ASSIGNMENT 1
LINEAR PROGRAMMING MODEL

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You should create a word or PDF copy for the following problem and upload the file to the same GitHub account. On Blackboard, you should then submit the address (the second link) to this file.

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.

a. Clearly define the decision variables
b. What is the objective function?
c. What are the constraints?
d. Write down the full mathematical formulation for this LP problem.

	Collegiate (X_1)	**Mini (X_2)**
Material	3 sqft	2 sqft
Sales	1,000 /week	1,200 /week
Production Time	45 min	40 min
Unit Profit	$32	$24

Resources (constraints):

- 5,000 sqft/week
- 35 laboreres working 40 hours/week each
- 1,000 max weekly quantity of X_1
- 1,200 max weekly quantity of X_2

Objective function:

$Z = 32 X_1 + 24 X_2$ (maximize profit)

Subject To (ST):

$3 X_1 + 2 X_2 \leq 5{,}000$	(material usage)
$X_1 \leq 1{,}000$	(quantity to be sold)
$X_2 \leq 2{,}000$	(quantity to be sold)
$45 X_1 + 40 X_2 \leq 84{,}000$*	(labor time for production)
$X_1, X_2 \geq 0$	(quantities not negative)

*Minutes instead of hours has been used for the formulation of the problem (84 thousand minutes is the results of the following multiplication, *35 laborers x 40 hours of work x 60 minutes in a hour*); it can be easily converted in hours (in this case the production time for X_1 would be *0.75 hour* and *0.67 hour* for X_2).