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Module 2 Assignment

Linear Programming Formulations

Problem 1: Back Savers Backpacks

Decision Variables

xC = number of Collegiate backpacks produced per week
xM = number of Mini backpacks produced per week

Objective Function

Maximize weekly profit:
$Z = 32xC + 24xM$

Constraints

Fabric:
$3xC + 2xM \leq 5000$
Labor:
$45xC + 40xM \leq 84,000$
Sales limits:
$xC \leq 1000$
$xM \leq 1200$
Nonnegativity:
$xC \geq 0, xM \geq 0$

Problem 2: Weigelt Corporation (Three Plants, Three Sizes)

Decision Variables

xiL = units of Large produced per day at plant i (i = 1,2,3)
xiM = units of Medium produced per day at plant i (i = 1,2,3)
xiS = units of Small produced per day at plant i (i = 1,2,3)
u = common utilization fraction of each plant's capacity ($0 \leq u \leq 1$)

Objective Function

Maximize daily profit:

$$Z = 420 \Sigma\ xiL + 360 \Sigma\ xiM + 300 \Sigma\ xiS, \text{ for } i = 1..3$$

Constraints

Capacity with equal utilization:

$$x1L + x1M + x1S \leq 750u$$
$$x2L + x2M + x2S \leq 900u$$
$$x3L + x3M + x3S \leq 450u$$

Storage:

$$20x1L + 15x1M + 12x1S \leq 13{,}000$$
$$20x2L + 15x2M + 12x2S \leq 12{,}000$$
$$20x3L + 15x3M + 12x3S \leq 5{,}000$$

Market demand:

$$\Sigma\ xiL \leq 900$$
$$\Sigma\ xiM \leq 1200$$
$$\Sigma\ xiS \leq 750$$

Nonnegativity:

$$xiL,\ xiM,\ xiS \geq 0 \text{ for } i=1,2,3$$
$$0 \leq u \leq 1$$