MODELING AND SIMULATION

WHAT IS MODELING

- Modeling is the process of producing a model; a model is a representation of the construction and working of some system of interest.
- Purpose of a model is to enable the analyst to predict the effect of changes to the system.
- Model should be a close approximation to the real system and incorporate most of its salient features.
- It should not be so complex that it is impossible to understand and experiment with it.

WHAT IS MODELING

- An important issue in modeling is model **validity**.
- Model validation techniques include simulating the model under known input conditions and comparing model output with system output.
- Generally, a model intended for a simulation study is a mathematical model developed with the help of simulation software.
- Mathematical model classifications include…
  - deterministic (input and output variables are fixed values) or stochastic (at least one of the input or output variables is probabilistic);
  - static (time is not taken into account) or dynamic (time-varying interactions among variables are taken into account).

WHAT IS SIMULATION?

- Simulation is a tool to evaluate the performance of a system, existing or proposed, under different configurations of interest and over long periods of real time.
- Simulation is used before an existing system is altered or a new system built,

  To reduce the chances of failure

  To meet specifications

  To eliminate unforeseen bottlenecks

  To prevent under or over-utilization of resources, and

  To optimize system performance.

Benefits Of Simulation Modeling And Analysis

- Obtain a better understanding of the system by developing a mathematical model of a system of interest, and observing the system's operation in detail over long periods of time.
- Test hypotheses about the system for feasibility.
- Compress time to observe certain phenomena over long periods or expand time to observe a complex phenomenon in detail.
- Study the effects of certain informational, organizational, environmental and policy changes on the operation of a system by altering the system‘s model; this can be done without disrupting the real system and significantly reduces the risk of experimenting with the real system.

Benefits Of Simulation Modeling And Analysis

- Experiment with new or unknown situations about which only weak information is available.
- Identify the "driving" variables - ones that performance measures are most sensitive to - and the inter-relationships among them.
- Identify bottlenecks in the flow of entities (material, people, etc.) or information.
- Use multiple performance metrics for analyzing system configurations.
- Employ a systems approach to problem solving.
- Develop well designed and robust systems and reduce system development time.

WHAT IS SIMULATION?

- The steps involved in developing a simulation model, designing a simulation experiment, and performing simulation analysis are:

Step 1. Identify the problem.

Step 2. Formulate the problem.

Step 3. Collect and process real system data.

Step 4. Formulate and develop a model.

Step 5. Validate the model.

Step 6. Document model for future use.

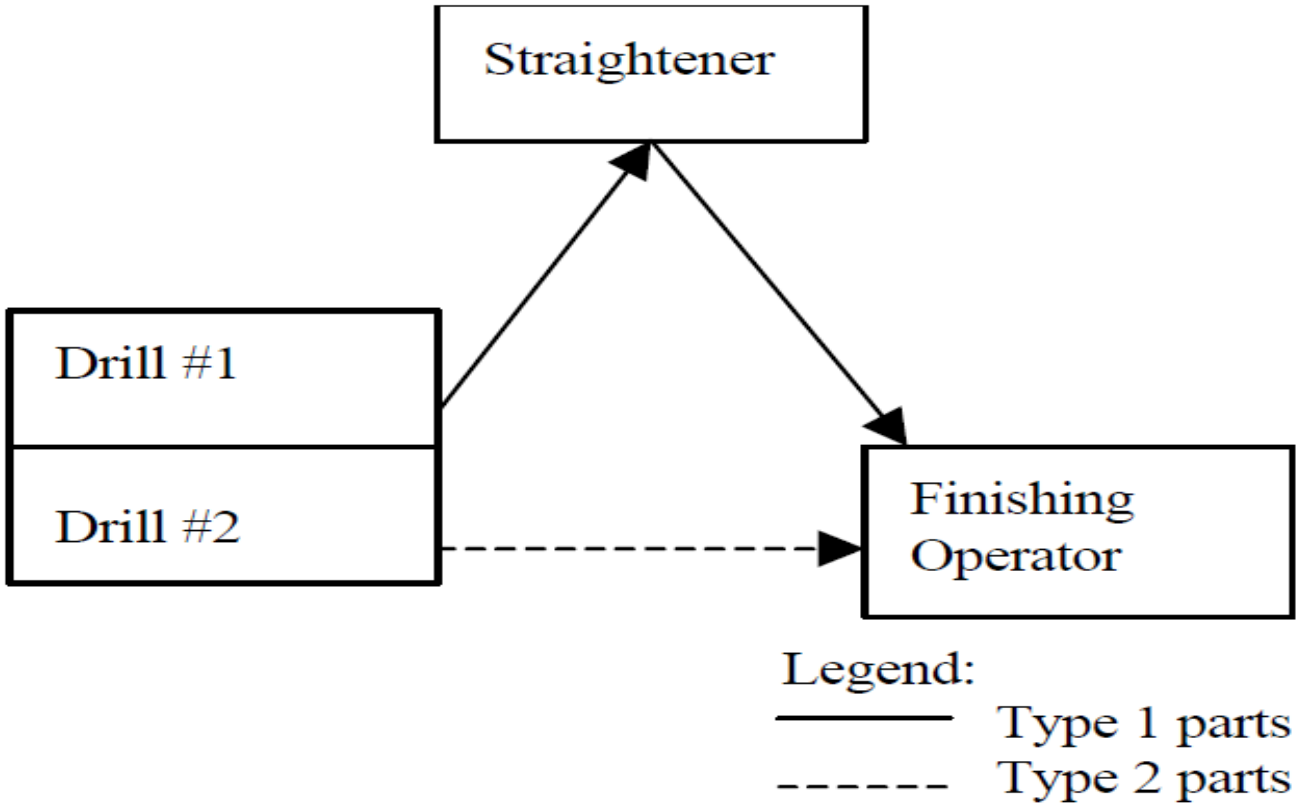
Step 7. Select appropriate experimental design.

Step 8. Establish experimental conditions for runs.

Step 9. Perform simulation runs.

Step 10. Interpret and present results.

Step 11. Recommend further course of action.



- Type 1 parts require drilling, straightening, and finishing in sequence.
- Type 2 parts require only drilling and finishing.
- The frequency of arrival and the time to be routed to the drilling area are deterministic for both types of parts.

Utilization Statistics

	Drilling	Straightening	Finishing
Mean Run #1	0.83 (0.78)	0.51 (0.58)	0.42 (0.39)
Mean Run #2	0.82 (0.90)	0.52 (0.49)	0.41 (0.45)
Mean Run #3	0.84 (0.81)	0.42 (0.56)	0.42 (0.40)
Std. Dev. Run #1	0.69 (0.75)	0.50 (0.49)	0.49 (0.49)
Std. Dev. Run #2	0.68 (0.78)	0.50 (0.50)	0.49 (0.50)
Std. Dev. Run #3	0.69 (0.76)	0.49 (0.50)	0.49 (0.49)