

Unit# 5

Process Analysis

OBJECTIVES

- **Process Analysis**
- **Process Flowcharting**
- **Types of Processes**
- **Process Performance Metrics**

Process Analysis Terms

- **Process:** Is any part of an organization that **takes inputs and transforms them into outputs**
- **Cycle Time:** Is the **average successive time** between completions of successive units
- **Utilization:** Is the **ratio of the time** that a resource is actually activated relative to the time that it is available for use

Process Flowcharting

Defined

- **Process flowcharting** is the use of a diagram to **present the major elements of a process**
- The basic elements can include tasks or operations, flows of materials or customers, decision points, and storage areas or queues
- It is an ideal methodology by which to begin analyzing a process

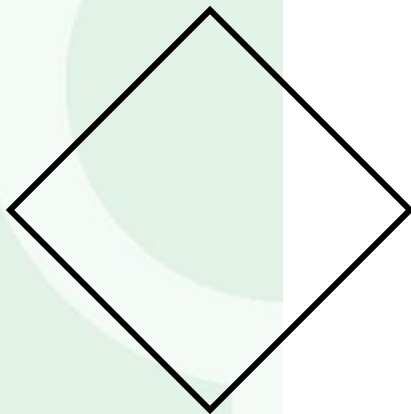
Flowchart Symbols

Purpose and Examples



Tasks or operations

Examples: Giving an admission ticket to a customer, installing a engine in a car, etc.

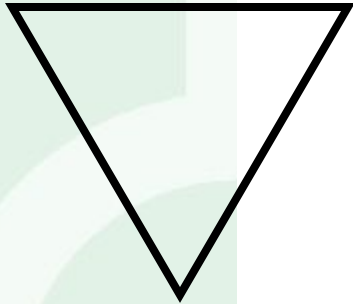


Decision Points

Examples: How much change should be given to a customer, which wrench should be used, etc.

Flowchart Symbols

Purpose and Examples



Storage areas or queues

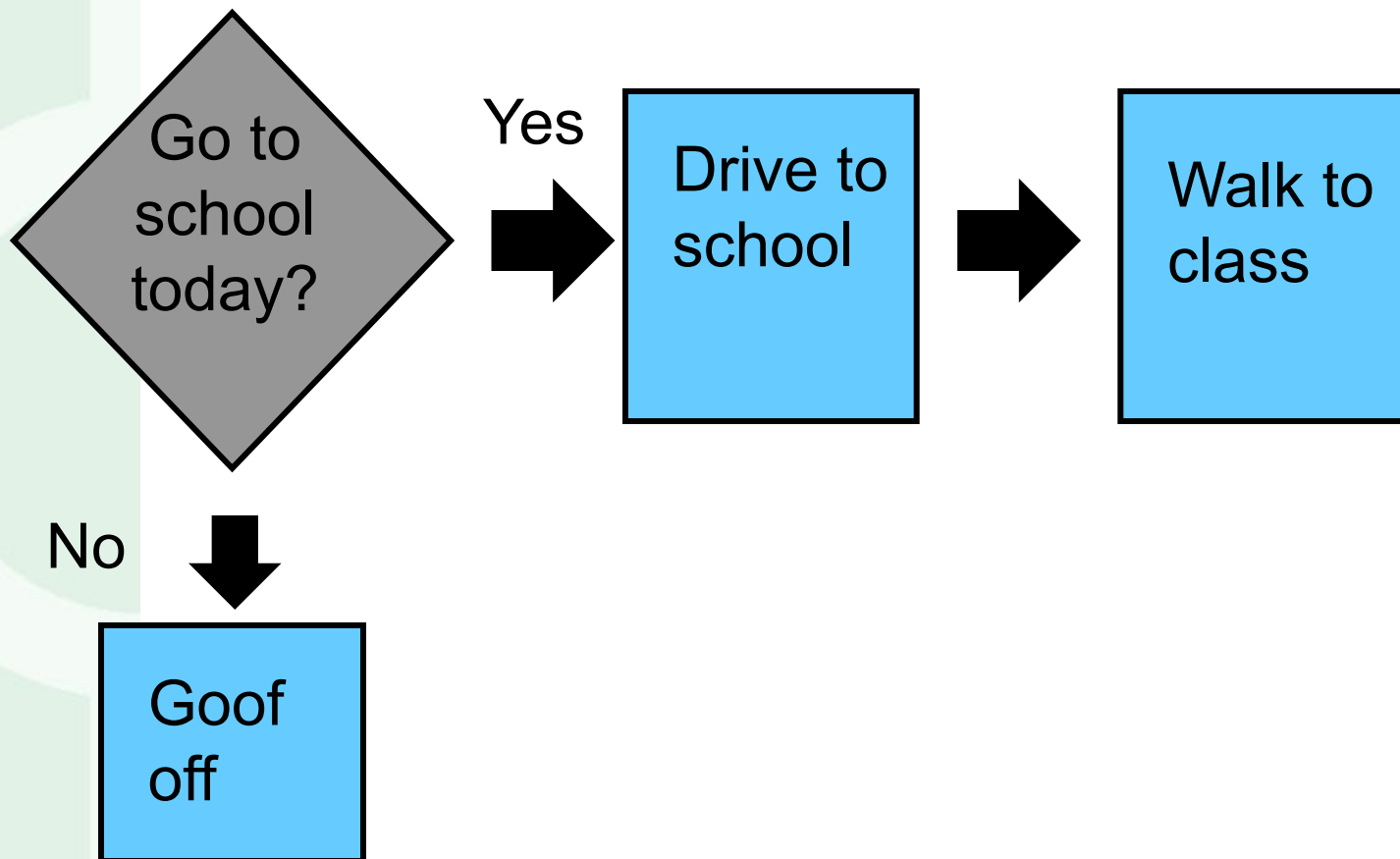
Examples: Sheds, lines of people waiting for a service, etc.



Flows of materials or customers

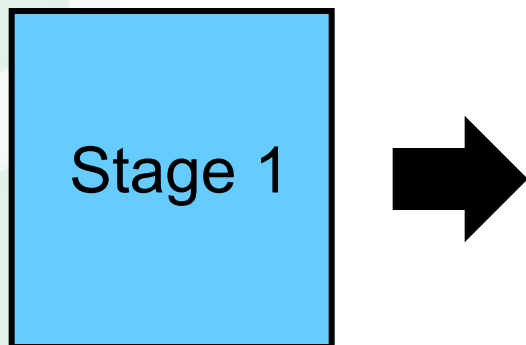
Examples: Customers moving to a seat, mechanic getting a tool, etc.

Example: Flowchart of Student Going to School

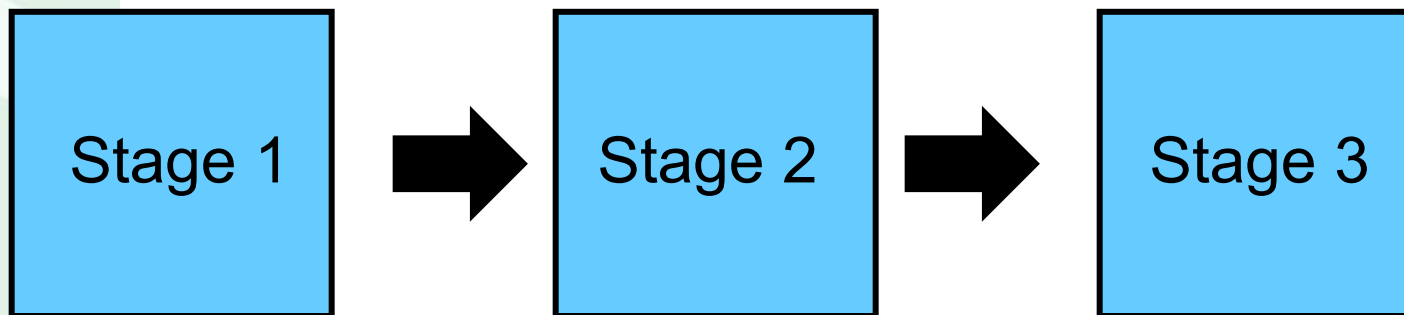


Types of Processes

Single-stage Process



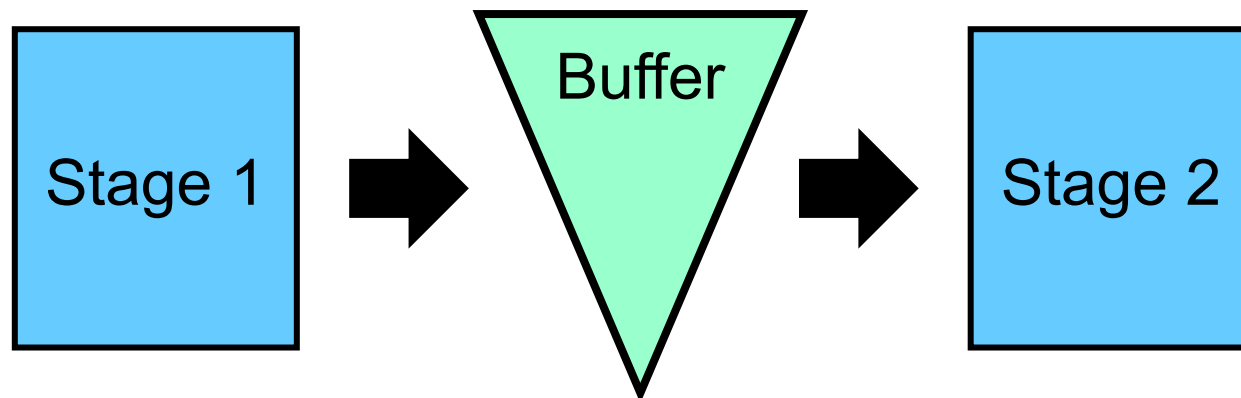
Multi-stage Process



Types of Processes (Continued)

A **buffer** refers to a storage area between stages where the output of a stage is placed prior to being used in a downstream stage

Multi-stage Process with Buffer



Other Process Terminology

- **Blocking**
 - Occurs when the **activities** in a stage **must stop** because there is **no place to deposit** the item just completed
 - If there is no room for an employee to place a unit of work down, the employee will hold on to it not able to continue working on the next unit
- **Starving**
 - Occurs when the **activities** in a stage **must stop** because there is **no work**
 - If an employee is waiting at a work station and no work is coming to the employee to process, the employee will remain idle until the next unit of work comes

Other Process Terminology (Continued)

- **Bottleneck**
 - Occurs when the **limited capacity** of a process causes **work to pile up** or become unevenly distributed in the flow of a process
 - If an employee works too slow in a multi-stage process, work will begin to pile up in front of that employee. In this case the employee represents the limited capacity causing the bottleneck.
- **Pacing**
 - Refers to the **fixed timing** of the movement of items **through the process**

Other Types of Processes

- **Make-to-order**
 - Only **activated** in response **to an actual order**
 - Both work-in-process and finished goods inventory kept to a minimum
- **Make-to-stock**
 - Process **activated to meet** expected or **forecast demand**
 - Customer orders are served from target stocking level

Process Performance Metrics

Operation time = Setup time + Run time

setup time = preparation time

run time = time to produce a batch of output (unit)

Throughput time or Flow time = Average time for a unit to move through the system

Value-added time = productive work done on a unit

Velocity = $\frac{\text{Throughput time}}{\text{value-added time}}$

Process Performance Metrics (Continued)

Cycle time = Average time between completion of units or $\frac{60\text{mins}}{\text{Unit produced}}$

- Elapse time between starting and completing a job

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

- or **Capacity rate**: max # a process expected to produce over period of time

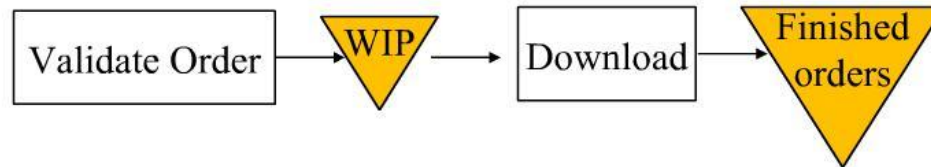
Efficiency = $\frac{\text{Actual output}}{\text{Standard Output}}$

efficiency: $36/30 = 120\%$

Sample 1

Example – iTunes Music Service

Assume only 1 order
in the system



Individual stages

Capacity rate:

40 units / hr

30 units / hr

Cycle time:

1.5 min

2 min

The (whole) process

Flow time:

$1.5 \text{ min} + 2 \text{ min} = 3.5 \text{ min}$

Capacity rate:

30 units / hr

Cycle time:

2 min

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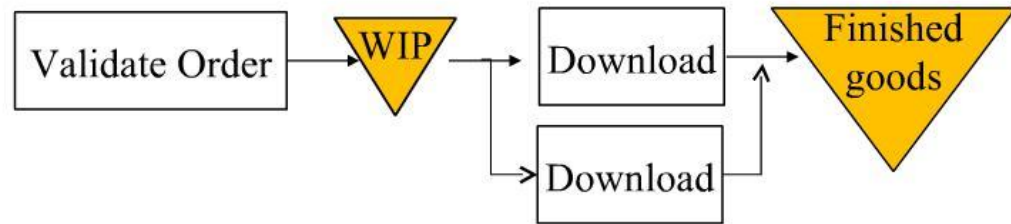


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Sample 2

(cont'd) adding an extra server for download

Assume only 1 order
in the system



Individual stages

Capacity rate:

40 units / hr

60 units / hr

Cycle time:

1.5 min

1 min

The (whole) process

Flow time:

1.5 min + 1 min = 2.5 min

Capacity rate:

40 units / hr

Cycle time:

1/40 hr = 1.5 min

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Process Performance Metrics (Continued)

Productivity = Output
Input

Utilization = Time Activated
Time Available

Cycle Time Example

Suppose you had to produce 600 units in 80 hours to meet the demand requirements of a product. What is the cycle time to meet this demand requirement?

Answer: There are 4,800 minutes (60 minutes/hour x 80 hours) in 80 hours. So the average time between completions would have to be: Cycle time = $4,800/600$ units = 8 minutes.

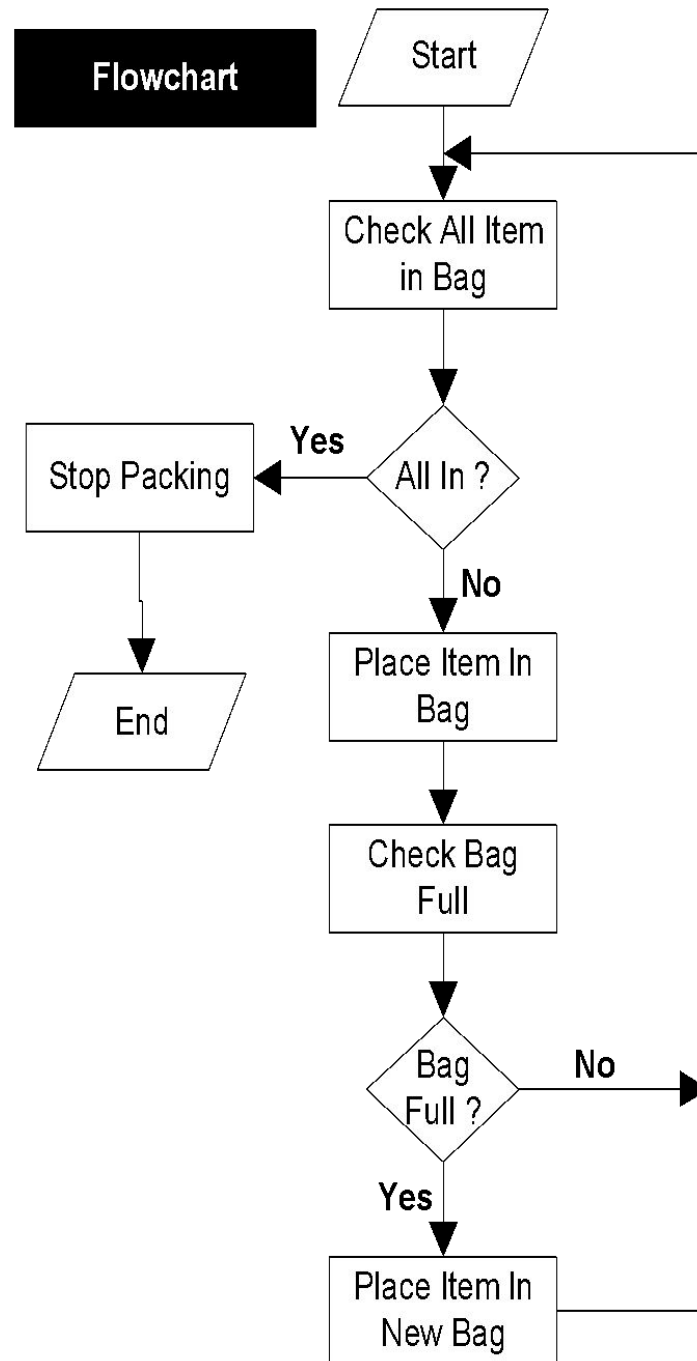
Process Throughput Time Reduction

- **Perform activities in parallel**
- **Change the sequence of activities**
- **Reduce interruptions**

Flowchart Exercise

- Using flowchart, expand the place item into a plastic bags to highlight set of tasks that includes *checking if all items are in bags*, than *stop packing* or *else place items into plastic bags*. It also includes *checking if the bag is full* than *place the next item into a new bag*.

Answer



Question Bowl

Which of the following are possible examples of “cycle times”?

- a. Time for each television to come off an assembly line.**
- b. Time it takes for a stock purchase**
- c. Time it takes for an instructor to grade an exam**
- d. Time it takes to build an automobile**
- e. All of the above**

Answer: e. All of the above

Question Bowl

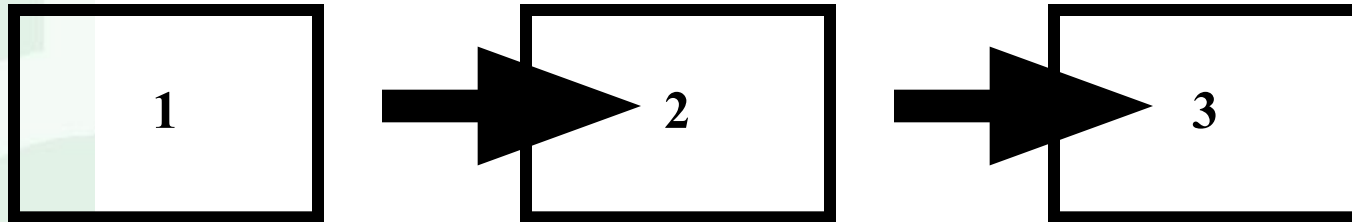
Which of the following are used as symbols in a Process Flowchart?

- a. Decision points**
- b. Blocking**
- c. Starving**
- d. Bottleneck**
- e. All of the above**

Answer: a. Decision points (A diamond shaped symbol.)

Question Bowl

Which type of process is configured as follows?



- a. **Single-stage process**
- b. **Multi-stage process**
- c. **Make-to-order process**
- d. **Make-to-stock process**
- e. **All of the above**

Answer: b. Multi-stage process

Question Bowl

When an assembly line employee is waiting for a unit of work to come down the line so they can stop being idle and get back to work, it is an example of which of the following process terms?

- a. Buffering**
- b. Blocking**
- c. Starving**
- d. Bottleneck**
- e. All of the above**

Answer: c. Starving

Question Bowl

When a company waits until they have an order for their product in hand before beginning any production for that order, we can characterize their operation as which of the following processes?

- a. Single-stage process**
- b. Multi-stage process**
- c. Make-to-order process**
- d. Make-to-stock process**
- e. All of the above**

Answer: c. Make-to-order process

Question Bowl

If the Run Time for a batch of parts is 45 minutes on a machine, and the Setup Time is 65 minutes, which of the following is the Operation Time?

- a. 75 minutes**
- b. 110 minutes**
- c. Only 45 minutes**
- d. 65/45 minutes or 1.44 hours**
- e. Can not be computed on the data above**

Answer: b. 110 minutes (Operation Time is the sum of Run Time and Setup Time, or $65 + 45 = 110$ minutes)

Question Bowl

If the standard expected phone calls for a telephone marketers is 24 per hour, and one telephone marketer did 27 per hour, which of the following can be used to describe their Efficiency?

- a. **88.8%**
- b. **100%**
- c. **112.5%**
- d. **Well over 150%**
- e. **Can not computed on the information given.**

*Answer: c. 112.5%
(Ratio of actual performance/expected performance, or $(27/24) \times 100 = 112.5\%$)*

End of Unit# 5