KHWOPA ENGINEERING COLLEGE

Department of Computer Engineering

Assignment1

Subject: Simulation and modeling

Answer the following Questions

1. **What do you mean by system simulation? Describe the situation when simulation is not appropriate.**

A system is a collection or combination of object joint in some regular interaction or interdependency and a simulation is the imitation of the operation of a real-world process or system over time. Therefore we can define system simulation as the technique of solving problems by the observation of the performance, over time, of a dynamic model of the system.

System simulation is a set of techniques for using computers to imitate or simulate the operations of various kinds of real-world facilities or processes. The computer is used to generate a numerical model of reality for the purposes of describing complex interaction among components of a system. The complexity of the system arises from the stochastic nature of the events, from the rules for the interactions of the elements and difficult to perceive the behavior of the systems as a whole with the passing of time. For example: simulation of traffic systems, auto pilot simulation in air-craft, solar energy electric power system simulation, banking system simulation, etc.

The situations when simulation is not appropriate are as follows:

* Simulation should not be appropriate if the problem is too simple can be solving analytically.
* Simulation should not be appropriate when the problem can be solved using common sense.
* Simulation should not be appropriate, if it is easier to perform direct experiments.
* Simulation should not be appropriate, if the costs exceed savings.
* If no data is available, not even estimate then simulation is not advised.
* If there are not resources or the person is not available, simulation is not appropriate.
* If managers have unreasonable expectation say, too much soon or the power of simulation is over estimated, simulation may not be appropriate.
* If system behavior is too complex or cannot be defined, simulation is not appropriate.

1. **Describe the types of models with examples each.**

The types of models are as follows:

MODELS

Physical Model

Mathematical Model

Static

Model

Dynamic

Model

Numerical

Model

System

Simulation

Static

Model

Dynamic

Model

Analytical

Model

Numerical

Model

**Physical Model**

Physical models are based on some analogy between such systems as mechanical and electrical, or electrical and hydraulic. In a physical model of a system, the system attributes are represented by such measurements as a voltage or the position of a shaft. For example, the rate at which the shaft of a direct current motor turns depends upon the voltage applied on the motor. If the applied voltage represents the velocity of a vehicle, then number of revolutions of the shaft measures the distance, the higher the voltage, or velocity, the greater is the buildup of revolutions or distance covered, in a given time.

Static models can only show the values that system attributes take when the system is in balance. For example, representation of building is an exam of physical static system.

Dynamic models follow the changes over time that result from the system activities. For example, representation of the electrical circuit system, hydraulic system.

**Mathematical Model**

Mathematical models use symbolic notation and mathematical equations to represent a system. The system attributes are represented by variables, and the activities are represented by mathematical functions that interrelates the variables.

**Static Mathematical Model**

If the variable value does not change with respect to the time then it is referred to as mathematical static model. It gives the relationships between the system attributes when the system is in equilibrium. If the point of equilibrium is changed by altering any of the attribute values, the model enables the new values for all the attributes to be derived but does not show the way in which they changed to their new values. For example, in marketing a commodity there is a balance between the supply and demand for the commodity. Both factors depend upon price: a simple market model will show what the price at which the balance occurs.

**Dynamic Mathematical Model**

A dynamic mathematical model allows the changes of system attributes to be derived as a function of time. The derivation may be made with an analytical solution or with a numerical computation, depending upon the complexity of the model. The equation that was derived to describe the behavior of a car wheel is an example of a dynamic mathematical model; in this case, an equation that can be solved analytically.

**Analytical and Numerical Model**

Analytical model means using the deductive reasoning of mathematical theory to solve a model. In practice, only certain forms of equations can be solved. Using analytical techniques, therefore, is a matter of finding the model that can be solved and best fits the system being studied. For example, linear differential equations can be solved analytically.

Numerical methods involve applying computational procedures to solve equations. To be strictly accurate, any assignment of numerical values that uses mathematical tables involves numerical methods, since tables are derived numerically.

**System Simulation**

Numerical dynamic model comprises of system simulation. In a system simulation we try to represent whole system and its behavior in a dynamic numerical model and simulate it through some simulation languages.

1. **Describe how simulation is beneficial in the system?**

Simulation is beneficial because of following points:

* Simulation enables the study of, and experimentation with, the internal interactions of a complex system, or a subsystem within a complex system.
* Where real experiment may not be possible, simulation can be appropriate.
* The knowledge gained in designing a simulation model may be of great value toward suggesting improvement in the system.
* Simulation helps to experiment with new designs or polices before the actual physical system implementation.
* By simulation, different capabilities for a machine, requirements can be determined.
* Where real experiment may not be possible, simulation can be appropriate.
* Simulation is a very good tool for training like: zero gravity simulation, air-craft simulation, etc.
* Simulation tools are flexible, easier and cheaper than real experiment.