

# TPPE74

## Design and Development of Manufacturing Operations

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Industrial Engineering and  
Management of European  
Higher Education

### Seminar 7

System Knowledge, Task D

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# Seminar 7

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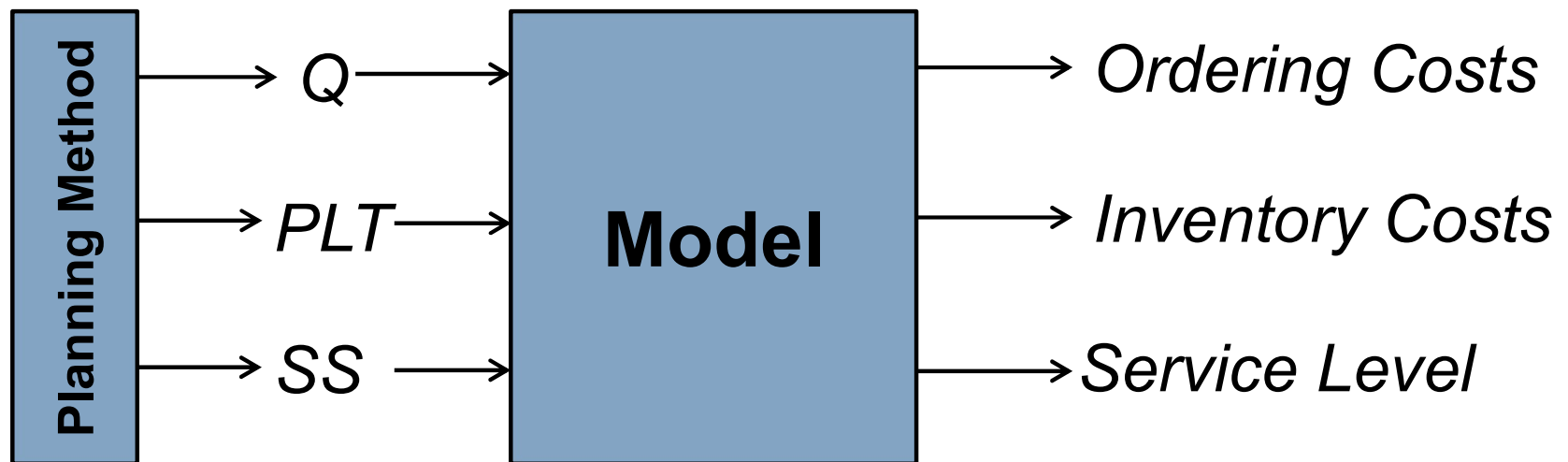
## Content

- Introduction to Task D
- Examination: Grading Criteria Task D
- Simulation run time slots

# PicSim

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- Production and Inventory Control Simulator (PicSim)
- From the Project Directive:  
“The markets all operate under the same **order winner, namely cost** (total cost in this case) and total service level (delivery) is seen as a market qualifier.”



# Four Tasks in the Project

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- Task A
  - Create graphs over nine different relationships.
  - Lisam Quiz to test conceptual shape.
- Task B
  - Run 10 simulations (we run the model) with the target to reach:  
Inventory cost: 340 000 kr  
Service level: 95 %  
Total Cost: 680 000 kr
  - Test all different planning methods
  - Lisam Quiz before simulations (at least one in each group needs to pass)
- Task C
  - Carry out a setup time reduction and study the effects.
  - Run 3 simulations (we run the model) to study the effects.
- Task D
  - Formulate system specific guidelines and rules that apply to the design parameters.
  - Run 3 simulations (we run the model) to “optimize” the system.
  - Competition!

# Task D Formulate system specific guidelines and r

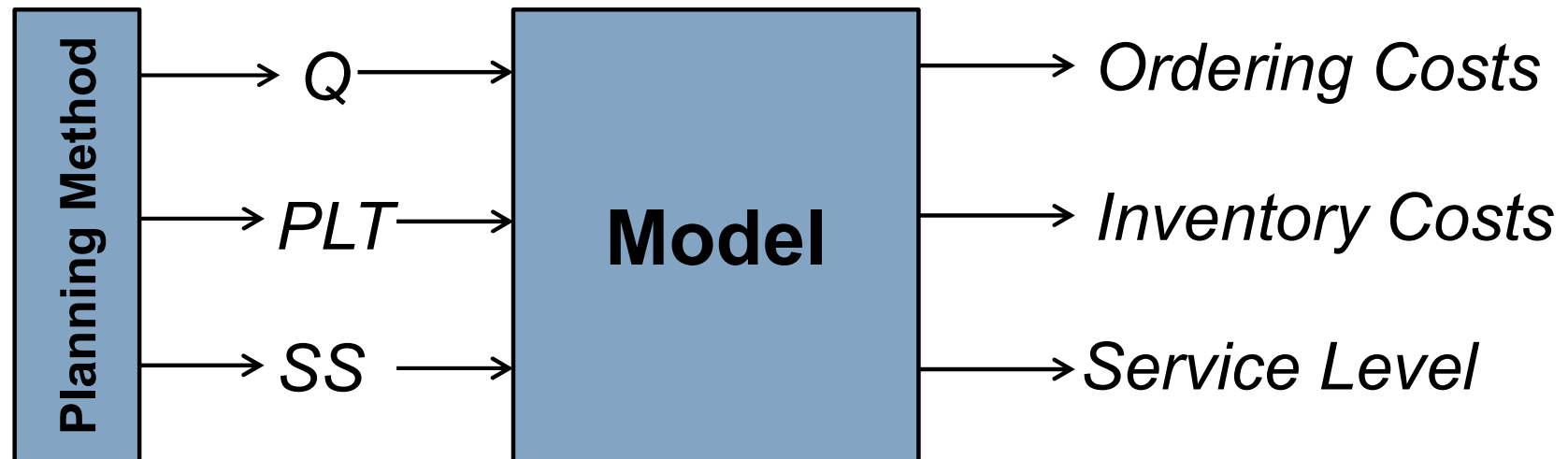
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- Task D
  - Formulate system specific guidelines and rules that apply to the design parameters.
  - Be specific in how design parameters are interrelated and how they affect the outputs, service level, inventory cost, ordering cost, and total cost.
  - Please note that order winner and market qualifier must be discussed in this context.

## Task D Formulate system specific guidelines and r

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- Task D
  - Design parameters



## Task D Formulate system specific guidelines and r

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- Example:

*Safety Stock is an extra stock level that always should be planned for to ensure the availability of end products for the customers, even during high demand periods.*

*Safety Stock will affect the Inventory Cost such as a higher Safety Stock level will increase the Inventory Cost.*

*At the same time there can be a positive impact on Service Level.*

# Task D Run 3 simulations

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- Task D
  - Task D is the basis for the final test: Improving a new version of the manufacturing planning system.
  - This new version is the same in all parameters except the randomness, thus it will behave a little bit different.
  - There are three runs available for the final test. If you chose to compete in the final competition, the last of the three runs are done live at Seminar 8.
  - These are the three simulation runs:
    1. Run 1: Chose a system design that meets the targets. This run is done with a new source of randomness.
    2. Run 2: Use the gathered knowledge in the course to improve the runs from 1. Use the graphs from Task A, results from Task B and rules from Task D.
    3. Run 3: The final run. If the group competes in the competition, this run is done at seminar 8, otherwise it is done just before the seminar.



# Model Randomness

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- All random behavior in the PicSim model comes from the Random Number Seed

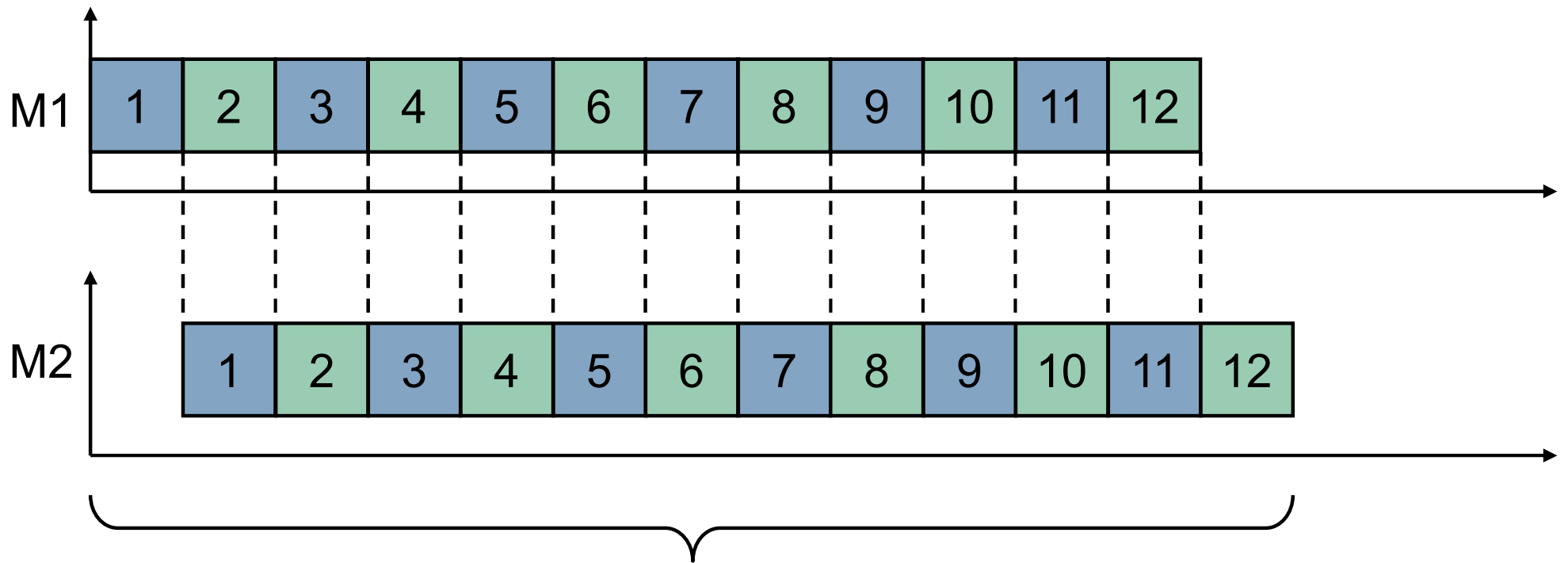
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- But why is this important? How?

# Example of randomness in a model

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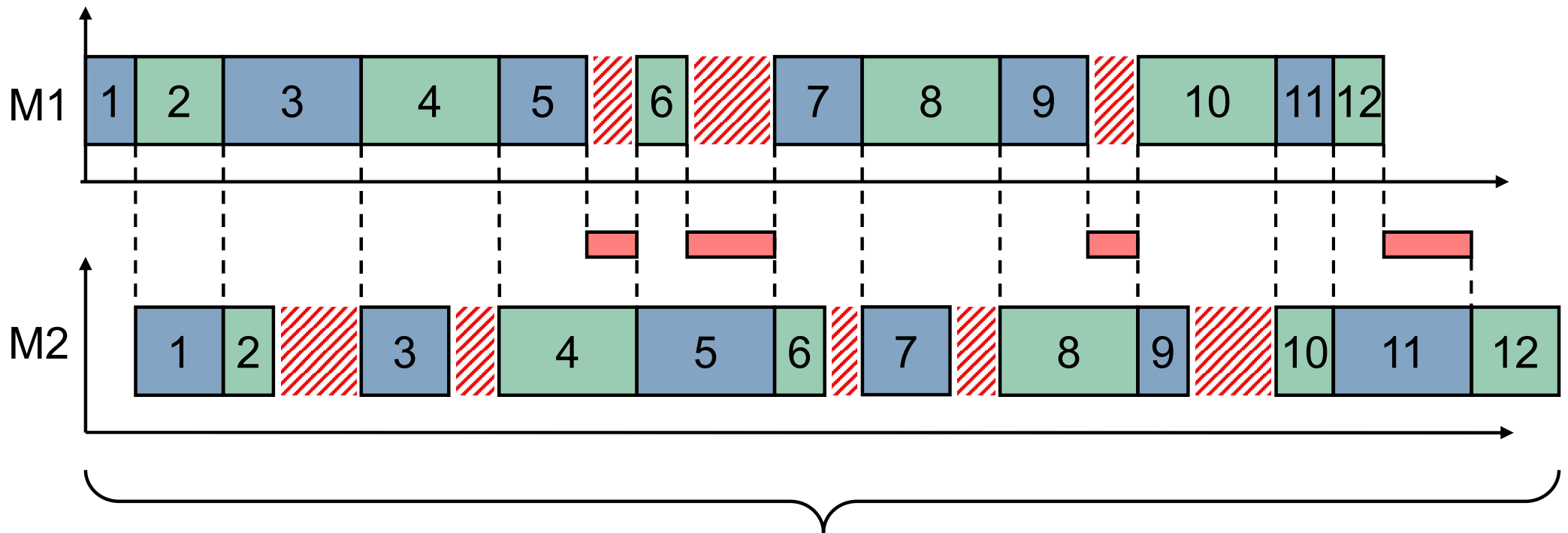
- Operation time M1: 10 minuter
- Operation time M2: 10 minuter



Throughput time = 130 minutes

# Example of randomness in a model

- Operation time M1: randomly sampled between 5, 10 and 15 minutes
- Operation time M1: randomly sampled between 5, 10 and 15 minutes



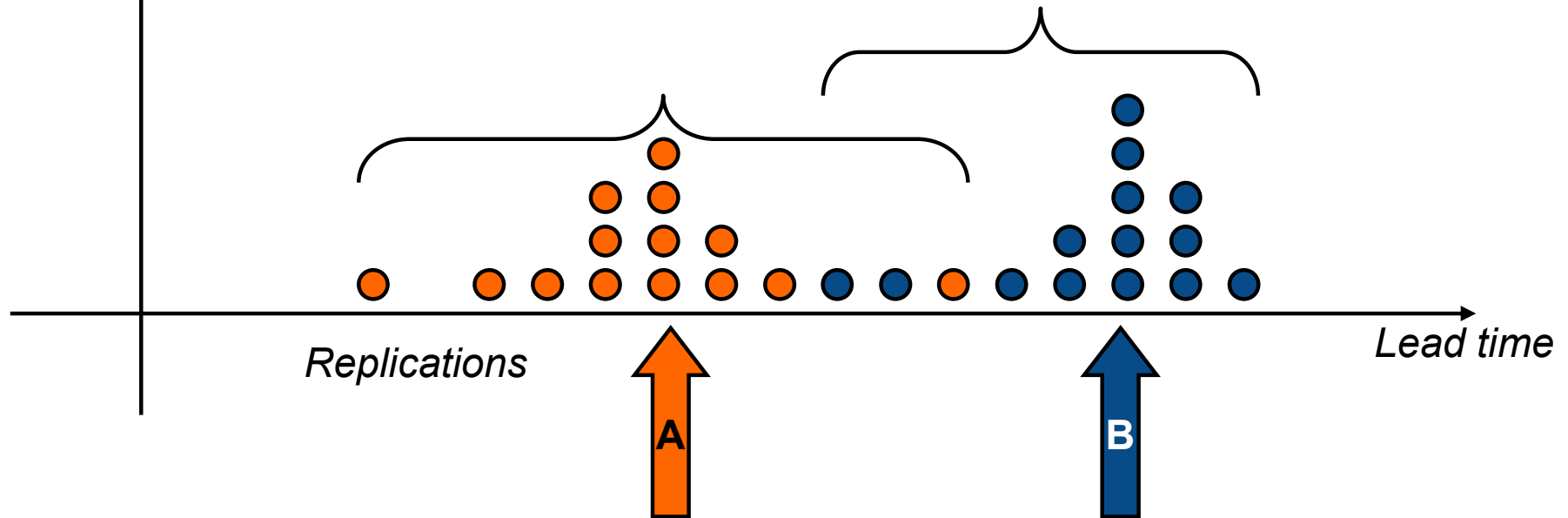
Throughput time = 160 minutes  
Slack (20 + 30 min) = 50 min

# Example of randomness in two models

Number of observations in a model

**Model A** use system A  
**Model B** use system B

Is A better than B?  
Does A have a shorter lead time than B?



# Random Number Exercise

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1

5	3	4	5	1	1	5
2	6	3	6	5	3	2
2	4	5	4	6	4	1
3	6	4	1	1	6	1
5	5	6	6	6	3	5
4	4	3	1	3	1	1
1	3	2	1	4	6	5

2

1	4	3	6	5	2	1
2	5	2	5	3	1	3
4	2	1	6	4	3	2
5	1	3	2	5	2	1
4	3	2	5	3	6	2
6	2	3	1	2	5	4
4	5	6	3	1	2	6

3

1	3	2	5	1	1	1
3	6	6	1	2	4	4
3	5	3	6	1	4	6
2	5	6	1	1	6	4
6	2	2	2	3	1	3
2	1	6	5	5	1	6
6	2	2	4	1	3	5

## More simulation in...

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- TPPE99 Simulation in Production and Logistics

## Task D

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- The new randomness in the model

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- This new version is the same in all parameters except the randomness, thus it will behave a little bit different.

# Task D

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- Three runs to...
  - Meet the targets
  - Improve beyond the targets
- These are the three simulation runs:
  1. Run 1: Chose a system design that meets the targets. This run is done with a new source of randomness.
  2. Run 2: Use the gathered knowledge in the course to improve the runs from 1. Use the graphs from Task A, results from Task B and rules from Task D.
  3. Run 3: The final run. If the group competes in the competition, this run is done at seminar 8, otherwise it is done just before the seminar.



# Examination – Grading Criteria

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- Grade Pass requires the following:
- Active participation in the project group.
- For part D:
  - Discussion and formulation of rules and guidelines for each one of the design parameters Order Quantity, Planned Lead Time, and Safety Stock.
  - Minimum two simulation runs to improve the performance measurements under a new set of randomness.

# Task D

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## Competition

- Friday May 21, kl. 13:15
- Each group can join the competition (not mandatory!)
- The prizes for the winning group is:
  - A long sleeve sweater with embroidery “LiU Produktionsekonomi”, sizes L or XL (a few M remains).
  - Key chain.
  - Diploma.



# Task D

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## Competition

- Friday May 21, kl. 13:15
- Each group can join the competition (not mandatory!)

## The seminar for competing Groups

- The competing run is submitted in Task D PicSim Submission 3, on time.
- I run the competing runs live.
- The “best” solution wins nice prices.
- Non-competing groups can participate.

## The seminar for non-competing Groups

- Watch the competing groups compete.

# Simulation Runs in Task D

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Input for each simulation run is uploaded on Lisam under submissions. There are 6 submissions, numbered, one for each run. Use the submissions in the correct order. Simulation input is uploaded latest at the time (hand in) in the schedule below. Results are available latest at the second time (results ready) in the schedule.

No.	Date	Latest hand in	Results ready
1	Tuesday, May 18	09:00	11:00
2	Tuesday, May 18	13:00	15:00
3	Wednesday, May 19	09:00	11:00
4	Wednesday, May 19	13:00	15:00
5	Thursday, May 20	09:00	11:00
6	Thursday, May 20	13:00	15:00