ASSIGNMENT 3
MIS 64018 Quantitative Management Modeling
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PROBLEM

Back Savers is a company that produces backpacks primarily for students. They are considering offering some combination of two different models—the Collegiate and the Mini. Both are made out of the same rip-resistant nylon fabric. Back Savers has a long-term contract with a supplier of the nylon and receives a 5000 square-foot shipment of the material each week. Each Collegiate requires 3 square feet while each Mini requires 2 square feet. The sales forecasts indicate that at most 1000 Collegiates and 1200 Minis can be sold per week. Each Collegiate requires 45 minutes of labor to produce and generates a unit profit of $32. Each Mini requires 40 minutes of labor and generates a unit profit of $24. Back Savers has 35 laborers that each provides 40 hours of labor per week. Management wishes to know what quantity of each type of backpack to produce per week.

Solve this problem graphically.

Solution:

From assignment 2, the 2-dimensional LP formation was as follows:

X1 = Number of Collegiate Models for production
X2 = Number of Minis Models for production.

Max Z = 32X1 + 24X2, where Z = profit in dollars ($), in we wish to maximize.

ST:

3X1 + 2M ≤ 5400 (in ft2) (Nylon raw material)
.75X1 + .67X2 ≤ 1400 (in hours) (Labor hours/week)
X1 ≤ 1000 (Sales forecast/production/week for Collegiate Models)
X2 ≤ 1200 (Sales forecast/production/week for Minis Models)

and, Xij ≥ 0 (X1 ≥ 0, X2 ≥ 0)

Please note: The total labor hours were found by converting minutes into hours multiplied by 40 hour work week.

Graphical solution for this LP problem (using isoprofit line and corner-point methods):

Figure 1. *Graphical solution for Back Savers' problem.*

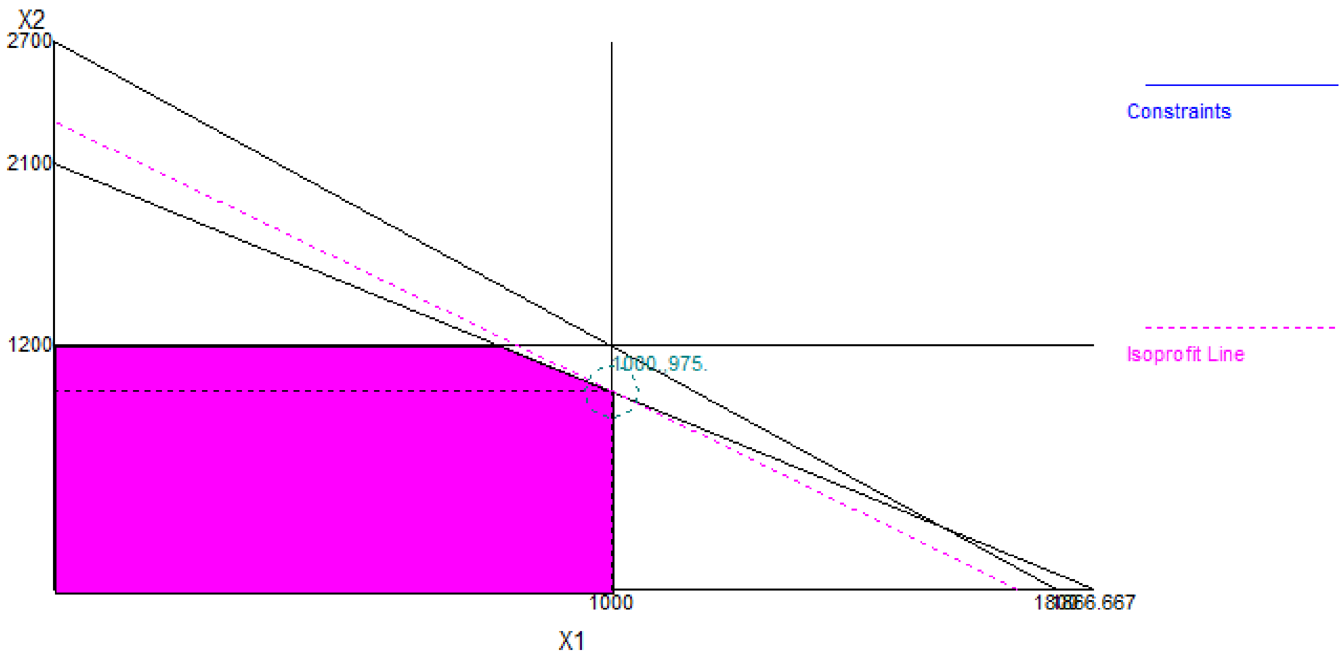

Table 1. *Corner-point solution for Back Savers' problem.*

Constraint Display

- Max 32X1+24X2
- 3X1+2X2 <=5400
- .75X1+.6666667X2 <=1400
- 1X1<=1000
- 1X2 <=1200
- none

Corner Points		
X1	X2	Z
0	0	0
1000	0	32,000.
0	1200	28,800.
1000	975	55,400.
799.9999	1200	54,400.

As shown is Table 1 and Figure 2, the optimum corner point that maximizes the profit ($55,400) via the isoprofit line (e.g. plot of objective function) on the upper bound of the feasible solution space is X1 = 1000 units of Collegiate Models and X2 = 975 units of Minis Models. In order to covert 2/3 in to a proper real numer that correctly represents this fraction, I used 0.6667.