

Week 2 formula sheet

Capacity · bottleneck · crossover — Heizer Ch. 7 + S7

1 · Capacity of a step units per hour

Capacity = $60 \div \text{min per unit} \times \text{parallel workers or machines}$

Batch = $\text{units per load} \times 60 \div \text{min per load}$

Oven, 2 pizzas per 10-min load: $2 \times 60 \div 10 = 12$ per hour

2 · Bottleneck slowest step rules

Bottleneck = step with the lowest capacity = **line capacity**

Bottleneck time = $60 \div \text{line capacity}$

Throughput time = sum of all step times

Pizza: $20 \cdot 15 \cdot 12 \cdot 30$ per h $\rightarrow$ line 12/h, one every 5 min, 19 min each

3 · Utilization and efficiency

Utilization = $\text{actual} \div \text{design capacity}$

Efficiency = $\text{actual} \div \text{effective capacity}$

Effective = design – planned losses (set-up, cleaning). Oven $540 \div 720 = 75\%$, $540 \div 600 = 90\%$

4 · People or machines needed

Needed = $\text{target per hour} \div \text{capacity of one per hour} \rightarrow \text{round up}$

Queue growth = arrivals – bottleneck capacity

$1,200 \text{ rolls/h} \div 420 \text{ per shaper} = 2.86 \rightarrow 3 \text{ shapers}$

5 · Supply chain capacity

Chain capacity = lowest capacity of all firms and transports

Frames 400 · assembly 500 · distributor 600 per week $\rightarrow$ chain 400; same time unit first

6 · Crossover and break-even

Total cost = fixed + variable per unit $\times$ volume

Crossover = $(\text{fixed B} - \text{fixed A}) \div (\text{variable A} - \text{variable B})$

Break-even = $\text{fixed} \div (\text{price} - \text{variable}) \rightarrow \text{round up}$

$36,000 \div (0.18 - 0.10) = 450,000$; above it the lower variable cost wins

Before you hand in

① "x [unit]
per [unit]"

② people and
machines rounded up

③ verdict in words,
matching your numbers

Heizer, Render & Munson (2023), Pearson · examples: own ·
compiled with Claude, reviewed by R. Bartnik