Gies Business

BADM 567: Process Management

Module 2: Process Configurations and Metrics

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Today’s Session

In Recent News

Introduction to Process Analytics

Case Analysis: Paediatric Orthopaedic

Bonus Material: Variability and Utilization

“Made Me Smile”

Deliberately slow checkouts in Dutch supermarket
Success resulted in installation in 200 stores

https://www.reddit.com/r/MadeMeSmile/comments/107gqi2/a_dutch_supermarket_chain_introduced_slow/

From Batch Production To Continuous Flow Tech.

Increase efficiencies in pharmaceutical production
Bringing generic drug manufacturing back to US

https://www.wbur.org/hereandnow/2023/01/17/generic-drugs-petersburg-virginia
https://news.vcu.edu/article/2021/10/medicines-for-all-institute-drives-down-production-costs-of
https://www.phlow-usa.com/what-we-do/

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Introduction to Process Analytics

Problem Solving Breakout Session

Application In Context
Toy Sailboats

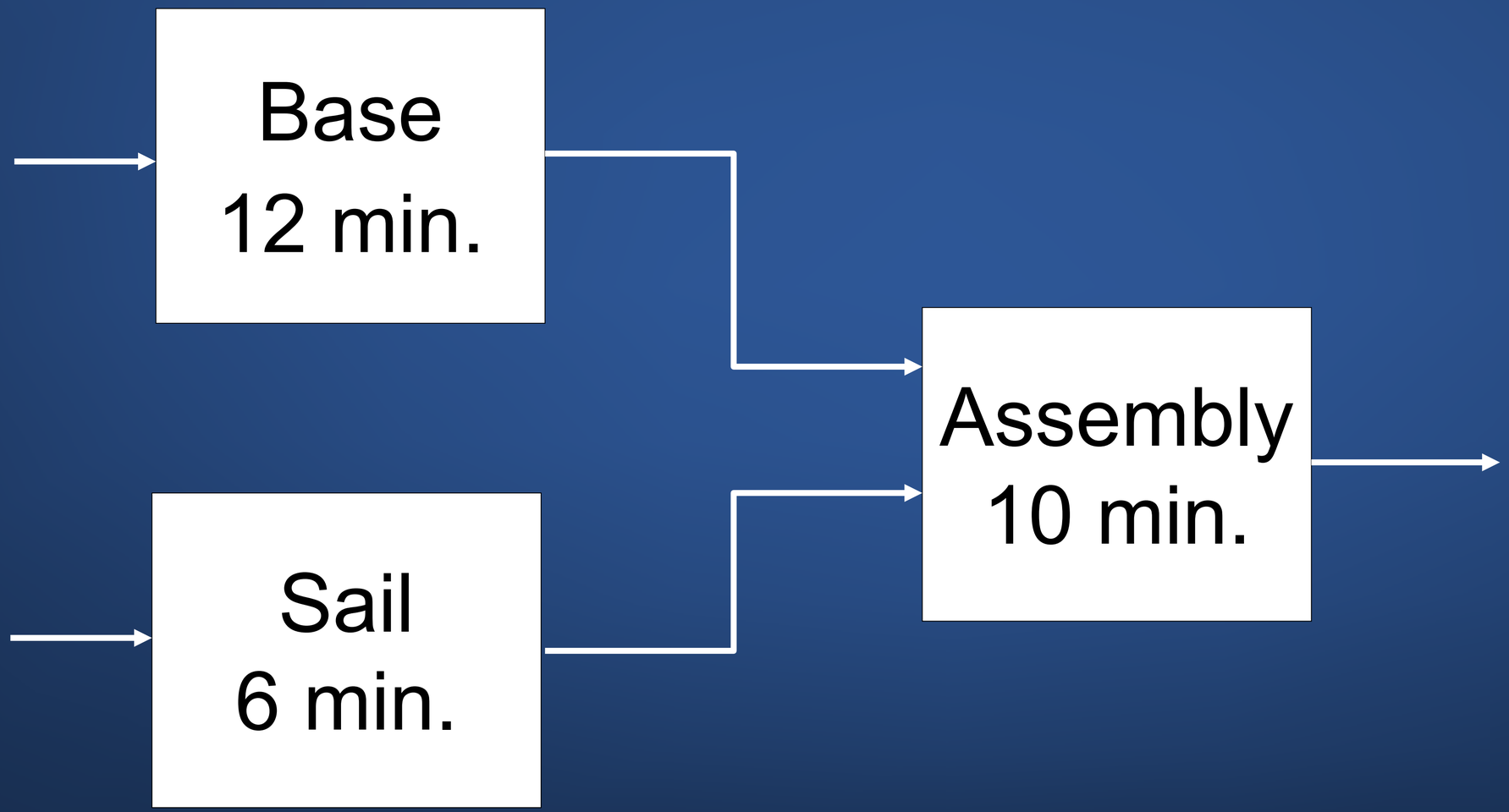
https://www.etsy.com/listing/243253376/wooden-toy-boat-sailboat-boat-toy

Example - Toy Sailboat Manufacturer

- Making sailboats (boats, in short) is a three step process (diagram on next slide).
- The base of the boat is made in Step “Base” and the sail is put together in Step “Sail”.

  Steps “Base” and “Sail” are parallel.
- The two boat-parts are combined in Step “Assembly” to complete a sailboat.

Time to Complete A Step



Find and Report - I

1) What is the shortest amount of time in which a boat can be ready from start to finish?

   If there are no stoppages between steps.

2) How many units can be done at each step in one hour?

   Consider each step in isolation.

Find and Report - II

3) How many units can be outputted from the process in one hour?

   Based on a continuously running process

4) To what extent is each step used?

   Incorporating previous question

Time to Make, and Each Step's Capacity

1. Process throughput time

   = 12 min. + 10 min. = 22 min.

2. Capacity of each step =

   1. 60 ÷ 12 = 5 boats/hour
   2. 60 ÷ 6 = 10 boats/hour
   3. 60 ÷ 10 = 6 boats/hour

Flow Rate of Process, and Utilization of Steps

3. Process flow rate
   (also known as process capacity)
   = Lowest capacity = 5 boats/hr.
4. Utilization of each step =
   1. 5 ÷ 5 * 100 = 100%
   2. 5 ÷ 10 * 100 = 50%
   3. 5 ÷ 6 * 100 = 83.33%

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Paediatric Orthopaedic Clinic…

Case Analysis

Customer Comments – We Can Relate

“Previous visits…have waited up to 6 hrs.”

“need your own X-ray; 5 waiting periods”

“I’m losing one day of work for 15 min consultation…”

Poll #1– True or False - And, So What?

The Chief of Surgery at Children's Hospital of Western Ontario (CHWO) was convinced that the staff was being over-utilized and had arranged to substantially expand the budget.

Summary of Situation

Long wait times at clinic

Clinic staff felt too busy

Pressures to cut budget

Aim to reduce wait times by 20%

Backgrounds of Incoming Patients

After emergency treatment

Referred by physicians

Walk-ins

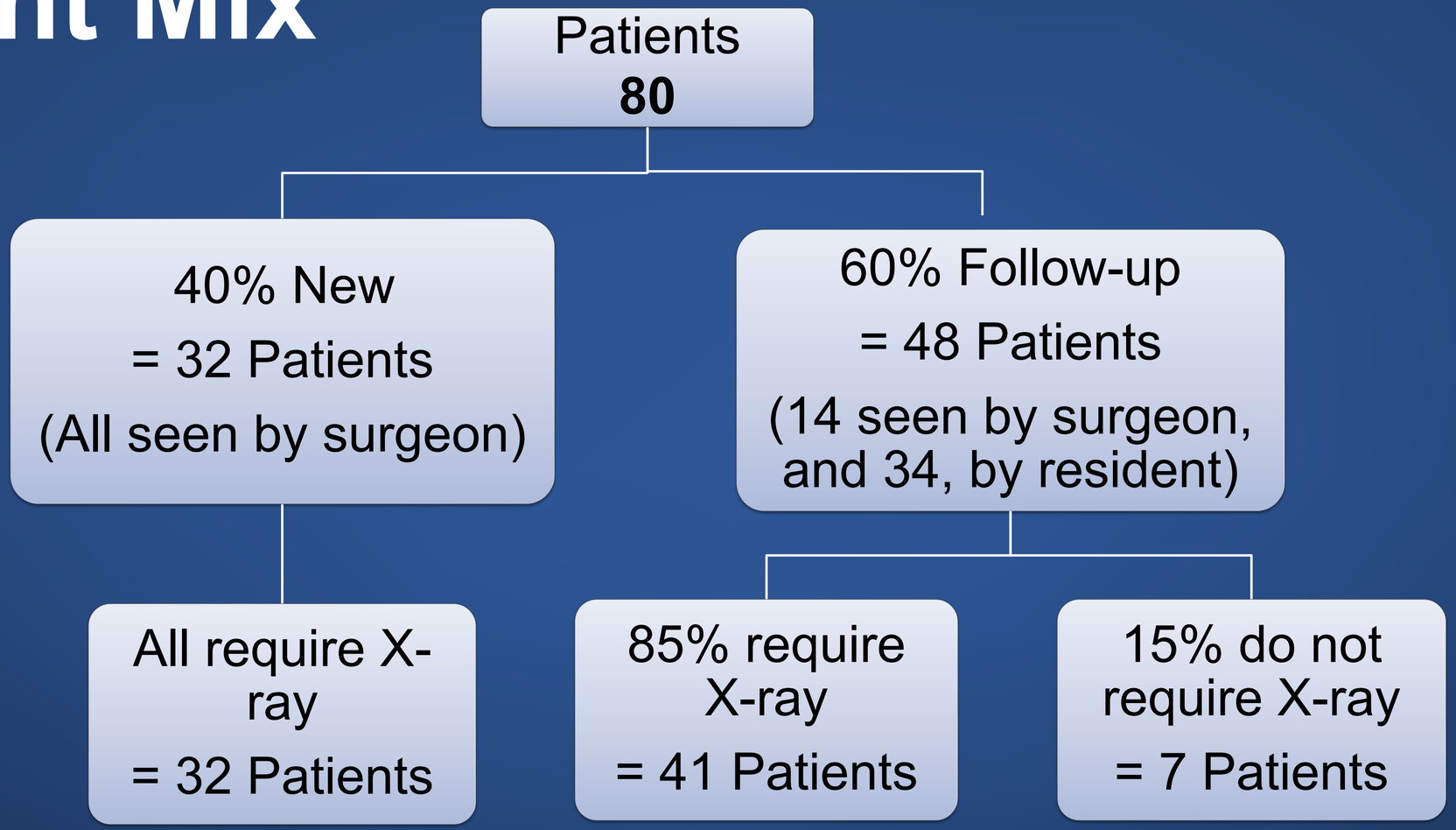
Follow-ups

Working Hours - Staffing

8:30 am – 1:00 pm

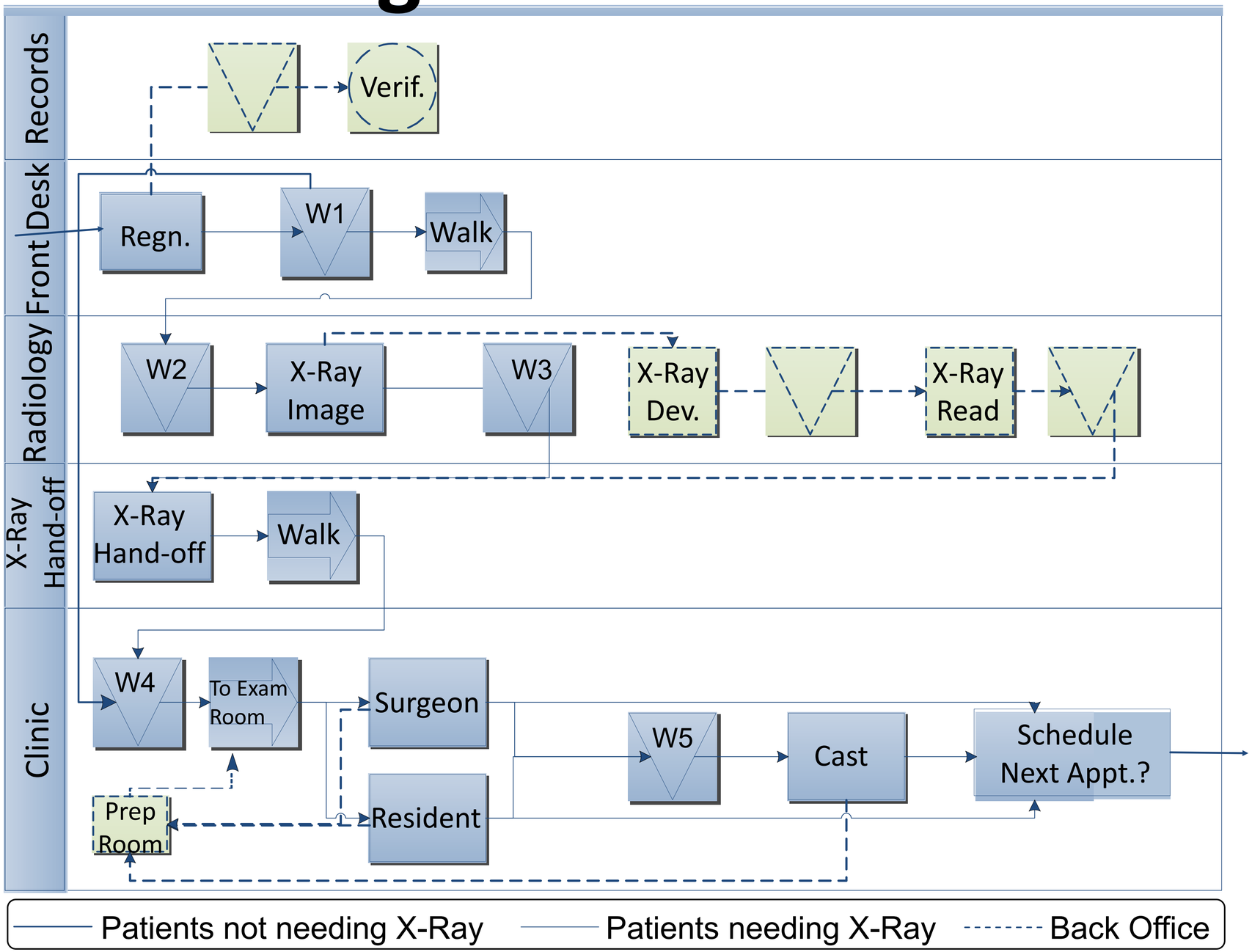
3 Clerks
4 Registered Nurses
1 Surgeon
2 Senior Resident Students
1 Cast Technician

Patient Mix



25% of New Patients + 15% of Follow-up Patients require casts
= **8** N + **7** F = **15** Patients

Swim Lane Diagram for Clinic



Poll #2 (Multiple Choice):

The resource that requires expansion in capacity most severely is:

A. Nurses
B. Radiology (X-ray)
C. Surgeon
D. Residents

What is your reasoning?

How Busy? - Utilization

Time Required ÷ Time Available

Same as

Patients that need the step ÷
Number of patients possible

Front Desk - Clerks

Time Required

- All patients
  - 80 patients * 5 minutes

Time Available

- 3 clerks, working 8:30 am – 11:30 am
  - 3 clerks * 180 minutes

Utilization

- 400 ÷ 540 = 74.07% ~ 74%

Verification + X-Ray Collection

Time Required

New patients: 32 patients * (9 + 2) minutes

Follow-up patients: 48 patients * 4 minutes

+ 41 patients * 2 minutes

Time Available

3 nurses, working 8:30 am – 12:45 pm

3 nurses * 255 minutes

Utilization

626 ÷ 765 = 81.83% ~ 82%

Radiology - Imaging

Time Required

(32N + 41F) patients * 11 minutes

Time Available

6 technicians, working 8:30 am – 12:30 pm, 2/3rd time

6 technicians * 240 minutes * 2/3

Utilization

803 ÷ 960 = 83.65% ~ 84%

Examination - By Surgeon

Time Required

32N patients * 7 minutes

14F patients * 4 minutes

Time Available

1 surgeon, working 8:45 am – 1:00

1 surgeon * 255 minutes

Utilization

280 ÷ 255 = 109.80% ~ 110%

Examination - By Senior Residents

Time Required

34F patients * 7 minutes

Time Available

1 resident, working 8:45 am – 1:00

1 resident * 255 minutes

Utilization

238 ÷ 255 = 93.33% ~ 93%

Summary

Task	Utilization
Front Desk Staff	74%
Nurses (Verification & X-Ray Hand off)	82%
X-Ray Technicians	84%
X-Ray Development (automated)	53%
Radiologist	76%
Filing/exam room Prep	63%
Surgeon	110%
Senior Resident	93%
Cast Technician	89%

Implications?

Poll #3 (Multiple Choice)

Based on average times, about how much time does a patient spend in the clinic?

A. 60 minutes
B. 120 minutes
C. 180 minutes
D. 240 minutes

How can we estimate that?

Time Spent in Clinic

All new patients

30 + 58 + 3 + 38 = **129** minutes

Follow- up patients

With x-ray: 25 + 58 + 3 + 33 = 119 minutes

Without x-ray: 25 + 3 + 3 + 33 = 61 minutes

Average Time for Follow-up Patients

(0.85 * 119) + (0.15 * 61) = **110** minutes

Avg. Throughput Time for all Patients

(0.4 * 129) + (0.6 * 110) = 117.6 ~ **118** Minutes

Calculating Space Needed in Radiology

Ave. Throughput Time = 58 minutes

Ave. Throughput Rate

Based on 32N + 41F = 73 patients

In 4 hours (or 240 minutes)

73 ÷ 240 = .30 patients per minute

Use Little's Law

I = T * R

I = 58 * 0.30 = 17.4 ~ 17 patients

Incorporating Uncertainty – Standard Deviation

Wait in Radiology:

58 – 11 = 47 minutes

Adding 2 standard deviations
(to get 97.5% coverage)

47 + (2 * 22) = 91 minutes

Potential Causes of Long Wait Times

Radiology
- Shared resource
- Setups

Examination
- Over 100% utilization for surgeon
- Over 90% for senior resident

Variability

Recommendations - 1 of 3

Radiology

- Dedicate one X-ray machine
- Install additional X-ray machine

Recommendations - 2 of 3

Better Scheduling – To the extent possible:

- get the no X-ray follow-up patients in early in the day
- reduce setups in X-ray imaging
- Estimate times based on history of follow-up patients

Recommendations - 3 of 3

Make use of second resident during peak times

Keep patients informed about wait times and back room activities

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Bonus Material

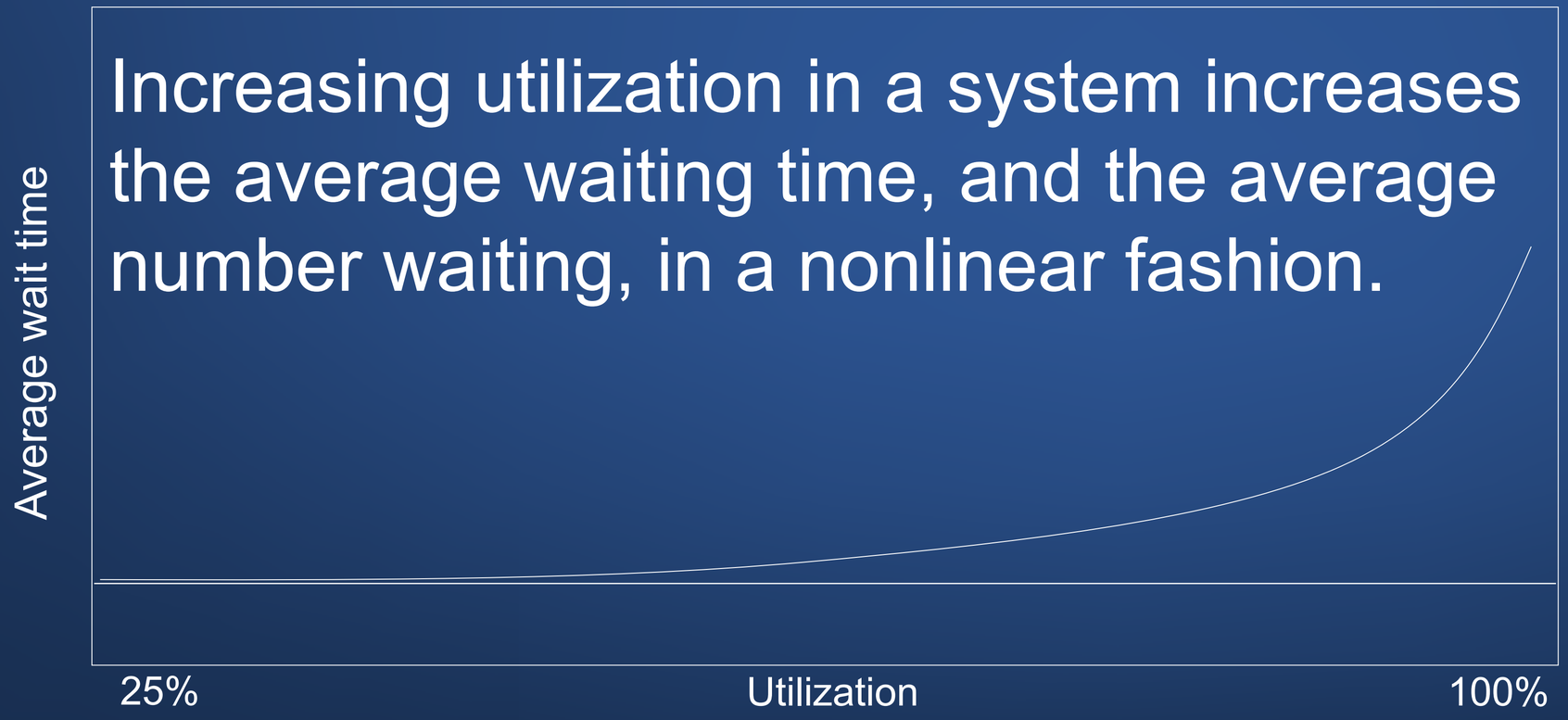
Variability and Utilization

Impact on Waiting

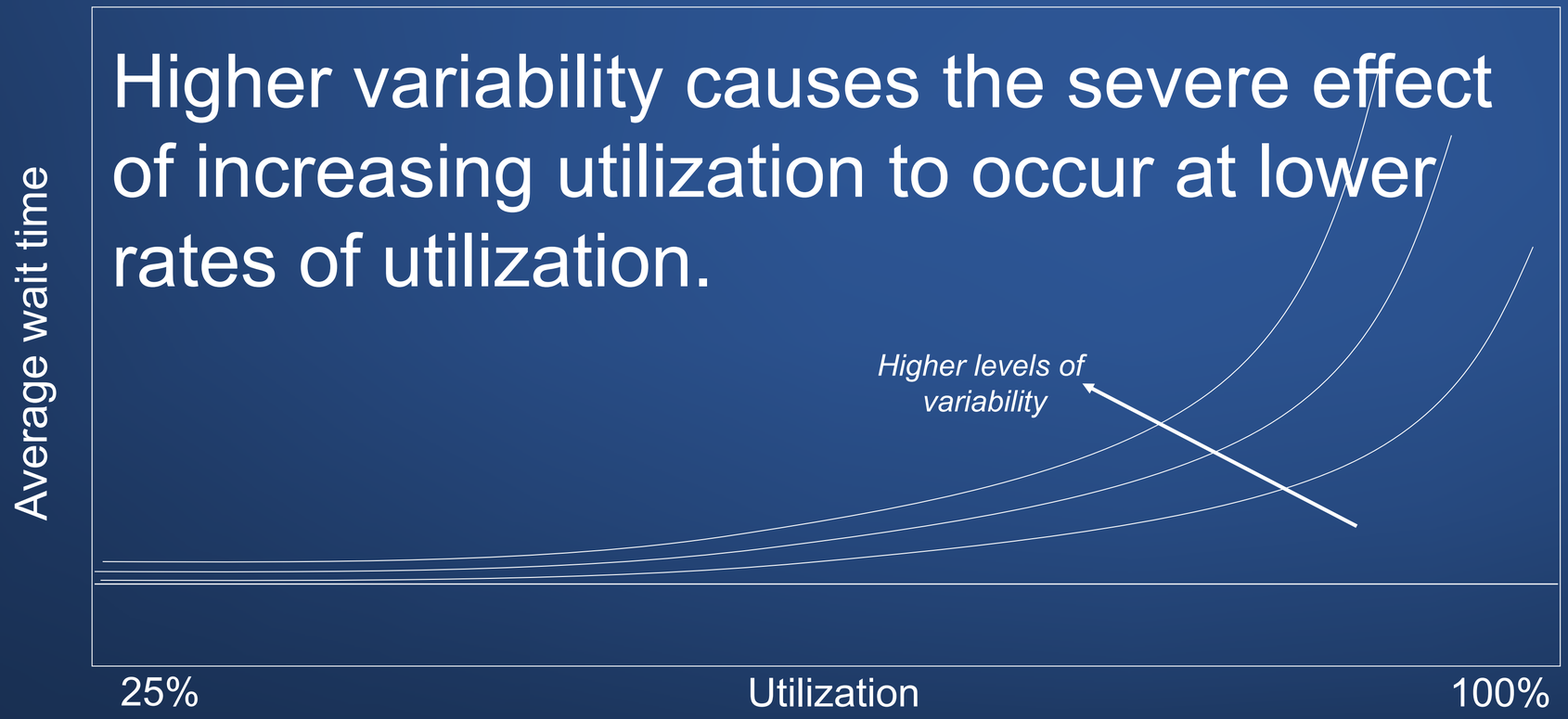
Sources of Variability, in General

Setup times
Rework
Demand changes
Machine downtime
Priority orders

Utilization and Waiting



Compounded by Variability



In Words

If there is very high utilization, close to 100%, (i.e., no buffer capacity), there will be waiting…

…unless there is no variability in the system.

As variability increases, wait times will occur,

and they will start worsening at lower and lower degrees of utilization.

Thus, if a business wants to utilize the capacity of a process at a high level, it must try to reduce variation.

Looking Forward to Next Week

Three Jays Case

- Case quiz – formulae included in case

Inventory Management on Coursera

- Definitions and Formulae on Canvas

Thank you!