

# IE102 A Process Outlook for Industrial Engineering

Bilkent University

## Lecture 2

Recapture the material covered in  
lectures for individual sections

# Meaning of the word “Process”

## Engineered Processes

- A series of actions, changes, functions; steps
- A particular “economic” motive
- May be repetitive
- Part of another process
- Structured – “well-defined”
- Measurable outcome

# Last week-Rice Cooking Example

- Existence of Alternatives
- Actions – decisions
  - Duration of frying
  - Duration of boiling/ intensity of heat
  - Quantity of water to use
  - Cooking duration for low heat
  - Duration (waiting) before serving
- Worthwhile? Catering firm? Army?
- Longer-term decisions (type of rice, stove, energy source, .....

# Airport Operations

- Sub-processes after plane reaches the gate until it leaves for another destination.
- Name those sub-processes. The ones we are familiar were detailed!
- Possible improvement ideas to decrease the total time the plane stays at the gate.

# Subprocesses mentioned

- Engagement to the gate (1)
- Passengers out (2)
- Crew out (3)
- Security check for left material (4)
- Cleaning crew (5)
- Crew in (6)
- Catering Service (7)
- Newspaper service (8)

# Subprocesses mentioned

- Head Phones (9)
- Passengers in (10)
- Equipment (in plane) check (11)
- Finalized flight information available (12)
- Passenger safety instructions (13)
- Final OK from air traffic controller (14)
- Final equipment check, locks (15)
- Disengagement from the gate (16)

# Subprocesses mentioned

- Engine check (A)
- Equipment check (Pilot's cabin) (B1-B...)
- Gas refill (C)
- Wheel checks (D)
- Other maintenance procedures (E)
- Baggage out (I)
- Baggage in (II)
- All are related – how?

# Improve Boarding

Many different boarding strategies:

Certain codes in the boarding passes which differentiate boarding times.

Issues to consider:

-passengers blocking in the aisle due to:

- pass to their seat (aisle seated before window)
- place their hand luggage



# Improve Boarding

Many different boarding strategies:

1. BackToFront (B2F)
2. Random
3. WindowMiddleAisle (WMA)
4. Steffen (Mixture of B2F and WMA with skipping and performing one side at a time)
5. SortedBoardingGroups (SBG)
6. DynamicallyOptimizedBoarding (DOB)  
(Similar to Steffen, considers cliques - who wants to board together)

# Improve Boarding

Video 1: Boarding

Video 2

# Improve Boarding Simulation

| Time parameters                            | Time ticks |
|--------------------------------------------|------------|
| Avg. walk time between 2 adjacent rows     | 1          |
| Avg. time to stow luggage                  | 3          |
| Avg. time to sit with 1-seat interference  | 10         |
| Avg. time to sit with 2-seats interference | 16         |
| Avg. passengers' inter-arrival time        | 4          |

| Strategy | Time units |
|----------|------------|
| B2F      | 667,56     |
| Random   | 661,26     |
| SBG      | 547,56     |
| WMA      | 496,86     |
| Steffen  | 487,86     |
| DOB      | 490,1      |

# Improve Boarding

## Video 3: Flying Carpet

# Wrap-up – your experience

- Simple ideas – may work – trade-off: demand effect
- More sophisticated – requires planning (schedule, layout) or investment
- Requires technical knowledge of the process, hence we have less suggestions
- Smart ideas that require further analysis before implementation

# Wrap-up (continued)

- Airport Operations –
  - Numerous processes
  - Complexity of the situation (history of IE)
  - Decisions are embedded in the processes
  - Decisions are interrelated
- IE's role – improvement via changing the implementation (decisions)
- Improvement with respect to a performance measure (total duration – Toast Kaizen)
- Examples for improvement: schedule, layout, equipment selection, boarding

# Generalizations

- Time span of decisions: Short, Medium, Long (operational, tactical, strategic)
- Importance – All affect processes – not all are handled for a given purpose
  - rice cooking, airline operations

How do IE's handle these decisions?

○Engineering approach - a process, as well!

How is IE different than other similar jobs?

○Mathematical orientation - structured decisions repeated consistently - main value-added for IE's over “smart” people

# Issues Summarized/Keywords

- Interrelated processes, complex decision making – IE emphasis
- Performance measure(s)
- Mathematical representation – Rice Cooking – **Abstract thinking, *modeling, decision variables***
- Improvement idea
- Time span of decisions



# Important Generic Areas for Decision Making

Generic: A lot applications approached with similar abstraction

## Example 1: Layout

- The way in which different parts of an area, volume is arranged
- Examples – factory, gate, warehouse, office
- Decision variables: size (continuous), function discrete)

# Important Generic Areas for Decision Making (cont.)

## Example 2: Schedule

- A plan of activities or events and when they will happen
- Examples – assembly line, construction, course
- Decision variables for course scheduling: when (time - continuous), where (location of class – discrete)

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