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Question no. 1 What is model? What are the components which help in the formation or illustration of a model?

→ Models are the replica of systems which can be represented physically or mathematically. It is a three-dimensional representation of a person or thing or of a proposed structure, typically on a smaller scale than original. Simulation modeling is the process of creating and analyzing a digital prototype of a physical model to predict its performance in the real world. eg:- weather forecasting, flight simulators, car crash modelling, etc. It tries to emulate a real life system through use of computer software.

Simulation of a system is the operation of a model in terms of time or space, which helps analyze the performance of an existing or a proposed system.

The components which help information of a model are :-

a) Entities: Entity is an object of interest in a system. An object whose value can be static or dynamic depending upon the process with other entities. They are created by the analyst, move around and are then disposed as they leave system. They represent real things in simulation. Determining the entities is one of the first things the analyst should do in construction of a simulation model.

b) Events: Events are the occurences that alter the

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system state. Here the events are the something that happens at an instant of simulated time that may change attributes, variables or statistical accumulators. In discrete systems, the changes in the system state are discontinuous and each change in the state of system is called event.

c) Groupings: Similiar entities are grouped in meaningful ways. Sometimes an ordering of entities within a group is relevant. It is also called as attribute. It is a common characteristic of all entities

d) but with a specific value that can differ from one entity to another. eg:- attribute for an entity could be arrival time, due date, colour, etc.

d) variables: variable also known as (global variable) is a variable that reflects a characteristic of the system regardless of the number of or what kinds of entities may be in the model. With global variables, the value of variable can change during simulation run.

e) Resources: Entities often compete for service from resources, such as personnel, machines, equipment or space in storage area. In everyday life, a resource, such as worker seizes an entity, performs some activity and then releases the entity to next operation when finished.

f) Queues: The purpose of queue is to hold an entity that needs to seize a resource in a temporary waiting area, but the resource is currently tied up

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with another entity. All queues have names and the names are typically the name of the process followed by a queue, such as assembly queue.

g) Simulation clocks: The variable called simulation clock stores the current value of simulated time during the simulation run.

Question 02) Difference between static and dynamic simulations

	static simulation	dynamic simulation
→	A static simulation model, represents a system at a particular point in time.	→ A dynamic simulation model represents systems as they change over time.
→	It cannot be changed in real time and this is why they are referred as static modelling.	→ It is flexible and can change with time as it shows what an object does with many possibilities that might arise in time
→	Static models are more structural than behavioral.	→ Dynamic model is representation of the behaviour of static components of system
→	It includes class diagram, object diagrams and help in depicting static constituents of system	→ It consists of sequence of operations, state change, activities, interactions and memory.
→	absence of differential equations.	→ uses differential equation

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Question 10.3) What are the advantages and disadvantages of simulation?

⇒ Advantages:

i) System behaviour analysis:

Simulation softwares analyze the behaviour of a system without building actual prototype. Engineers can work on alternative solutions and simulate various designs. Therefore, simulation during the product design has advantage of finalizing the best solution for prototyping before actually building it. It helps in reducing the number of iterations.

ii) Reduces manufacturing cost

Simulation softwares help engineers in iterating and testing designs very quickly. As a result we can reduce number of errors and hence manufacturing and testing costs are decreased.

iii) Understanding "Why?": we can understand why certain phenomena is happening in real life by reconstructing and taking microscopic examination of system to find out the cause.

iv) explore possibilities: One of the greatest advantage is that once we have developed a valid simulation model, we can explore new policies, operating procedures, methods without the expense and disruption of experimenting with the real system.

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v) visualization of plan: Taking the designs beyond CAD drawings by using the animation features offered by simulation packages allow us to see the facility or organization actually running.

vi) Wise investment: The typical cost of simulation study is less than 1% of the total amount being expended for the implementation of a design or redesign.

disadvantages:

i) model building requires special training: It is an art ~~of~~ learned over time and through experiences.

ii) Accurate Boundary conditions and input data: Simulation results accuracy depends on input data and boundary conditions. System boundary conditions include environmental temperature, pressure and material. Therefore, boundary conditions need to be defined accordingly and accurately to achieve accurate results.

iii) Simulation results are difficult to interpret.

iv) Time consuming and expensive with higher initial investment

v) not 100% accurate: There is some discrepancies in simulation results and tested products.

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Question 4)

What are factors which affect the simulation of any system?

⇒ factors which affect simulation of any systems are:

i) unclear objective ii) using simulation when an analytical solution is appropriate iii) invalid model iv) bugs in simulation program v) initial bias in output data vi) using wrong input probability distribution vii) erroneous assumptions viii) method used and simulation parameters such as initial step size and tolerance

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