10 October.

§1.1 Two topics:

-Mathematical modeling - problem set 2. (with solutions) includes the even-numbered exercises from §1.1

-General linear programming problem (pg 51) and standard and canonical form.

Eg: (#11. pg 60)

A local health food store packages 3 types of snack foods — Chewy, Cunchy and Nutty — by mixing seeds, raisins, and peanuts. The specifications for each mixture are given in the table.

Mixture	Seeds	Raisins	Peanuts	Selling price ($)
Chewy		≥60%	≤20%	2
Cunchy	≥60%			1.6
Nutty	≤20%		≥60%	1.2

The suppliers of the ingredients can deliever at most 100 kg of seeds at $1 per kg. 80kg of raisins at 1.5 $ per kg, and 60 kg of peanuts at $ 0.8 per kg.

Set up a linear programming problem which will maximizes the store's profit.

Choosing the independent variable Let x_{ij} = #kg of ingredient j used in mixture i.

	Seeds ($j=1$)	Raisins ($j=2$)	Peanuts ($j=3$)
Chewy ($i=1$)	x_{11}	x_{12}	x_{13}
Cunchy ($i=2$)	x_{21}	x_{22}	x_{23}
Nutty ($i=3$)	x_{31}	x_{32}	x_{33}

Constraints

$.6(x_{11}+x_{12}+x_{13}) \le x_{12}$

$.2(x_{11}+x_{12}+x_{13}) \ge x_{13}$

$.6(x_{21}+x_{22}+x_{23}) \le x_{21}$

$.2(x_{31}+x_{32}+x_{33}) \ge x_{31}$

$.6(x_{31}+x_{32}+x_{33}) \le x_{33}$

Also:

$x_{11}+x_{21}+x_{31} \le 100$

$x_{12}+x_{22}+x_{32} \le 80$

$x_{13}+x_{23}+x_{33} \le 60$

also:

$x_{ij} \ge 0$, all $i,j = 1,2,3$

Profit = revenue − cost

$= 2(x_{11}+x_{12}+x_{13}) + 1.6(x_{21}+x_{22}+x_{23}) + 1.2(x_{31}+x_{32}+x_{33}) - (x_{11}+x_{21}+x_{31}) - 1.5(x_{12}+x_{22}+x_{32}) - 0.8(x_{13}+x_{23}+x_{33})$

A linear programming problem in general form:

Maximize $Z = x_{11} + 0.5x_{12} + 1.2x_{13} + 0.6x_{21} + 0.1x_{22} + 0.8x_{23} + 0.2x_{31} - 0.3x_{32} + 0.4x_{33}$

S.t. $0.6x_{11} - 0.4x_{12} + 0.6x_{13} \le 0$

$2x_{11} + 0.2x_{12} - 0.8x_{13} \ge 0$

$-0.4x_{21} + 0.6x_{22} + 0.6x_{23} \le 0$

$$-2X_{31}+2X_{32}+0.2X_{33}\geq 0$$

$$0.6X_{31}+0.6X_{32}-1.4X_{33}\leq 0$$

$X_{11}+X_{21}+X_{31}\leq 100$

$X_{12}+X_{22}+X_{32}\leq 80$

$X_{13}+X_{23}+X_{33}\leq 60$

$X_{ij}\geq 0$ for $i=1,2,3; j=1,2,3.$