

EN



MAELICE

IN WONDERLAND

PRODUCTION AND
BUSINESS PROCESSES



« From idea to service, nothing is truly linear. »



WELCOME TO THE RABBIT HOLE

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Now test yourself!	20

HOW TO USE THE RABBIT HOLE



THE CATERPILLAR

Key definitions



DRINK ME

The formula, each term explained, the unit



EAT ME

A step-by-step worked example



THE WHITE RABBIT'S TIPS

Method and time management in the exam



THE CHESHIRE GRIN

A memory trick that stays when everything else has vanished



OFF WITH THEIR HEADS!

The classic trap, the mistake that costs points



THE GOLDEN KEY

The 5 things to remember from the session



TEA TIME

Test yourself! Answers upside down at the bottom



THE WHITE RABBIT'S TIPS

For the midterm, this sheet covers Sessions 1 to 4. Session 3, a short asynchronous session, isn't included; review it directly on Courses. Method: read a session, do Tea time without peeking at the answers, then reread The golden key. The night before, keep only the rabbit hole on 1 page.



SESSION 1 • PART 1

INTRODUCTION TO OPERATIONS MANAGEMENT



SESSION 1

INTRODUCTION TO OPERATIONS MANAGEMENT AND THE PROCESS VIEW OF THE ORGANISATION

By the end of this session, you can:

- ✓ define a process and operations management (OM)
- ✓ link inventory, flow time and flow rate with Little's Law
- ✓ identify the flow unit of a process
- ✓ compute inventory turns and a gross margin

"Begin at the beginning, and go on till you come to the end: then stop." (the King)



THE CATERPILLAR "Who are you?"

Process: any activity that transforms **inputs** into **outputs**.

Operations Management (OM): the **systematic** design, management and control of processes.



The **supply chain** is one big process made of many sub-processes.

Input: all the raw materials.

Output: the final product delivered to customers.

Every company depends on its processes to survive: **understanding them is how you improve them.** OM tools make processes:

more efficient

cheaper

more resilient

less polluting

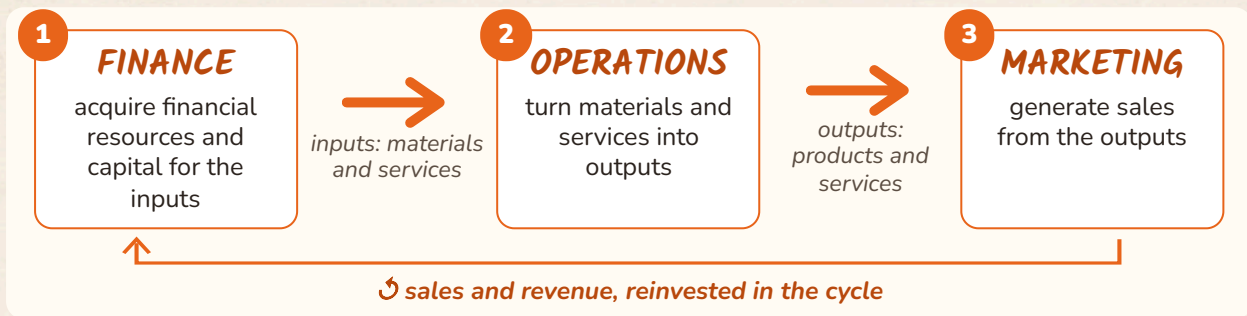
know all 4 by heart!



SESSION 1 • PART 1

THE OPERATIONS CYCLE AND ITS JOBS

To create a product or a service, every company does **3 things**: marketing, operations and finance. Together they form a cycle.



Support functions:

accounting

information systems

human resources

engineering

SUPPLY CHAIN CAREERS

1 S&OP and demand planning

The “engine room” of the supply chain (*Sales & Operations Planning*).

Entry point for many young graduates, growing number of jobs.

2 Supply / procurement

Connect the company, its suppliers and its buyers.

Secure supply flows, build supplier relationships, manage shortages. Growing number of jobs.

3 Logistics, warehousing, site management

Run the warehouse: project management and optimisation.

Hiring driven by e-commerce growth.

4 Supply Chain Manager

Tackle the chain's challenges: inventory, transport, CSR...

Job offers more than doubled in 3 years.

3,779
Supply planner

JOB OFFERS PUBLISHED IN FRANCE IN 2023

1,004
Demand planner

989
Procurement manager

220
S&OP manager

Supply planner is by far the most hired

KFC AND THE FLOW UNIT

KFC / DHL CASE (UK, 2018): A BAD OM DECISION



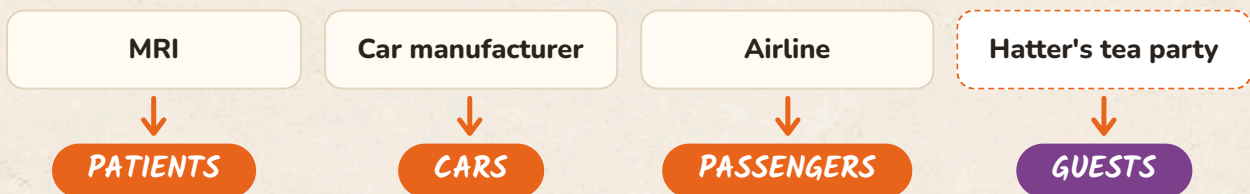
👑 OFF WITH THEIR HEADS!

Changing everything at once (6 warehouses → 1) with no backup plan: **634 restaurants closed**. One bad OM decision can paralyse an entire company, even a giant.

PART 2: THE PROCESS VIEW OF THE ORGANISATION

🐛 THE CATERPILLAR "Who are you?"

Flow unit: what **moves through** the process, from start to finish. Every process has one or more flow units.



🕒 THE WHITE RABBIT'S TIPS

To find the flow unit, ask yourself: **"What comes in, waits, then goes out?"**
Always write it at the top of your answer: every calculation depends on it.

SESSION 1 • PART 2

THE 3 MEASURES OF A PROCESS



THE CATERPILLAR "Who are you?"

FLOW TIME (T)

Time a flow unit needs to go through the process. It **includes waiting time**, which varies from one unit to another.

MRI: patient's departure time – arrival time.

INVENTORY (I)

Number of flow units **inside** the process. In production: **work in process**.

MRI: too many patients in the unit = bad sign.

FLOW RATE (R)

Rate at which the process **delivers outputs** (throughput).

MRI: 3 patients per hour.



LITTLE'S LAW Drink me

Average inventory = Average flow rate × Average flow time

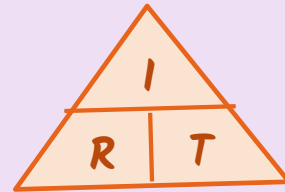
$$I = R \times T$$

I in units · **R** in units per time unit · **T** in time units.

So also: $T = I / R$ and $R = I / T$.



THE CHESHIRE GRIN



$I = R \times T$: "I'm Running Tardy", like the White Rabbit. Cover the letter you want: what remains gives the formula.



EAT ME: LITTLE AT THE MRI

An MRI unit receives on average **3 patients/h** and each patient stays **40 min**. How many patients are in the unit on average?

1 Same units: $40 \text{ min} = \frac{40}{60} \text{ h} = \frac{2}{3} \text{ h}$

2 $I = R \times T = 3 \text{ patients/h} \times \frac{2}{3} \text{ h} = \text{2 patients}$



OFF WITH THEIR HEADS!

Mixing **hours and minutes** in Little's Law = wrong answer. Convert **everything to the same unit** before multiplying.



SESSION 1 • EXERCISES

WALMART AND GROSS MARGIN

EAT ME #1: WALMART

On average, how long does it take Walmart to turn \$1 invested in inventory into \$1 of sales?

2023 annual report: inventory \$56,576M, cost of goods sold (COGS) \$463,721M.

$$T = \frac{\text{Inventory}}{\text{Flow rate (COGS)}}$$

$$T = \frac{56,576}{463,721} = 0.122 \text{ year} \times 365 = \text{44.5 days}$$

↖ *≈ 45 days in Walmart's supply chain, on average*

INVENTORY TURNS *Drink me*

$$\text{Turns} = \frac{365}{T \text{ (days)}} = \frac{\text{COGS}}{\text{Inventory}}$$

How many times a year the inventory is completely renewed. The 365 never changes.

EAT ME #2

1 $\frac{365}{45} = \text{8.1 times a year}$

2 Exact version: $\frac{463,721}{56,576} = 8.2$

both are right, the gap comes from rounding to 45 days

GROSS MARGIN *Drink me*

$$\frac{\text{Revenue} - \text{COGS}}{\text{Revenue}} \times 100$$

The share of the selling price (in %) left once the product's cost is paid.

EAT ME #3: THE TEAPOT

One of the Hatter's teapots: price €90, COGS €50.

$$\frac{90 - 50}{90} \times 100 = \text{44.4\%}$$

OFF WITH THEIR HEADS!

Divide by the selling price, not the cost.

$$\frac{40}{50} = 80\% \rightarrow \text{wrong!}$$

THE WHITE RABBIT'S TIPS

In a financial report, the flow rate in \$ is **COGS**, not revenue. Inventory is valued at cost, so is the flow rate.



SESSION 1 • RECAP

END OF SESSION 1

THE GOLDEN KEY *key takeaways*



- 1 **Process** = inputs → transformation → outputs. **OM** designs, manages and controls processes.
- 2 Always identify the **flow unit** before computing anything.
- 3 **Little's Law:** $I = R \times T$, with the same units everywhere.
- 4 In finance: **T** = Inventory / COGS and **turns** = COGS / Inventory = 365 / T (days).
- 5 **Gross margin** = (Revenue – COGS) / Revenue, divide by the price.

TEA TIME *mini quiz*

- 1 A bakery holds 12 customers on average and serves 36 per hour. How long does a customer spend there on average?
- 2 What is the flow unit of an airline?
- 3 Inventory €20M, COGS €240M per year. How many inventory turns?
- 4 Price €120, COGS €90. What gross margin?
- 5 True or false: flow time does not include waiting time.

Answers : 1. $T = I / R = 12 / 36 = 1/3 \text{ h} = 20 \text{ min}$ • 2. Passengers • 3. $240 / 20 = 12$ times a year (about 30 days of inventory) • 4. $(120 - 90) / 120 = 25\%$ • 5. False, it includes it

"I can't go back to yesterday, because I was a different person then."

• Alice •



SESSION 2 · PARTS 1 AND 2

PROCESS STRATEGY



SESSION 2

PROCESS STRATEGY AND CAPACITY MANAGEMENT

By the end of this session, you can:

- ✓ place a process in the product-process matrix
- ✓ find the bottleneck and the capacity of a process
- ✓ recognise the 4 types of process
- ✓ compute flow rate, utilisation, labour cost and cycle time

"It's always six o'clock now... it's always tea-time." (the Hatter)



THE CATERPILLAR "Who are you?"

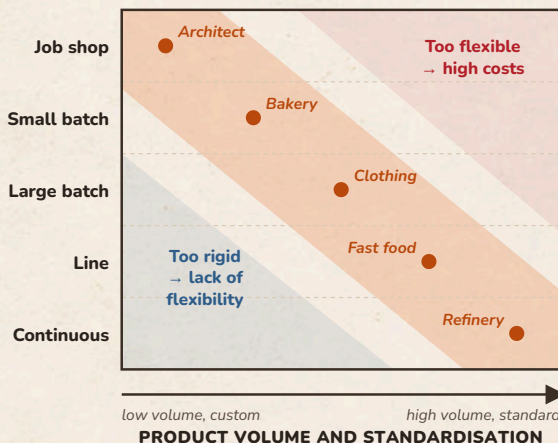
Process: a series of tasks leading to the production of a good or the delivery of a service.

Process strategy: an organisation's approach to transforming resources into goods and services.

Goal: meet customer requirements while staying **efficient, flexible and profitable**.

THE PRODUCT-PROCESS MATRIX

PROCESS TYPE



It links the **type of product** (horizontal axis: from low-volume custom to high-volume standard) to the **type of process** (vertical axis: from most flexible to most automated).

On the diagonal: efficient zone, the process fits the product.

Above (top right): process too flexible for a standard product → inefficient, **high costs**.

Below (bottom left): process too rigid for a custom product → **lack of flexibility**, unhappy customers.

the diagonal = the right path



THE WHITE RABBIT'S TIPS

The key message: **stay on the diagonal** and adapt the process as the product evolves. As volumes grow, you move down the diagonal.



SESSION 2 · PART 3

THE 4 MAIN TYPES OF PROCESS

TYPE	FEATURES	EXAMPLES	DRAWBACK	IN WONDERLAND
1 Job shop <i>job process</i>	Very flexible Low volume, high customisation	Custom furniture, architecture	High unit cost	<i>The Hatter's made-to-measure hats</i>
2 Batch <i>small or large batch</i>	Moderate flexibility Produced in groups (batches), small or large	Bakery, clothing factory	Downtime between batches	<i>The Queen's batches of tarts</i>
3 Line <i>assembly line</i>	Standardised and repetitive Each station repeats the same task	Tesla, fast-food chains	One failure stops the whole line	<i>The cards painting the roses red, bush after bush</i>
4 Continuous <i>continuous flow</i>	Fully automated Identical output 24/7	Oil refinery, brewery	Very expensive, no flexibility	<i>The never-ending tea at the Hatter's</i>

😊 THE CHESHIRE GRIN

"Just Bake Little Cakes": Job, **Batch**, Line, **Continuous**. In the order of the phrase, **volume goes up** and **flexibility goes down**.

👑 OFF WITH THEIR HEADS!

A bakery bakes in **batches**: that's **batch**, not continuous. And "job" means **custom, one at a time**, not just "work".



SESSION 2 · PART 4

CAPACITY MANAGEMENT

THE CATERPILLAR "Who are you?"

Capacity: number of units a resource can process per period.

Bottleneck: the station with the lowest capacity. It sets the capacity of the whole process.



CAPACITY Drink me

$$\text{Station capacity} = \frac{\text{No. of workers} \times 60}{\text{Processing time (min/unit)}}$$

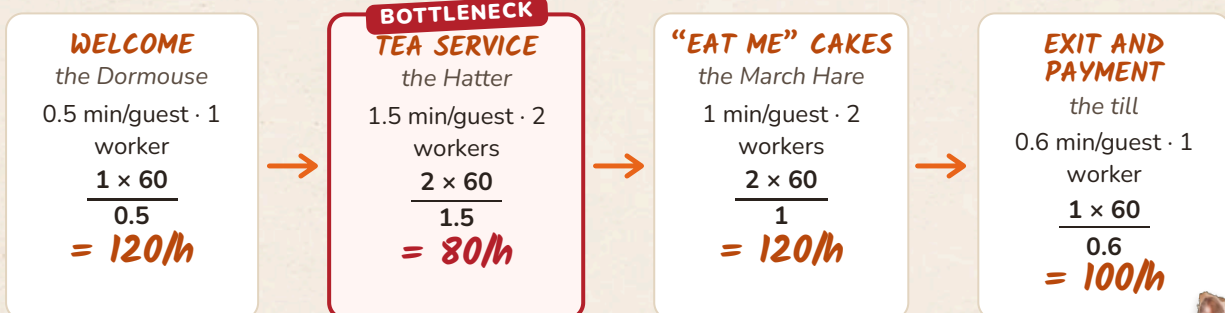
$$\text{Process capacity} = \min \{ \text{station capacities} \}$$

Result in units per hour: the 60 turns minutes into an hour.



EAT ME: THE MAD HATTER'S TEA PARTY

4 stations, each worker paid €12/h. Compute each station's capacity, then the process capacity.



that's the bottleneck: everyone waits for tea!

$$\text{Process capacity} = \min \{120; 80; 120; 100\} = \mathbf{80 \text{ guests/h}}$$

THE CHESHIRE GRIN

Like the neck of the "Drink me" bottle: whatever the size of the bottle, the tea comes out **at the pace of the neck**.



THE 5-STEP METHOD

- ① Capacity of each station
- ② Bottleneck = the smallest
- ③ Flow rate = min (demand, capacity)
- ④ Utilisations
- ⑤ Labour cost and cycle time



FLOW RATE AND UTILISATION



FLOW RATE, UTILISATION AND IMPLIED UTILISATION *Drink me*

$$\text{Flow rate} = \min \{ \text{Demand} ; \text{Process capacity} \}$$

$$\text{Utilisation} = \frac{\text{Flow rate}}{\text{Capacity}}$$

what is **actually** produced: **never above 100%**

$$\text{Implied utilisation} = \frac{\text{Demand}}{\text{Capacity}}$$

what we **would like** to produce: **can exceed 100%**



EAT ME: THE TEA PARTY IS SWAMPED

One Saturday, **100 guests/h** turn up at the tea party. Capacity = 80/h → **Flow rate = min (100; 80) = 80 guests/h.**

STATION	CAPACITY	IMPLIED UTILISATION 100 / capacity	UTILISATION 80 / capacity
Welcome	120/h	83%	67%
Tea service	80/h	125%	100%
Cakes	120/h	83%	67%
Exit and payment	100/h	100%	80%

overloaded! the queue explodes

dotted line = 100%

Process utilisation = bottleneck utilisation = 80 / 80 = 100%. Implied utilisation of the process = 100 / 80 = 125%: the tea queue keeps growing!



OFF WITH THEIR HEADS!

Mixing up **implied utilisation** (demand / capacity) and **utilisation** (flow rate / capacity). A value above 100% can only be **implied** utilisation: it flags an overloaded station.



THE WHITE RABBIT'S TIPS

If demand is **below** capacity, flow rate = demand: even the bottleneck is no longer 100% busy.

SESSION 2 · PART 6

COST, CYCLE TIME AND LINE BALANCING



COST AND CYCLE TIME *Drink me*

$$\text{Labour cost} = \frac{\text{Total wages per hour}}{\text{Flow rate per hour}}$$

in € per unit

$$\text{Cycle time} = \frac{1}{\text{Flow rate}}$$

time between **two successive outputs**



EAT ME: BALANCING THE TEA PARTY

Before · 6 workers, flow rate 80/h

1 Cost = $\frac{6 \times 12}{80} = \text{€0.90/guest}$

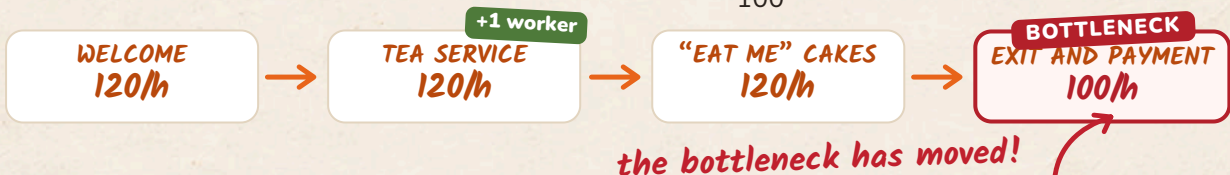
2 Cycle = $\frac{60}{80} = 0.75 \text{ min} = \text{45 s}$

After · 3rd worker on tea, 7 workers

1 Tea: $\frac{3 \times 60}{1.5} = 120/\text{h} \rightarrow$ new bottleneck: **exit** (100/h)

2 Flow rate = $\min(100; 100) = 100/\text{h}$ · cycle = 0.6 min = **36 s**

3 Cost = $\frac{7 \times 12}{100} = \text{€0.84/guest}$



THE CATERPILLAR "Who are you?"

Line balancing: spreading the work so that stations have **similar capacities**. Result: higher flow rate, shorter cycle time, lower cost per unit.



OFF WITH THEIR HEADS!

Improving the bottleneck raises capacity... **but the bottleneck moves!** Recompute **every** capacity after each change.

"It takes all the running you can do, to keep in the same place."

· the Red Queen ·



SESSION 2 · RECAP

END OF SESSION 2

THE GOLDEN KEY *key takeaways*



- 1 **Product-process matrix:** stay on the diagonal, adapt the process as the product evolves.
- 2 **4 types:** job, batch, line, continuous. Volume goes up, flexibility goes down.
- 3 **Process capacity = min** of station capacities = capacity of the **bottleneck**.
- 4 **Flow rate = min (demand, capacity).** Utilisation = flow rate / capacity ($\leq 100\%$), implied = demand / capacity.
- 5 **Cost = wages/h $\div$ flow rate, cycle = 1 / flow rate.** After improving the bottleneck, find where it moved.



TEA TIME *mini quiz*

- 1 A station has 3 workers and a processing time of 4 min/unit. What is its capacity?
- 2 Three stations at 50, 40 and 60 units/h. Process capacity and bottleneck?
- 3 Demand 30/h, capacity 40/h. Flow rate, process utilisation and cycle time?
- 4 5 workers at €15/h, flow rate 50 units/h. Labour cost per unit?
- 5 Which type of process does an oil refinery use?

Answers : 1. $3 \times 60 / 4 = 45$ units/h · 2. 40/h, bottleneck = the 2nd station · 3. Flow rate 30/h, utilisation 75%, cycle 2 min · 4. $75 / 50 = €1.50$ · 5. Continuous

“Why is a raven like a writing-desk?”

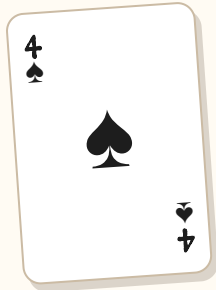
· the Hatter (he doesn't know the answer either) ·





SESSION 4

LINEAR PROGRAMMING



SESSION 4

LINEAR PROGRAMMING WITH EXCEL SOLVER

By the end of this session, you can:

- ✓ define linear programming and name its applications
- ✓ set up Excel Solver and read its solution
- ✓ model a problem in 4 steps

"That depends a good deal on where you want to get to." (the Cat, to Alice asking for directions)



THE CATERPILLAR "Who are you?"

Linear programming (LP): a mathematical optimisation method to find the **best possible solution** to a problem, under a set of **linear constraints**.

Objective: for example **maximise** a profit or **minimise** a cost.

DOCUMENTED APPLICATIONS OF LP

LAST-MILE DELIVERY

the final delivery to the customer

DPD · DHL · La Poste

URBAN MANAGEMENT

waste collection and transport...

Buenos Aires · Rotterdam · Denver

MANUFACTURERS

those who make the product

Ford · P&G · HP

HOSPITALS AND HEALTHCARE

scheduling, beds, operating rooms

Necker Hospital (Paris) · Lucile Packard
Children's Hospital (Stanford)

ENERGY AND EMISSIONS

manage energy, cut emissions

Chevron · Peoples Energy (gas, Chicago)

REVENUE MANAGEMENT

set prices to demand to maximise revenue

Air France · NFL · IHG

SUPPLY CHAIN

move products, information and resources from suppliers to customers

Renault · Zara · Carrefour · Walmart · Amazon



MODELLING A TRANSPORTATION PROBLEM

NM Co. makes bathtubs in **3 plants** (Rouen, Paris, Marseille) and ships them to **3 warehouses** (Nantes, Lille, Reims). **Objective:** decide how many to ship from each plant to each warehouse to **minimise transport costs**, while meeting supply and demand.

	Nantes	Lille	Reims	Capacity
Rouen	5	4	3	100
Paris	8	4	3	300
Marseille	9	7	5	300
Demand	300	200	200	700

 THE CHESHIRE GRIN

“Very Odd Cheshire Tricks”: Variables, Objective, Constraints, Technical constraints.

1 DECISION VARIABLES

x_{ij} = number of bathtubs shipped from plant i to warehouse j .
 i : 1 Rouen, 2 Paris, 3 Marseille · j : 1 Nantes, 2 Lille, 3 Reims

2 OBJECTIVE FUNCTION

$$\text{Min } 5x_{11} + 4x_{12} + 3x_{13} + 8x_{21} + 4x_{22} + 3x_{23} + 9x_{31} + 7x_{32} + 5x_{33}$$

the costs from the table, row by row

3 CONSTRAINTS

Plant capacity ($\leq$)

$$x_{11} + x_{12} + x_{13} \leq 100 \cdot \text{Rouen}$$

$$x_{21} + x_{22} + x_{23} \leq 300 \cdot \text{Paris}$$

$$x_{31} + x_{32} + x_{33} \leq 300 \cdot \text{Marseille}$$

Warehouse demand ($\geq$)

$$x_{11} + x_{21} + x_{31} \geq 300 \cdot \text{Nantes}$$

$$x_{12} + x_{22} + x_{32} \geq 200 \cdot \text{Lille}$$

$$x_{13} + x_{23} + x_{33} \geq 200 \cdot \text{Reims}$$

4 TECHNICAL CONSTRAINTS

$x_{ij} \geq 0$ for all i, j (non-negativity: you can't ship negative bathtubs).

 THE WHITE RABBIT'S TIPS

Before solving, compare supply and demand: $100 + 300 + 300 = 700 = 300 + 200 + 200$. Balanced problem: all capacity will be used.

SOLVING WITH EXCEL SOLVER

SETTING UP EXCEL SOLVER *The White Rabbit's tips*

- 1 **Enable Solver:** File > Options > Add-ins > Excel Add-ins > tick Solver. It appears in the **Data** tab.
- 2 **Build the table:** a 3×3 matrix of quantities (the x_{ij} , starting at 0) + row and column totals with SUM.
- 3 **Set objective:** a cell =SUMPRODUCT(costs, quantities), then choose **Min**.
- 4 **By changing variable cells:** the quantity matrix.
- 5 **Constraints:** plant totals $\leq$ capacities, warehouse totals $\geq$ demands.
- 6 Tick **"Make unconstrained variables non-negative"**.
- 7 Solving method: **Simplex LP**, then **Solve**.



EAT ME: THE OPTIMAL SOLUTION

	Nantes	Lille	Reims	Shipped
Rouen	100 ⁵	0 ⁴	0 ³	100/100
Paris	0 ⁸	200 ⁴	100 ³	300/300
Marseille	200 ⁹	0 ⁷	100 ⁵	300/300
Received	300	200	200	

Minimum cost:

$$5 \times 100 + 4 \times 200 + 3 \times 100 + 9 \times 200 + 5 \times 100$$

$$= 500 + 800 + 300 + 1,800 + 500$$

$$= \mathbf{3,900}$$

Reading it: Rouen, the cheapest, sends everything to Nantes. Paris serves Lille and Reims. Marseille, the most expensive, tops up Nantes and Reims.

OFF WITH THEIR HEADS!

The 3 costly mistakes: **forgetting non-negativity** (Solver may suggest negative quantities), **swapping the signs** ($\leq$ for plants, $\geq$ for warehouses), or choosing **GRG Nonlinear** instead of **Simplex LP**.



SESSION 4 • RECAP

END OF SESSION 4

THE GOLDEN KEY *key takeaways*

- 1 LP = optimise (max or min) an **objective function** under **linear constraints**.
- 2 **4 steps**: variables, objective, constraints, technical constraints ($x \geq 0$).
- 3 Transportation: **plants $\leq$ capacity, warehouses $\geq$ demand**.
- 4 **Solver**: objective, variable cells, constraints, non-negativity, **Simplex LP**.
- 5 **NM Co.**: minimum cost of **3,900**.

TEA TIME *mini quiz*

- 1 In a transportation problem, which sign for a plant capacity constraint?
- 2 What does x_{23} stand for in the NM Co. case?
- 3 Which method should you pick in Solver for a linear problem?
- 4 2 plants and 4 warehouses: how many decision variables?
- 5 Why add $x_{ij} \geq 0$?

Answers : 1. $\leq$ (you can't ship more than capacity) · 2. Bathtubs shipped from Paris to Reims · 3. Simplex LP · 4. $2 \times 4 = 8$ · 5. You can't ship a negative quantity

"Oh dear! Oh dear! I shall be too late!"
· the White Rabbit, the night before the exam ·



EVERY FORMULA

THE RABBIT HOLE ON 1 PAGE

SESSION 1 · FLOWS

Little's Law

$$I = R \times T$$

units = units/time × time

Flow time

$$T = \frac{I}{R}$$

time unit

Flow time (finance)

$$T = \frac{\text{Inventory}}{\text{COGS}}$$

years (× 365 = days)

Inventory turns

$$\frac{365}{T \text{ (days)}} = \frac{\text{COGS}}{\text{Inventory}}$$

times per year

Gross margin

$$\frac{\text{Revenue} - \text{COGS}}{\text{Revenue}} \times 100$$

%

SESSION 2 · CAPACITY

Station capacity

$$\frac{\text{No. of workers} \times 60}{\text{Processing time}}$$

units/h (time in min/unit)

Process capacity

$$\min \{ \text{station capacities} \}$$

units/h

Flow rate

$$\min \{ \text{Demand} ; \text{Capacity} \}$$

units/h

Utilisation

$$\frac{\text{Flow rate}}{\text{Capacity}}$$

% (≤ 100%)

Implied utilisation

$$\frac{\text{Demand}}{\text{Capacity}}$$

% (can exceed 100%)

Labour cost

$$\frac{\text{Total wages per hour}}{\text{Flow rate per hour}}$$

€ per unit

Cycle time

$$\frac{1}{\text{Flow rate}}$$

h/unit (× 60 = min/unit)

SESSION 4 · LINEAR PROGRAMMING

Objective

$$\text{Min } \sum c_{ij} x_{ij}$$

total cost (or Max for a profit)

Plants

$$\sum_j x_{ij} \leq \text{capacity of plant } i$$

one constraint per plant

Warehouses

$$\sum_i x_{ij} \geq \text{demand of warehouse } j$$

one constraint per warehouse

Technical

$$x_{ij} \geq 0$$

non-negativity

END OF THE JOURNEY... ALMOST

NOW TEST YOURSELF!



MAELICEINWONDERLAND.FR



Scan the QR code to find **quizzes**, **formula flashcards** and the other Maelice in Wonderland sheets on the website.

“Everybody has won, and all must have prizes.”

• the Dodo •



THE NIGHT-BEFORE-THE-EXAM CHECKLIST

- ☐ Reread *the rabbit hole* on 1 page
- ☐ Redo *the Hatter's tea party* from A to Z
- ☐ Check *Solver is enabled* if the exam is on a computer
- ☐ Redo the 3 *Tea times* without peeking
- ☐ Redo *NM Co.* in Excel with Solver
- ☐ Charged calculator, and *sleep* (even the Dormouse knows)

Sheet written by a PGE 1A student, based on the “Production and Business Processes” course at NEOMA Business School. It complements the course, it does not replace it.

Universe inspired by Lewis Carroll's *Alice's Adventures in Wonderland* and *Through the Looking-Glass* (1865 and 1871, public domain).

Company examples are cited for educational purposes.

WRITTEN BY A PGE 1A STUDENT

