Problem 1 Back Savers

	Material	Labor (per hour)	Unit Profit	Sales Forecast for unit sold
Collegiate	3	.75	$32	1000
Mini	2	.667	$24	1200

The Number of Collegiate Backpacks

= b_c

The Number of Mini Backpacks

= b_m

The total Quantity mix of backpacks (in thousands)

= Z

- Decision variables are:

  =b_c and b_m

- The objective function is to maximize unit production

  Max Z = $1b_c + 1.2b_m$

- Constraints
  - Material Constraints

    $3b_c + 2b_m \leq 5000$

  - Labor Constraints

    $0.75b_c + 0.667b_m \leq 1400$

- Complete Model
  - Z = $1b_c + 1.2b_m$

    subject to the following constraints:

    Material Constraints

    $3b_c + 2b_m \leq 5000$

    Labor Constraints

    $0.75b_c + 0.667b_m \leq 1400$

    And non-negativity of the decision variables

    $b_c \geq 0$, $b_m \geq 0$

Problem 2 - The Weigelt Corporation

	Unit Profit	Required Storage Space in SqFt	Sales Forecast Per Unit
Large	420	20	900
Medium	360	15	1,200
Small	300	12	750

	Excess to produce	Storage space in SqFt
Plant 1	750	13,000
Plant 2	900	12,000
Plant 3	450	5,000

- Decision Variables
  - P_1 = New Product Large
  - P_2 = New Product Medium
  - P_3 = New Product Small
  - X_1 = Plant 1
  - X_2 = Plant 2
  - X_3 = Plant 3
- The Objective is to Maximize profits
  - Z = $420(P_1X_1 + P_1X_2 + P_1X_3) + 360(P_2X_1 + P_2X_2 + P_2X_3) + 300(P_3X_1 + P_3X_2 + P_3X_3)$
- Constraints
  - Production (related to excess to produce in units)
    - $P_1X_1 + P_2X_1 + P_3X_1 \leq 750$
    - $P_1X_2 + P_2X_2 + P_2X_2 \leq 900$
    - $P_1X_3 + P_2X_3 + P_3X_3 \leq 450$
  - Storage
    - $20P_1X_1 + 15P_2X_1 + 12P_3X_1 \leq 13{,}000$
    - $20P_1X_2 + 15P_2X_2 + 12P_2X_2 \leq 12{,}000$
    - $20P_1X_3 + 15P_2X_3 + 12P_3X_3 \leq 5{,}000$
  - To avoid Layoffs related to Production
    - $(P_1X_1 + P_2X_1 + P_3X_1)- 750 = 0$
    - $(P_1X_2 + P_2X_2 + P_2X_2) - 900 = 0$
    - $(P_1X_3 + P_2X_3 + P_3X_3) - 450 = 0$
- Complete Model
  - Z = $420(P_1X_1 + P_1X_2 + P_1X_3) + 360(P_2X_1 + P_2X_2 + P_2X_3) + 300(P_3X_1 + P_3X_2 + P_3X_3)$

    Subject to the following constraints:

    Production

    $P_1X_1 + P_2X_1 + P_3X_1 \leq 750$

    $P_1X_2 + P_2X_2 + P_2X_2 \leq 900$

    $P_1X_3 + P_2X_3 + P_3X_3 \leq 450$

    Storage

    $20P_1X_1 + 15P_2X_1 + 12P_3X_1 \leq 13{,}000$

    $20P_1X_2 + 15P_2X_2 + 12P_2X_2 \leq 12{,}000$

    $20P_1X_3 + 15P_2X_3 + 12P_3X_3 \leq 5{,}000$

    Avoid Layoffs related to Production

$(P_1X_1 + P_2X_1 + P_3X_1)- 750 = 0$

$(P_1X_2 + P_2X_2 + P_2X_2) - 900 = 0$

$(P_1X_3 + P_2X_3 + P_3X_3) - 450 = 0$

And non-negativity of the decision variables

$P_1 \geq 0$

$P_2 \geq 0$

$P_3 \geq 0$

$X_1 \geq 0$

$X_2 \geq 0$

$X_3 \geq 0$