

In-Class Exercise: The Orbital Payload

Time Limit: 15 Minutes

Tools Allowed: Pen & Paper, Excel, Calculator, Python, AI, or Guesswork.

The Scenario

You are the Lead Mission Engineer for a new CubeSat satellite launch. Your team has developed **5 distinct scientific instruments** (Modules), but the rocket has strict limits on **Weight** and **Power Supply**.

Your goal is to select which subset of instruments to include on the manifest to maximize the total **Scientific Value (Score)**.

The Data

The Constraints (The Limits)

The satellite bus has the following hard capacities:

1. **Maximum Weight:** 60 kg
2. **Maximum Power Draw:** 50 Watts

The Candidates (The Instruments)

You can choose to include (1) or exclude (0) each instrument. You cannot take partial instruments, and you have only one of each.

Instrument Name	Weight (kg)	Power Draw (Watts)	Scientific Value (Score)
A. Alpha Imager	30 kg	10 W	60
B. Beta Sensor	20 kg	20 W	45
C. Gamma Ray Detector	15 kg	15 W	40
D. Delta Comm Array	10 kg	30 W	50
E. Epsilon Magnetometer	5 kg	5 W	10

Your Task

Answer the following questions:

1. **The Manifest:** Which instruments are you loading onto the satellite? (e.g., "A, C, and E")

2. **The Check:** What is the Total Weight and Total Power of your selection? (Must be \leq 60kg and \leq 50W)
3. **The Result:** What is your Total Scientific Value?
4. **The Method:**
 - o Did you try to pick the highest value items first? Did that work?
 - o Did you calculate "Value per kg"?
 - o If you used AI, did it understand that you can only take **one** of each (Binary constraint)?