An Introduction into Modelling and Simulation
Case Studies

Computer Networks and Mobile Communication

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Case Study 1

- Based on the simulation project in the introduction consider now the following points:
  - Consider a walk-up bank that has an ATM, a single teller, and a manager.
  - ATM customers visit the ATM and teller customers visit the teller.
  - 10% of customers (regardless of original type) visit the manager after visiting the ATM or teller.
  - Arrival and service time properties are:
    - ATM customers arrive at the rate of 10/hour and spend approximately 4 minutes at the ATM
    - Teller customers arrive at the rate of 5/hour and spend approximately 7 minute at the teller
    - Customers that visit the manager spend approximately 20 minutes with the manager
  - Run 25 replications for 2000 hours each (no warmup) and determine the server utilizations and the times that the customers spend in the system (ATM customers, teller customers, customers that see the manager)
Case Study 2

Word model from the Introduction:

We plan an office that dispenses automotive license plates. In our first approach we want to divide its customers into categories to level the office workload.

Customers arrive and enter one of three lines based on their residence location. Each customer type is assigned a single, separate clerk to process the application forms and accept payment, with a separate queue for each.

After completion of this step, all customers are sent to a single, second clerk who checks the forms and issues the plates (this clerk serves all three customer types, who merge into a single first-come, first-served queue for this clerk).

- So, is this a good architecture or could we do better? By the way
  - what is the expected average and maximum time of a customer in the system for all customers?
  - how many servants do we really need and what is their utilization?
  - How much space do we need in front of the clerks
  - Did we oversee something?
- Go through the hole simulation process and define all steps. Come up with a presentation for the management
Travelers arrive at the main entrance door of an airline terminal according to an exponential interarrival-time distribution with mean 1.6 minutes, with the first arrival at time 0. The travel time from the entrance to the check-in is distributed uniformly between 2 and 3 minutes. At the check-in counter, travelers wait in a single line until one of five agents is available to serve them. The check-in time (in minutes) follows a Weibull distribution with parameters $\beta = 7.76$ and $\alpha = 3.91$. Upon completion of their check-in, they are free to travel to their gates.

Create a Simulation model, with animation (including the travel time from entrance to check-in), of this System. Run the Simulation for 16 hours to determine

- the average time in system,
- number of passengers completing check-in,
- the average length of the check-in queue
- make an experiment and study the influence of additional servants of the time in system
Case Study 4

- Modify Case Study 4 check-in problem by adding agent breaks. The 16 hours are divided into two 8-hour shifts. Agent breaks are staggered, starting at 90 minutes into each shift. Each agent is given one 15-minute break. Agent lunch breaks (30 minutes) are also staggered, starting 3.5 hours into each shift. The agents are rude and, if they're busy when break time comes around, they just leave anyway and make the passenger wait until break time is over before finishing up that passenger. Compare the results of this model to those of the model without agent breaks.