Quantitative Management Modeling Model 2 Assignment

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1. Back Savers
    a. Decision Variables
        i. Mini backpacks to produce per week (variable 2)
        ii. Collegiate backpacks to produce per week (variable 1)
    b. Objective Function
        i. Estimate the number of mini backpacks and collegiate backpacks to produce per week to achieve the highest profit
            1. Mini backpacks produce $24 profit per unit
            2. Collegiate backpacks produce $32 profit per unit
    c. Constraints
        i. Maximum number of backpacks that can be produced per week based on sales quota
            1. 1000 per week for collegiate backpacks
            2. 1200 per week for mini backpacks
        ii. Supplier has limited number supply of nylon available per week
            1. 5000 square feet available
            2. Mini backpacks use 2 square feet per unit
            3. Collegiate backpacks use 3 square feet per unit
        iii. Back Savers have limited number of worker hours
            1. 35 total workers * 40 hours per week = 1400 hours per week
            2. Mini backpacks require 40 minutes per unit = 0.67 hours per week
            3. Collegiate backpacks require 45 minutes per unit = 0.75 hours per week
        iv. Linear Programming Model
            1. Objective
                a. Maximize Profit (p)
                    i. $P = 32x_1 + 24x_2$
            2. Constraints
                a. Mini backpacks to produce per week
                    i. $x_2 \leq 1200$
                b. Collegiate backpacks to produce per week
                    i. $x_1 \leq 1000$
                c. Nylon availability per week
                    i. $3x_1 + 2x_2 \leq 5000$
                d. Work hours available per week

i. $0.75x_1 + 0.67x_2 \leq 1400$

2. Weigelt Corporation
   a. Decision Variables
      i. Large units made at Plant 1 = x_{L1}
      ii. Medium units made at Plant 1 = x_{M1}
      iii. Small units made at Plant 1 = x_{S1}
      iv. Large units made at Plant 2 = x_{L2}
      v. Medium units made at Plant 2 = x_{M2}
      vi. Small units made at Plant 2 = x_{S2}
      vii. Large units made at Plant 3 = x_{L3}
      viii. Medium units made at Plant 3 = x_{M3}
      ix. Small units made at Plant 3 = x_{S3}
   b. Linear Programming Model
      i. Objective
         1. $P = 420(x_{L1} + x_{L2} + x_{L3}) + 360(x_{M1} + x_{M2} + x_{M3}) + 300(x_{S1} + x_{S2} + x_{S3})$
      ii. Plant 1 production constraint
         1. $x_{L1} + x_{M1} + x_{S1} \leq 750$
      iii. Plant 2 production constraint
         1. $x_{L2} + x_{M2} + x_{S2} \leq 900$
      iv. Plant 3 production constraint
         1. $x_{L3} + x_{M3} + x_{S3} \leq 450$
      v. Large units sales constraint
         1. $x_{L1} + x_{L2} + x_{L3} \leq 900$
      vi. Medium units sales constraint
         1. $x_{M1} + x_{M2} + x_{M3} \leq 1200$
      vii. Small units sales constraint
         1. $x_{S1} + x_{S2} + x_{S3} \leq 750$
      viii. Plant 1 storage space constraint
         1. $20x_{L1} + 15x_{M1} + 12x_{S1} \leq 13000$
      ix. Plant 2 storage space constraint
         1. $20x_{L2} + 15x_{M2} + 12x_{S2} \leq 12000$
      x. Plant 3 storage space constraint
         1. $20x_{L3} + 15x_{M3} + 12x_{S3} \leq 5000$

xi. Avoid layoffs by having consistent capacity between old and new products constraint

1. $$\frac{x_{L1}+x_{M1}+x_{S1}}{750} = \frac{x_{L2}+x_{M2}+x_{S2}}{900} = \frac{x_{L3}+x_{M3}+x_{S3}}{450}$$