



CIT CASE STUDY

Presented by Molly Li

2025

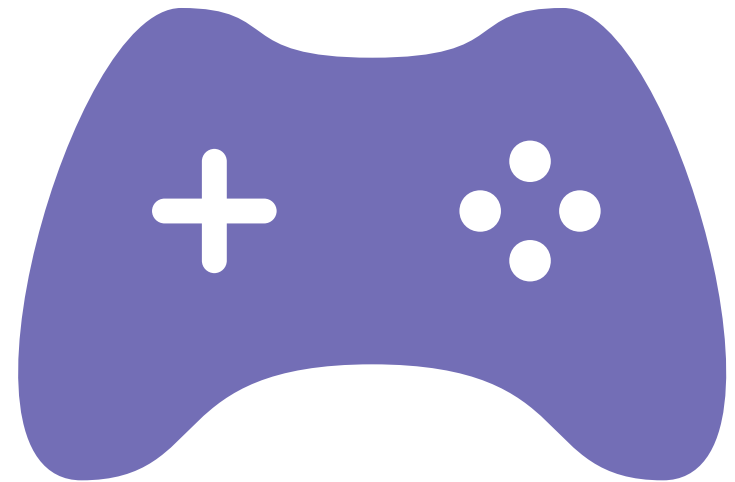


Case 1 Forecast

Objective

Goal:

Forecast first 15 weeks of Superman Plus sales



Data Overview

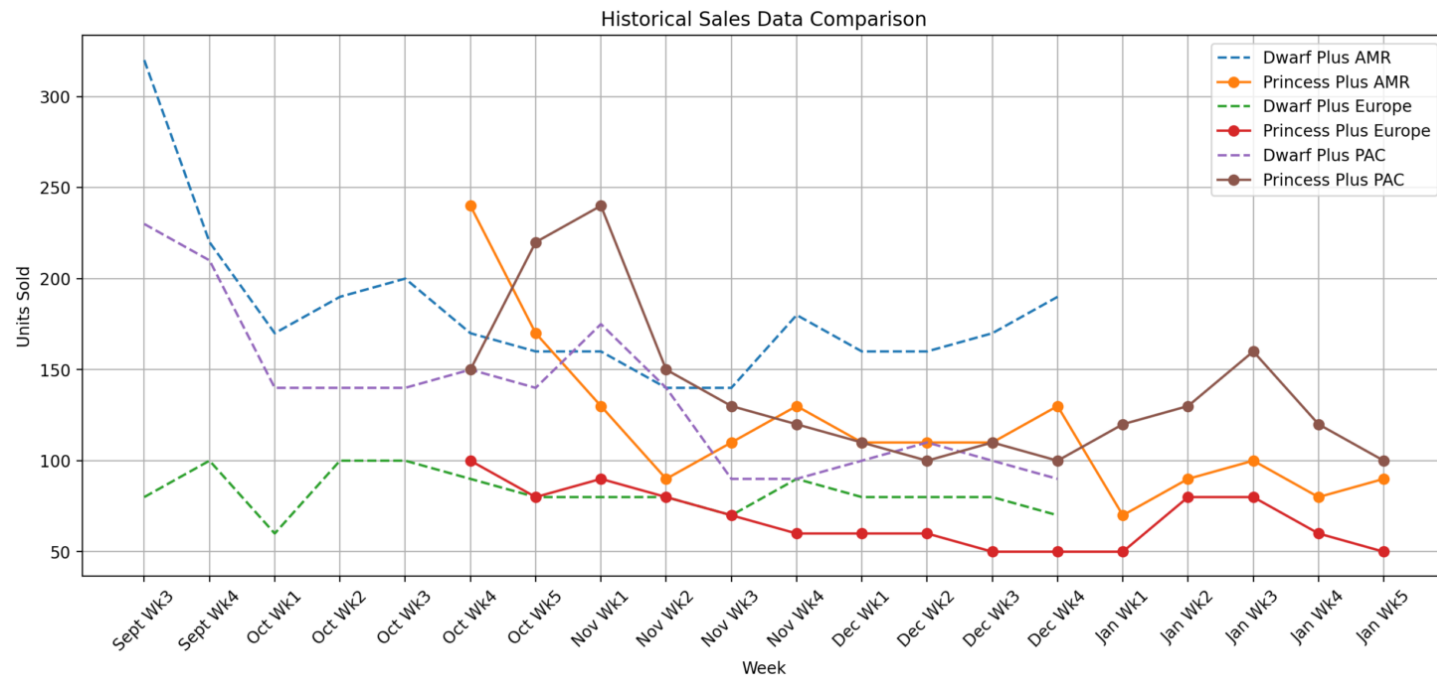
What We Know

- **Dwarf Plus** (2 years ago, Price = \$120)
- **Princess Plus** (last year, Price = \$200, with new technology)
- 15 weeks of historical weekly sales data for both products per region (AMR, Europe, PAC)

Data Overview

What We Know - Visualize

- [Visualization Dashboard](#)



Full Problem Breakdown

- Product: Superman Plus
- Launch: Sep Wk3 this year.
- Price: \$205
- Reference Products:
 - Princess Plus launched last year (Oct Wk4, \$200)
 - Dwarf Plus launched two years ago (Sep Wk3, \$120)

Forecasting Methodology



Understand historical product nature and timing - Set baseline



Seasonality & Linearity Adjustment (Region-specific) - Adjust timing curve for each region



Price Elasticity Adjustment (by Region) - Reflect regional price sensitivity



Adjust for New Technology Sensitivity by Region (Optional) - Reflect regional differences toward battery improvement



Forecast First 15 Weeks

Forecasting Methodology

Factors to Consider

Factor	Include?	Why?
Region-specific Seasonality	V	AMR, EU, PAC have different shopping spikes: Thanksgiving, Christmas/New Year, Chinese New Year
Linearity	Partially	Useful for pacing the sales, but not dominate early launch weeks where novelty/marketing push matters more.
Price Elasticity	V	Price up from \$200 → \$205. Region-specific sensitivity needs to be considered carefully.
Product Improvement	V	Different regions react differently to product improvements; needs to be factored
Economic Trend / Macro Conditions	X	No provided macro data, assume stable environment.
Channel/Availability Expansion	X	No mention of expansion in channels, assume same as historical launches.

Forecasting Methodology

Calculation Process

1. Input historical sales.
2. Calculate Price Elasticity (PE) ratios per region.
3. Identify region-specific seasonality peaks/drops.
4. Apply launch phase uplift (+10% first 5 weeks).
5. Apply price elasticity adjustments.
6. Apply optional new technology sensitivity for PAC.

Price Elasticity Analysis

$$PE = (\text{Demand \% Change}) \div (\text{Price \% Change})$$

Region	Avg Demand (Dwarf Plus)	Avg Demand (Princess Plus)	Demand Change %	PE Ratio
AMR	172.67	116.67	-32.44%	$-32.44\%/66.67\% = -0.49$
Europe	80.67	68	-15.74%	$-15.74\%/66.67\% = -0.24$
PAC	136.33	137.33	+0.73%	$0.73\%/66.67\% = 0.01$

Apply Price Adjustment for Superman Plus: $(205-200) / 200 = 2.5\%$

- Demand Adjustment (AMR) = $-0.49 \times 2.5\% = -1.23\%$
- Demand Adjustment (Europe) = $-0.24 \times 2.5\% = -0.6\%$
- Demand Adjustment (PAC) = $0.01 \times 2.5\% = 0.03\%$

Seasonality Adjustments - AMR

- **Nov Wk4 (Holiday Shopping Peak) - Dwarf Plus**

Baseline: $(140+140+160+160)/4 = 150$, Uplift: $(180-150)/150 = \mathbf{20\%}$

- **Dec Wk4 (New Year Peak) - Dwarf Plus**

Baseline: $(160+170+160+160)/4 = 162.5$, Uplift: $(190-162.5)/162.5 = \mathbf{16.9\%}$

- **Oct Wk1 (Launch Exhaustion Drop) - Dwarf Plus**

Baseline: $(320+220+190+200)/4 = 232.5$, Uplift: $(170-232.5)/232.5 = \mathbf{-26.9\%}$

Seasonality Adjustments – EU

- **Nov Wk4 (Holiday Shopping Peak) - Dwarf Plus**

Baseline: $(80+70+80+80)/4 = 77.5$, Uplift: $(90-77.5)/77.5 = 16.1\%$

- **Oct Wk1 (Launch Exhaustion Drop) - Dwarf Plus**

Baseline: $(80+100+100+100)/4 = 95$, Uplift: $(60-95)/95 = -36.8\%$

Seasonality Adjustments – PAC

- Nov Wk1 (Singles Day Effect) - Dwarf Plus

Baseline: $(140+150+140+90)/4 = 130$, Uplift: $(175-130)/130 = 34.6\%$

- Jan Wk3 (Chinese New Year Peak) - Princess Plus

Baseline: $(120+130+120+100)/4 = 117.5$, Uplift: $(160-117.5)/117.5 = 36.2\%$

- Oct Wk1 (Launch Exhaustion Drop) - Dwarf Plus

Baseline: $(230+210+140+140)/4 = 180$, Uplift: $(140-180)/130 = -22.2\%$

Seasonality Adjustments

Region	Week	Type	Adjustment (%)
AMR	Nov Wk4	Boost (Thanksgiving)	+20%
AMR	Dec Wk4	Boost (New Year)	+16.9%
AMR	Oct Wk1	Drop (Launch Exhaustion)	-26.9%
Europe	Nov Wk4	Boost (Holiday)	+16.1%
Europe	Oct Wk1	Drop (Launch Exhaustion)	-36.8%
PAC	Nov Wk1	Boost (Singles Day)	+34.6%
PAC	Jan Wk3	Boost (Chinese New Year)	+36.2%
PAC	Oct Wk1	Drop (Launch Exhaustion)	-22.2%

New Technology Impact

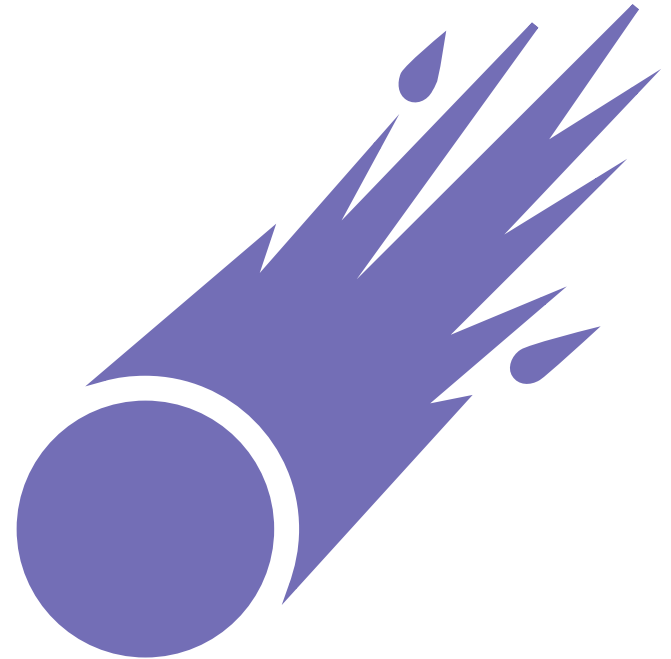
- PAC market showed a positive response to technology improvement (+3.49%).
- Conservative +3% uplift applied only to PAC region in one forecast version as a High Case
- AMR and Europe: No positive tech sensitivity observed
→ no uplift applied.



Final Script

1. Input raw Dwarf Plus and Princess Plus 15-week historical data
2. Calculate Demand Change % per region (Dwarf → Princess)
3. Calculate Price Elasticity (PE Ratio) per region
4. Calculate expected demand adjustment for \$5 Superman Plus price increase
5. Detect special weeks (uplift/drop) using 2w-before + 2w-after
6. Apply launch seasonality uplift (+10% for first 5 weeks)
7. Apply special week adjustments per region
8. Apply price elasticity adjustment per region
9. Apply optional +3% tech uplift for PAC as High Case
10. Forecast two versions:
 - (A) case1_forecast_with_tech_sensitivity.csv
 - (B) case1_forecast_without_tech_sensitivity.csv

[Visualization Dashboard](#)



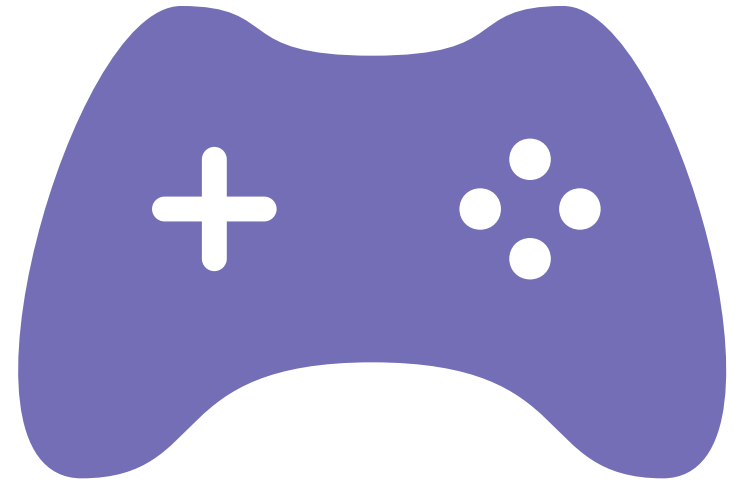


Case 2
Allocation

Objective

Goal:

Efficiently allocate a fixed weekly supply across 3 product lines—Superman, Superman Plus, Superman Mini—while maximizing fulfillment and satisfying business constraints.



Key Success Metrics



Fully utilize the available supply



Meet or exceed demand for core products
(Superman, Superman Mini)



Maintain healthy
inventory levels

Core Product: WoS ≥ 4
Others: WoS ≥ 2



Respect channel and region-level priorities

Data Overview

What We Know

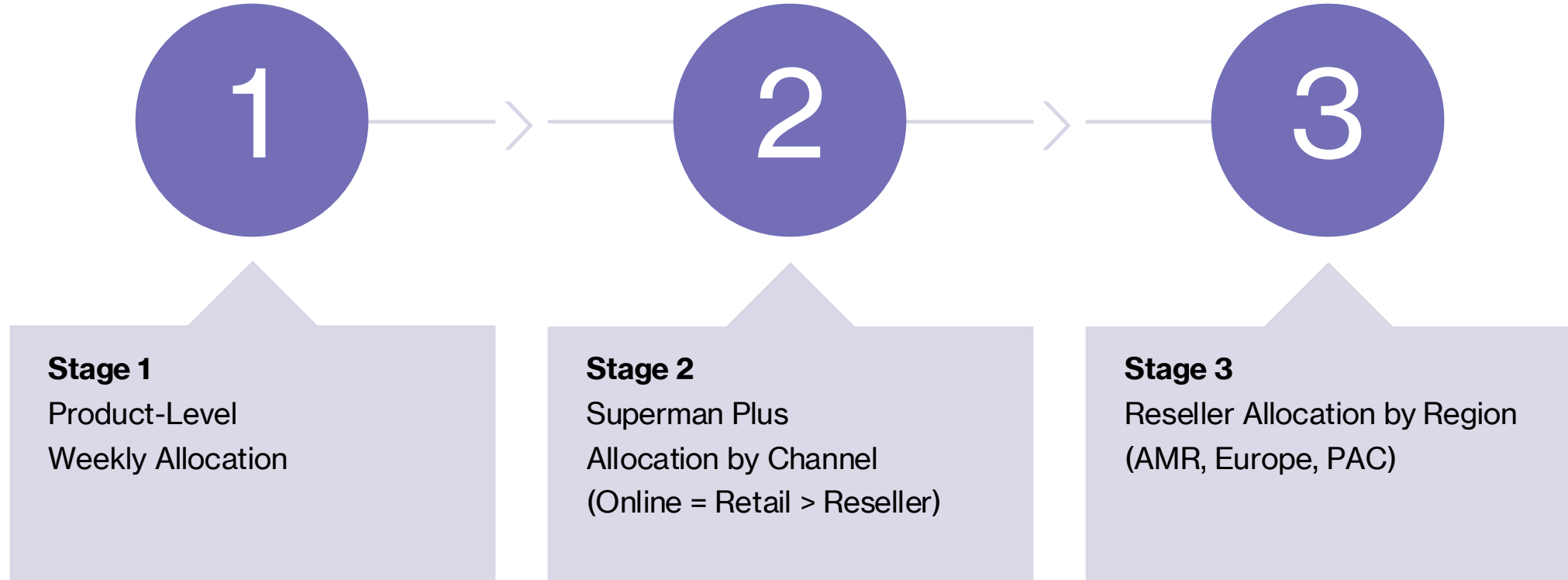
Products: Superman, Superman Plus, Superman Mini

Weeks Covered: Jan Wk2 – Jan Wk5

Inputs:

- Fixed Total Cumulative A Supply in Different Weeks
- Jan Wk1 Cumulative Actual Build
- Weekly Cumulative Demand Forecast for Different Programs
- Channels & Regionals Cumulative Demand Ask (Superman Plus only)

Model Structure



Constraint 1 - Demand Fulfillment

Why💡 Ensures core SKUs meet customer demand, with flexibility on SKUs with tiered importance (Superman Plus)

- Meet the cumulative demand for Superman & Superman Mini each week
- Soft constraint for Superman Plus (allowed slack with penalty) since we're not prioritizing it

Constraint 2 - Cumulative Actual Build

Definition:

Cumulative Actual Build = Allocation + Wk1 Actual Build

- Superman / Superman Plus: +70
- Superman Mini: +60

Use Case: Used in WoS calculations to simulate production and inventory buffering

Constraint 3 - Week of Supply

Why 💡 Ensures inventory resilience and prevents under-stocking for downstream weeks

$$\text{WoS} = \frac{(\text{Cumulative Actual Build} - \text{Cumulative Demand})}{\text{Average Future Incremental Demand}}$$

1. Enforced strictly for all products (wk2–wk5)
 - Superman /Superman Mini ≥ 4 WoS
 - Superman Plus ≥ 2 WoS
2. Assumption: Feb wk 1 will have a similar incremental demand rate as wk5

Constraint 4 - Supply Utilization

Why💡 Prevent waste and maximize operational efficiency

- Total allocated units = 1200
- All supply must be used

Constraint 5 - Channel Priority (Superman Plus)

Why 💡 Fulfill in-house business channel preference

- Allocation priority: **Online = Retail > Reseller**
- Channel-level demand deviation is minimized with soft penalty

Constraint 6 - Reseller Region Distribution

Why 💡 Supports global-market balance without overconstraining the solution

- Regions: AMR, Europe, PAC
- Demand used as a soft constraint to distribute reseller supply fairly

Constraint 7 - Integer Optimization

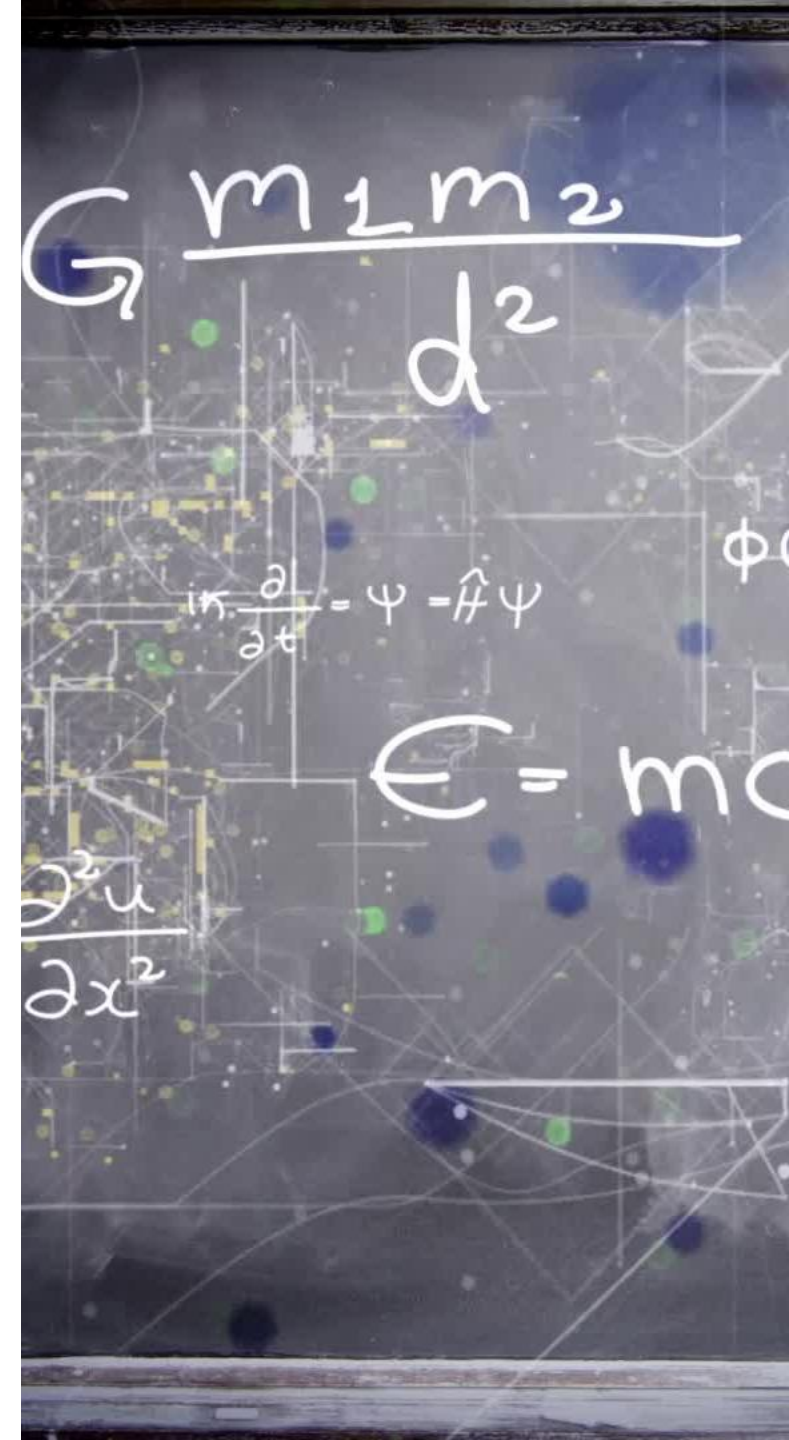
Why 💡 Operational feasibility: prevents fractional build quantities (there's no halfway product)

- All allocations are constrained to be integers

Outcome Summary Allocation Solution 1

- Superman & Superman Mini demand fully met
(WoS ≥ 4 satisfied for both products)
- Superman Plus demand fully met (WoS ≥ 2)
- Superman Plus Jan Wk4 Reseller demand fully met

(Actual calculation is on github)

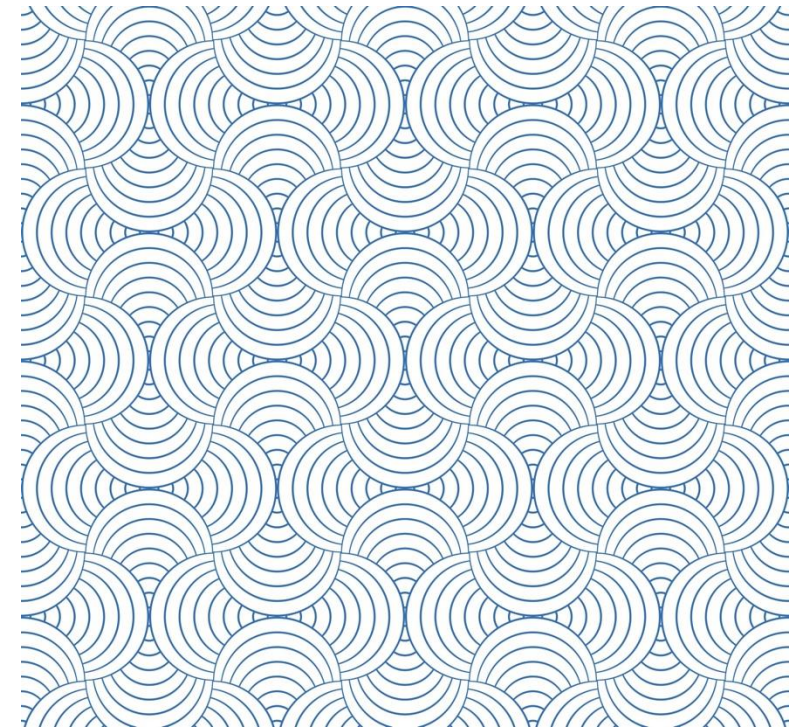


Outcome Summary

Allocation Solution 2 - Better

1. Three Programs have at least 4 WoS every week, core products have more WoS in wk4 & 5
 - Superman & Superman Mini demand fully met ($\text{WoS} \geq 4$)
 - Superman Plus demand fully met ($\text{WoS} \geq 4$)
2. Superman Plus all channels demands fully met
3. Maximize the Objective

(Actual calculation is on github)



THANK YOU

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2025

