📦 Warehouse Space Optimization for a Growing E-Commerce Startup

Business Scenario

A fast-growing e-commerce startup manages a small urban warehouse. The warehouse receives three types of products daily:

- **Eco-friendly Gadgets**
- **Home Decor Items**
- **Fitness Accessories**

Given limited warehouse space, labour hours, and a daily delivery quota, the company wants to maximize daily profit by deciding how many units of each product to stock and sell. Each product has different space requirements, profit margins, and handling times.

Your task:
Formulate and solve an optimization model that tells the business how many units of each product to stock and sell daily to maximize profit, subject to operational constraints.

Step 1: Problem Setup

Parameters

Product	**Profit per Unit**	**Space per Unit (cubic ft)**	**Handling Time (min)**	**Max Daily Supply**
Eco-friendly Gadgets	$30	2.0	10	40
Home Decor Items	$22	3.0	8	50
Fitness Accessories	$18	1.5	6	60

- **Warehouse space available:** 150 cubic feet/day
- **Total labor available:** 8 worker-hours/day (480 minutes)
- **Delivery van quota:** 80 units/day (all products combined)

Step 2: Model Formulation

Let:

- $x1x1$: Number of Eco-friendly Gadgets to stock and sell per day
- $x2x2$: Number of Home Decor Items
- $x3x3$: Number of Fitness Accessories

Objective:
Maximize profit: $Profit=30x1+22x2+18x3Profit=30x1+22x2+18x3$

Constraints:

- Space: 2x1+3x2+1.5x3≤1502*x*1+3*x*2+1.5*x*3≤150
- Labor: 10x1+8x2+6x3≤48010*x*1+8*x*2+6*x*3≤480
- Delivery: x1+x2+x3≤80*x*1+*x*2+*x*3≤80
- Supply: x1≤40, x2≤50, x3≤60*x*1≤40, *x*2≤50, *x*3≤60
- Non-negativity: x1, x2, x3≥0*x*1, *x*2, *x*3≥0 and integers

Insights

- The optimal plan shows how many units of each product to stock and sell daily for maximum profit.

- If any variable is at its upper bound, that product's supply is a limiting factor.

- If all constraints are binding, consider expanding warehouse space, increasing labor, or negotiating for higher delivery quotas to further boost profit.

- This model can be adapted for other scenarios by adjusting product types, constraints, and profit values.