CO 370

Deterministic Operations Research Models

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1. Blending problem

We are **buying** 3 types of **crude oil**, each with given

- **octane** level,
- **sulfur** levels,
- **price**, and
- **limited supply**.

We are **selling** 2 types of refined **gas** produced by blending our 3 types of crude oil. Each type of gas

- must attain prescribed minimum **octane** level,
- must not exceed prescribed maximum **sulfur** level,
- has a fixed **price**, and
- must at least satisfy a given **demand**.

Determine a way to maximize profits.

1. Blending problem: data

Buy **Crude 1**, **Crude 2**, **Crude 3** $\longrightarrow$ Sell **Gas 1**, **Gas 2**

	octane (AKI)	sulfur (ppm)	cost ($/barrel)	purchase (barrels)
Crude 1	80	20	60	≤ 5000
Crude 2	90	10	85	≤ 5000
Crude 3	98	5	120	≤ 5000

$\downarrow$

	octane (AKI)	sulfur (ppm)	revenue ($/barrel)	production (barrels)
Gas 1	≥ 87	≤ 15	120	≥ 8000
Gas 2	≥ 91	≤ 9	140	≥ 4000

Maximize profits.

2. Multiperiod problem

Initial cash: **$ 100,000**

	Y1	Y2	Y3	Y4
A	**x**	0.5	1	-
B		**x**	0.5	1
C	**x**	1.2	-	-
D	**x**	-	-	1.9
E			**x**	1.5

(**x** = investment time)

Max investment: **$ 75,000** per project
Bank account: **8%** interest per year

Maximize cash at Y4. How much to invest in each project?

3. Multiperiod problem (generic)

Initial cash: **$ K**

	Y_1	$\cdots$	Y_j	$\cdots$	Y_N
P_1					
$\vdots$					
P_i			f_{ij}		
$\vdots$					
P_M					

(**x** at investment time, $f_{ij} = -1$)

Max investment: **$ U** per project
Bank account: interest rate **R**, per year

Maximize cash at Y_N. How much to invest in each project?