THE UNIVERSITY OF TENNESSEE KNOXVILLE

CASE STUDY

Modeling and Simulation

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Case Study: Modeling and Simulation of Single Server Systems & Extensions

Goal:: *To learn the following basic Discrete Event (DE) methods/techniques:*

- Process Modeling Library: source, queue, delay, sink, select output, time measure start/end etc.
- Define variables and display their values.
- Collect statistics such as Time in System (TIS), Average Waiting Time in Queue (AWTQ), Time Average Number of parts in Queue (TANQ), Working in Process (WIP), utilization, etc. Use Time Measure Start/End to collect TIS/AWTQ and display a histogram. Use Statistics to collect discrete/continuous performance measures.
- Make plots such as histogram plots, time plots, etc.
- Basic animation: status of the machine, queue, delay, etc. through Space Markups.
- Define Agent (Entity) Type and attributes. Collect TIS through this method.

Problem Statement I: Simulate a customer order fulfillment center in which customer orders arrive about 5 orders per minute in the format of a QR card. There is 1 worker who uses a barcode scanner to enter the order information into a software and verifies its information. This operation takes about 5 to 12 seconds. Evaluate the system performance.

Problem Statement II: Simulate a single machine system in which a drilling machine processes incoming parts that arrive to the system at the rate of 2 per minutes. The processing time follows a triangular distribution with minimum 1, maximum 6, and mode 3. Evaluate the system performance.

Phase 1: Build a bare bone model and run the model. Configure a simulation run and run settings including time and randomness.

Phase 2: Collect basic statistics such as WIP, TIS, AWTQ, Queue length, TANQ. Display results via Presentation toolbox.

Phase 3: Add time plots for WIP, TIS, etc. Add histogram plots for WIP, TIS, WTQ, etc.

Phase 4: Add basic animation including queue, process/delay, busy/idle of the machine etc. *Discussion*: will animation change the model output?

Phase 5: [#2] After the drilling process, an inspection station is added where an inspector checks on the parts. Historical data shows that about 92% of the parts passed the inspection while 8% failed. The failed parts will be sent back to the waiting area along with other incoming parts to be processed by the machine. However, the processing time takes about 8 to 12 minutes for these parts because this is considered as "re-work". What's impact to the system performance compared to previous models? What if we have 5 parallel machines while the arrival rate is 1 per minute?