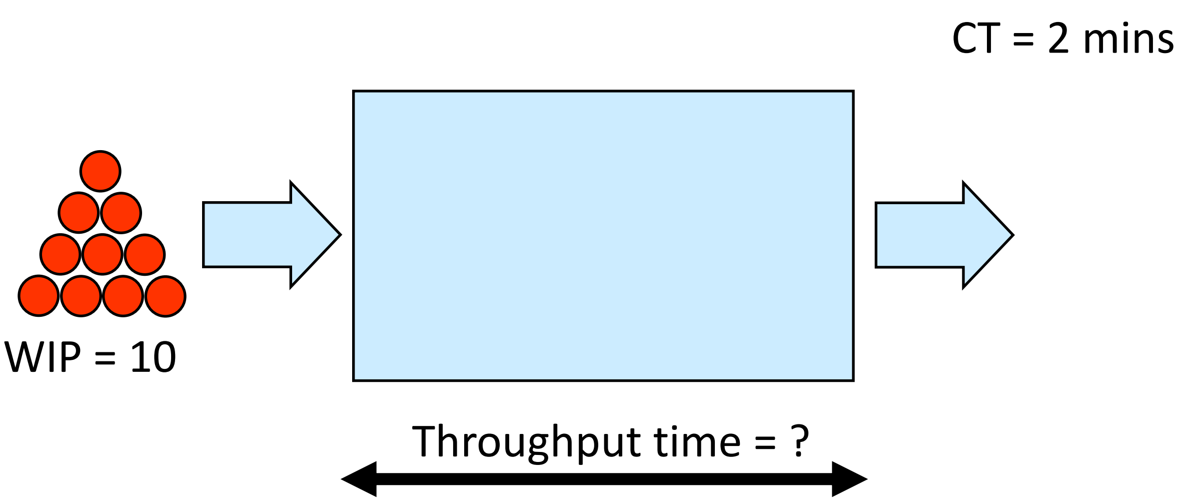
Little’s law

Context

Little's law (quite a useful law)

Throughput time (TH) = Work In Process (WIP) x Cycle Time (CT)



Throughput time = 10 x 2 mins

= 20 mins

Little’s Law: a worked example…

We need to mark 357 exam scripts in 5 days. A working day is 8 hours and it takes 0.5 hours to mark a script. How many markers are needed?

Throughput (Th) = Work In Process (WIP) x Cycle Time (CT)

40 hours = 357 x Cycle Time (CT)

$$CT = \frac{40\ \text{hours}}{357}$$

CT= **0.112 hours**

$$\text{Number of markers} = \frac{\text{Work content}}{\text{Cycle time}}$$

$$\text{Number of markers} = \frac{0.5\ \text{hour}}{0.112\ \text{h}}$$

Number of markers= **4.464 → At least 5 markers needed.**

Little's law – an example

Throughput time = WIP x Cycle Time

A hotel needs to check-in 500 customers in 5 days (working 7 hours a day). It takes 0.75 hours to check-in a customer. How many receptionist are needed?

Required throughput time (TH) = 5 x 7 hours = 35 hours

TH = WIP x Cycle time

$$\text{Cycle time} = \frac{\text{TH}}{\text{WIP}} = \frac{35\text{h}}{500} = 0.07\text{h}$$

$$\text{Number of markers} = \frac{\text{Work content}}{\text{Cycle time}} = \frac{0.75\text{ h}}{0.07\text{h}} = 10.71$$ → <u>11 receptionist needed</u>

Little's Law: calculating process efficiency for a dress maker

We need to make 150 dresses in 5 days. A working day is 9 hours and it takes 1.5 hour to make one in our shop. How many dress makers are needed?

Throughput (Th)= Work In Process (WIP) x Cycle Time (CT)

In this example our TT is given to us **TT = 5 x 9 = 45 hours**

45 = 150 x CT ----- CT= 45/150 = 0.3hrs

$$\text{Number of dress makers} = \frac{\text{Work content}}{\text{Cycle time}}$$

1.5/0.3 = 5 dress makers are needed

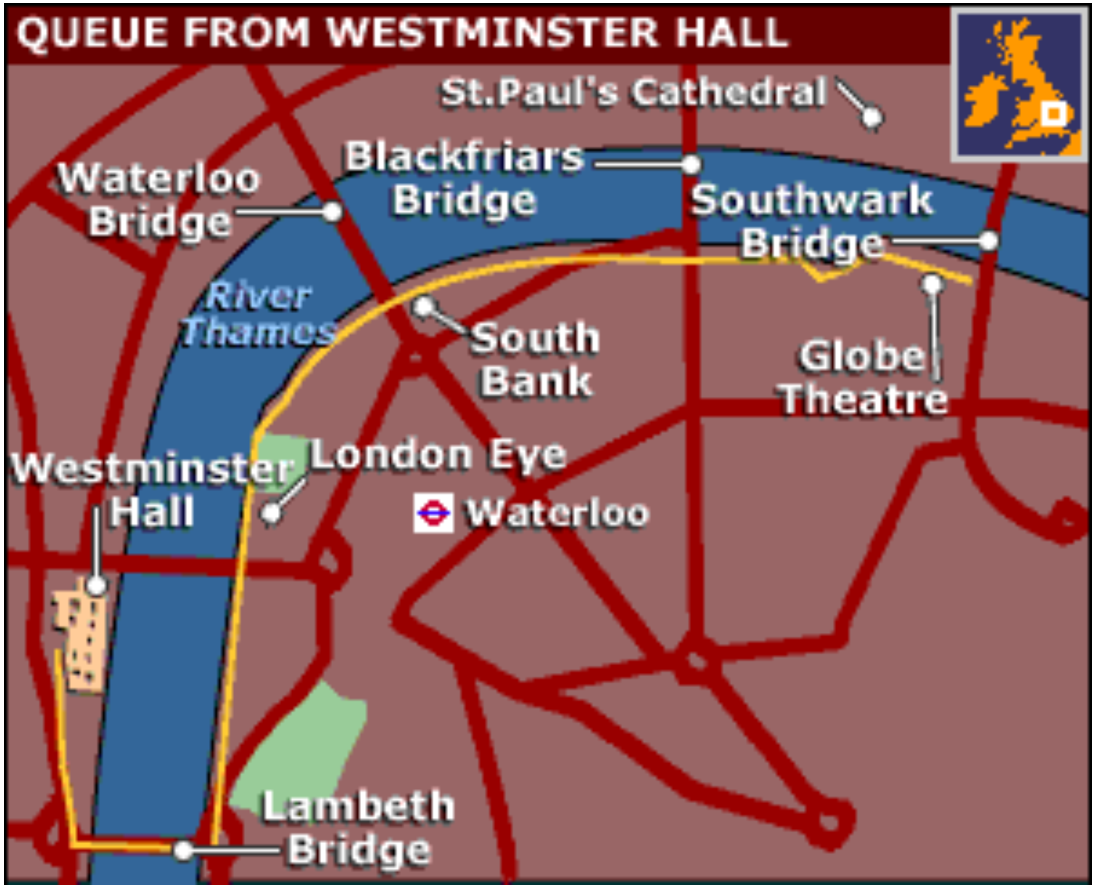
How efficient is the process?

Throughput efficiency: refers to the work content needed to produce an item in a process expressed in terms of a percentage of total throughput time.

$$\text{Throughput efficiency (\%)} = \frac{\text{Work content}}{\text{Throughput time}} \times 100$$

1.5 hrs / 45 hours = ~ 3% so our dress shop is 3% efficient which is not really that great. This means that each dress takes only 1.5 hours to be made but we delivered these dresses to the customers only after 5 days.

Let's use Little's Law



The image shows a queue starting from Westminster and ending at Globe Theatre.

If people are exiting the queue at Westminster Hall at a rate of 1 every 4 seconds, <u>where do you put "waiting time 5 hours" sign in this queue?</u>

Approx. distances from Hall to:

- Lambeth Bridge 500 metres
- London Eye 1400 metres
- South Bank 1800 metres
- Globe Theatre 3800 metres

Note: assume 3 people take 1 meter of queue

Well, let's do the maths

Cycle time = 4 sec. = 4/3600 h

TH = WIP x Cycle time = 5h

$$WIP = \frac{TH}{CT} = \frac{5h * 3600}{4\ h} = 4500\ \text{(people)}$$

4500 is the length of queue in terms of people, while we'd need meters.

How to calculate that?

Let's assume 3 people take 1 meter of queue

Distance from Hall = 4500 / 3 = **1500 (meters)**
(→ 100 meters behind London Eye)

Concluding points on Little's Law and Lean

- We can use Little's Law to analyze the impact of Throughput, WIP and Cycle Time on process performance