# Quiz 1: Formulate the Problem & Draw Feasible Space

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## Problem Statement

A green-energy refinery in Maharashtra is optimizing its monthly production of Ethanol and specialized Industrial Solvent. The refinery can use two types of raw materials: Sugarcane and Corn. Sugarcane costs ₹ 3,200 per ton and yields 80 liters of raw fermented juice per ton, whereas Corn costs ₹ 22,000 per ton but yields a much higher 400 liters of juice per ton. The primary Milling Stage can process a maximum of 10,000 tons of raw material (Sugarcane and Corn combined) per month. The raw juice is then moved to the Fermentation Stage, which has a total volumetric capacity of 2,000,000 liters of juice. After fermentation, the juice is converted into Ethanol. The refinery has a mandatory government contract to supply at least 1,200,000 liters of pure Ethanol to oil companies at a fixed price of ₹ 65 per liter. Any Ethanol produced beyond this mandatory contract can either be sold directly to the same oil companies at the same price or converted into high-grade Industrial Solvent. Converting Ethanol to Solvent requires an additional chemical catalyst known as "Agent-X." Every 1 liter of Ethanol combined with 0.1 kg of Agent-X produces exactly 1 liter of Solvent. The refinery has a limited monthly stock of 50,000 kg of Agent-X, which costs the company ₹ 400 per kg. The finished Industrial Solvent is sold to pharmaceutical companies at a premium price of ₹ 150 per liter. Assuming the refinery wants to maximize its net monthly profit (defined as total sales revenue minus the total costs of raw materials and catalysts), formulate the complete linear programming model for this operation. Identify all decision variables, the objective function, and the multi-stage constraints. Also, draw the feasible space in both refinery input and output space separatly.

*— End of Problem Statement —*