

# Systems Modelling and Simulation (Lab session 7)

After this session you should understand

1. Variable arrival processes
2. The concept of sets in Arena
3. More variables and expressions

# Model 5-2: Enhancing the call centre model

- New problem description
  - **Main objective is to find the most cost effective way to increase service level or customer satisfaction.**
  - **Actual arrival over a day is a non-stationary Poisson process- Table 5-2 (thus rate varies at various time over the day)**
  - **Staffing level actually varies over the day – Table 5-3**
  - **4% of technical calls require further investigation after completion;**
    - *Further investigation is handled by a team outside our model.*
    - *This takes EXPO(60)*
    - *After this feedback is then sent to the tech. Person who answered the original call*
    - *This person then calls the customer which takes TRIA(2,4,9)*
    - *These calls use one of 26 trunk lines and have priority over incoming calls.*
    - *If call is not completed on same day as original call, its carried to next day.*
    - *We want to count number of rejected calls during each hour.*



# New concepts

- Variable arrival rates
- Sets
- Reusing schedules
- Costing



# Modifying the model 5-1

- Back to Arena

# Model 5-3: More output performance measures

- So far we don't have an overall economic figure to help compare various configurations of the system.
- We'll create an over all cost measure as primary output.
- We'll make five replications representing a work week.
- Will focus on weekly costs.
- Two areas of cost;
  - Staffing and resource costs – **tangible**
    - *\$20/hr – sales staff, additional staff is \$17/hr*
    - *\$18-\$22/hr – tech staff depending on training*
    - *Cost incurred when staff are scheduled (busy or not busy)*
  - Costs due to poor customer service – **less tangible**
- We find peak time based on hourly reject counts: Model 5-2 (between 12:00 and 4pm).
- To model additional resource we use variable “*New Sales*”. Need to make changes to sales schedule.
- For Tech staff, we use variables; *New Tech 1, New Tech 2, New tech 3, and New Tech All*, according to product type.



## Model 5-3: More output performance measures, cont.

- Additional generic resources
  - Larry, \$16/hr (product 1 expert)
  - Moe, \$16 (Product 2..)
  - Curly, \$16 (product 3..)
  - Hermann, \$18 (all)
  - Create schedule for each
  - Add resources to all product sets
- Each Trunk line costs \$98/wk
- We need an expression for the total resource cost



# Model 5-3: More output performance measures, cont.

- Poor customer service cost
  - **Customer waiting limit**
    - *Tech calls – 3min*
    - *Sales calls – 1min*
    - *Order status calls – 2min*
    - *Corresponding cost per minute*
      - Tech support customers: 36.8 cents
      - Sales customers: 81.8 cents
      - Order status customers: 34.6 cents
  - **Collect accumulated waiting time beyond the limit**
  - **Determine weekly cost of waiting for completed customers**
  - **Determine overall total cost and define as output statistic (Statistic data module)**
- Constraint - Not more than 5% of calls should get a busy signal.



# Model scenarios

- Scenario 0: Base scenario
  - **Results**
    - *Total cost = \$22,500.07*
    - *Percent of customers rejected = 12.9%*
- Scenario 1: 3 additional units of each resource
  - **Results**
    - *Total cost = \$23,668.69*
    - *Percent of customers rejected = 1.6049%*