at £18 per barrel, all jet fuel produced, £16 per barrel; and all heating oil produced, £14 per barrel. Marketing considerations dictate that at least 2500 barrels of gasoline, 3000 of jet fuel and 3500 of heating oil must be produced daily. How can Margaret Oils maximize its daily profit? Analyze the limits of the company and its possibilities for improvements.

Final products	Gasoline	Jet fuel	Heating oil
Minimum octane	8.5	7	4.5
Price (£)	18	16	14
Minimum production	2500	3000	3500

Distillation	Distilled 1	Distilled 2	Naphtha	Cost
Crude 1	0.3	0.1	0.6	12
Crude 2	0.2	0.4	0.4	10

Cracking	Distilled 1	Distilled 2
Cracked 1	0.8	0.7
Cracked 2	0.2	0.3

	Distilled 1	Distilled 2	Naphtha	Cracked 1	Cracked 2
Octane	4	5	8	9	6