1. **What does a system represent? Component of a system with example?**

A system is defined as a group of objects that are joined together in some regular interaction or interdependence toward the accomplishment of some purpose**.**

Components of a System:

• Entity- … An object of interest in the system: Machines in factory

• Attribute- … The property of an entity: speed, capacity

• Activity- … A time period of specified length: welding, stamping

• State- … A collection of variables that describe the system in any time: status of machine (busy, idle, down…) 19 Components of a System

• Event-… An instantaneous occurrence that might change the state of the system: breakdown.

• Endogenous- … Activities and events occurring with the system.

• Exogenous-… Activities and events occurring with the environment.

Example of System and its components…

System	*Entities*	*Attributes*	*Activities*	*Events*	*State Variables*
Banking	Customers	Checking account balance	Making deposits	Arrival; departure	Number of busy tellers; number of customers waiting
Rapid rail	Riders	Origination; destination	Traveling	Arrival at station; arrival at destination	Number of riders waiting at each station; number of riders in transit
Production	Machines	Speed; capacity; breakdown rate	Welding; stamping	Breakdown	Status of machines (busy, idle, or down)
Communications	Messages	Length; destination	Transmitting	Arrival at destination	Number waiting to be transmitted
Inventory	Warehouse	Capacity	Withdrawing	Demand	Levels of inventory; backlogged demands

2. **Why is it necessary to decide on th boundary between system & its environment?**

There are two reasons for this. Firstly, setting a boundary defines the scope of what you are trying to understand. Without a boundary, your analysis has no limits and may become unfocussed or even lose its way completely. In this respect, the environment consists of all those things that are relevant to the system — thus you may need to know about their existence and behavior — but which do not themselves require detailed analysis — so you do not need to understand their internal organization or objectives.

Secondly, identifying a boundary helps you to understand a system's interactions with its environment. This is one of the most important aspects of a system, and focuses your attention on inputs (received from the environment) and outputs (sent into the environment).

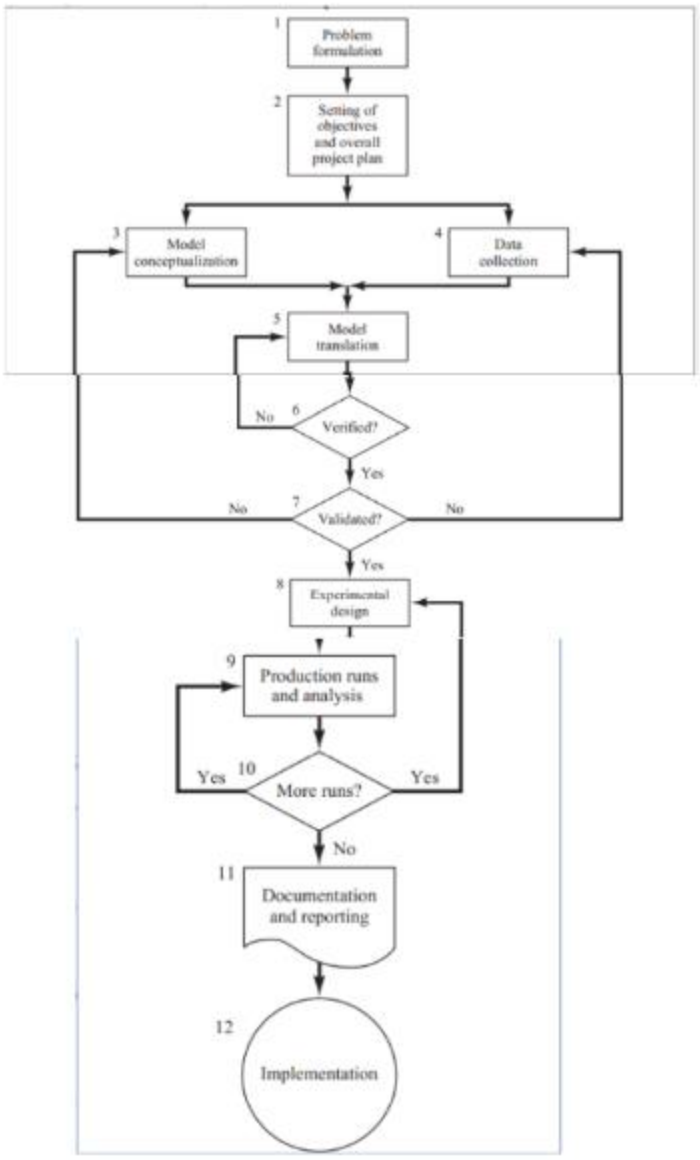
3. **what type of simulation implemented in augmented reality**
4. **Is it possible to simulate a system without modeling an entity from outside the boundary of the system?**
5. **Compare live,Virtual & constractive simulation with example?**

Live - A simulation involving real people operating ***real systems***. Military training events using real equipment are live simulations. They are considered simulations because they are not conducted against a live enemy.

Virtual - A simulation involving real people operating *simulated systems*. Virtual simulations inject a Human-in-the-Loop into a central role by *exercising motor control skills, decision making skills, or communication skills*

Constructive - A simulation involving *simulated people operating simulated systems*. Real people stimulate (make inputs to) such simulations, but are not involved in determining the outcomes. *A constructive simulation is a computer program.* For example, a military user may input data instructing a unit to move and to engage an enemy target. The constructive simulation determines the speed of movement, the effect of the engagement with the enemy and any battle damage that may occur.

6. Note down the step of simulation with appropriate flowchart



7(a). Discuss the situation when simulation is a not an appropriate tool.

When Simulation Is **Not Appropriate**

- When the problem can be solved by **common sense**.
- When the problem can be solved **analytically (logically)**.
- If it is **easier** to perform **direct experiments**.
- If **cost** exceed savings.
- If **resource or time** are not available.
- If system behavior is too **complex**.
  - Like human behavior

7(B). Discuss the situation when simulation is an appropriate tool.

Simulation … Appropriate Tool

- SIMULATION … FOLLOWING PURPOSES:
  - … study of **internal interaction** of a subsystem … **complex system**
  - Informational (say false fire alarm) + organizational (say removing supervisor)+ environmental changes(say introducing lunch) →… **find their effects**
  - … to **gain knowledge** about **improvement** of system
  - Finding important **input parameters** with changing simulation inputs

- … with **new design and policies** before implementation
- … **different capabilities** for a machine can help determine the requirement.
- … for **training** …without the **cost** disruption.
- A **plan can be visualized** with animated simulation
- The **modern system** (factory, wafer fabrication plant, service organization) is **too complex** that its **internal interaction** can be treated only by simulation

8. Define system & model? Note different type of model?

Model: It construct a conceptual framework that describes a system. It is necessary to consider those accepts of systems that affect the problem under investigation. It helps analyst to predict the effect of the change of system.

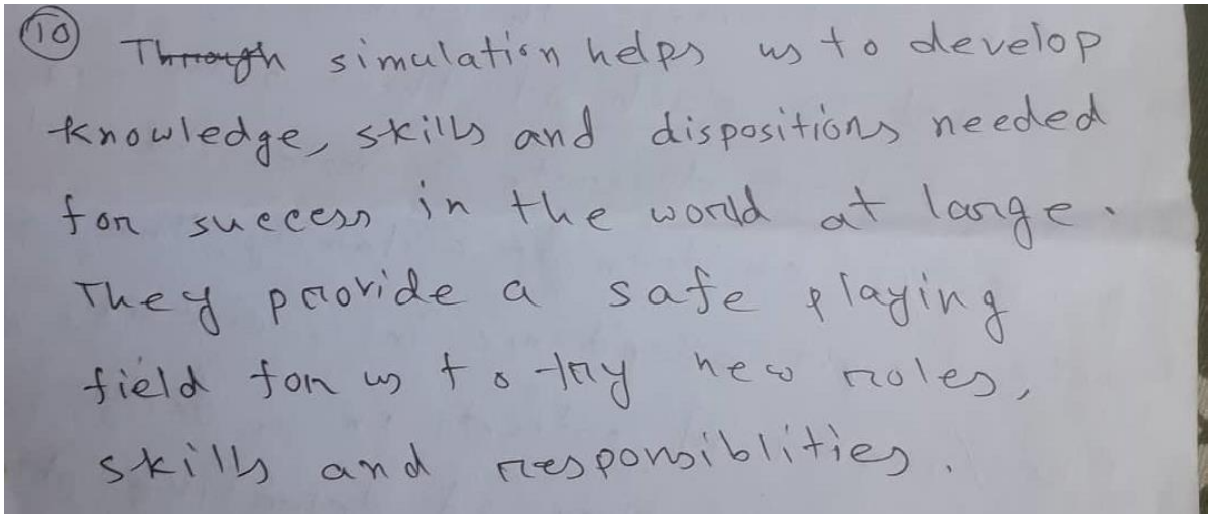
Types of Models & System Models

- Models can be classified
  mathematical, **physical** & **process.**
  - A mathematical model uses **symbolic notation and mathematical equations** to represent a system.
    - A simulation model is a particular type of mathematical model of a system.
- System Models may be further classified as:
  - STATIC OR DYNAMIC,
  - DETERMINISTIC OR STOCHASTIC,
  - DISCRETE OR CONTINUOUS

9. Define attribute entity activities with real life example?

See 1

10. How simulation improves our lives?



11. Explain Discrete Event Simulation & Continuous-event simulation?

Discrete Event Simulation: Discrete event simulation (DES) is the process of codifying the behavior of a complex system as an ordered sequence of well-defined events. In this context, an event comprises a specific change in the system's state at a specific point in time. Common applications of DES include stress testing, evaluating potential financial investments, and modeling procedures and processes in various industries, such as manufacturing and healthcare.

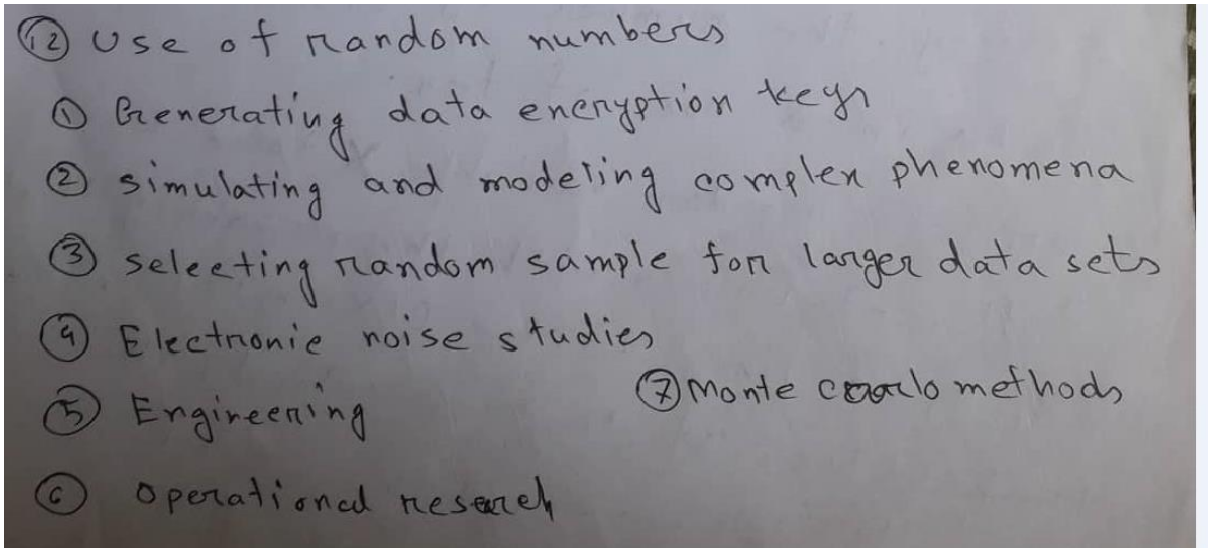
Continuous-event simulation: n *continuous* simulations, certain state variables (or states of simulation objects represented by real-valued attributes) change continuously, as modeled by *differential equations*. Two prominent general approaches to continuous simulation are: *System Dynamics* and *Equation-Based Object-Oriented Modelling* with *Modelica*

12. Mention the properties of randorm number? Use of random numbers.

A random number is a number generated by a process, • whose outcome is unpredictable, • and which cannot be sub sequentially reliably reproduced.

A sequence of random numbers, R1, R2, R3 must have two important properties:

1. Uniformity-they are equally probable every where
2. Independence-the current value of a random variable has no relation with the previous values



13. Discuss similarities and dissimilarity true random number pseudo random number

TRUE-RANDOM

	Pseudo-random	**True-random**
Approach	Algorithm of mathematical formula, later translated into relatively bits of programming code	Extract randomness from physical phenomena and introduce it into a computer
Efficiency	Fast responses in generating numbers	Slow responses in generating numbers
Determinism	Sequence of numbers can be reproduced	Sequence of numbers cannot be reproduced
Periodicity	Sequence of numbers is repeated	Sequence of numbers will or will not repeated

14. Which point should be considered in generating pseudo number? Why?]

- Important considerations in RN routines:
  - The routine should be fast
  - Portable to different computers… (different programming languages)
  - Have sufficiently *long cycle*
  - *Replicable*
  - Closely approximate the ideal statistical properties of uniformity and independence

15. Define pseudo random number? Why is it called pseudo?

Software-generated random numbers only are pseudorandom. They are not truly random because the computer uses an algorithm based on a distribution, and are not secure because they rely on deterministic, predictable algorithms.

With the advent of computers, programmers recognized the need for a means of introducing randomness into a computer program. However, surprising as it may seem, it is difficult to get a computer to do something by chance as computer follows the given instructions blindly and is therefore completely predictable. It is not possible to generate truly random numbers from deterministic thing like computers so PRNG is a technique developed to generate random numbers using a computer.

16. what are the problem may occur when generating pseudo number?

- Problems when generating pseudo-random numbers
  - The generated numbers might not be uniformly distributed
  - The generated numbers might be discrete-valued instead of continuous-valued
  - The mean of the generated numbers might be too high or too low
  - The variance of the generated numbers might be too high or too low

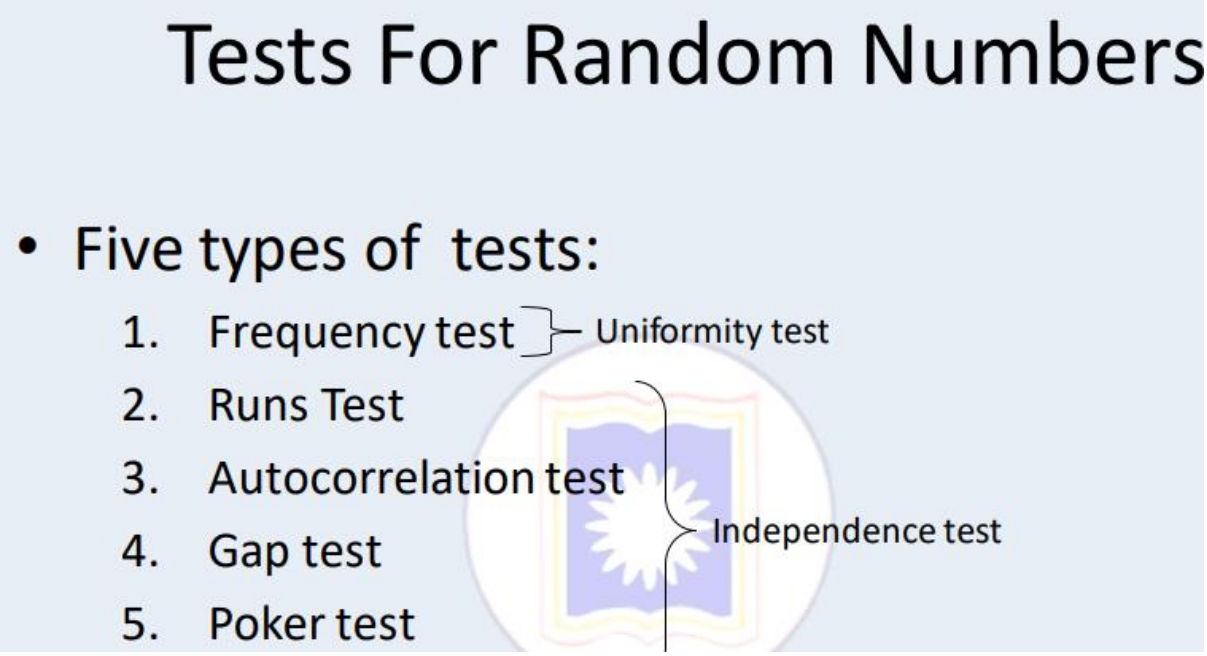
17. Lcm as a pseudo random number generator. What are the weakness and strength of it?

Linear Congruential Method is a class of Pseudo Random Number Generator (PRNG) algorithms used for generating sequences of random-like numbers in a specific range. This method can be defined as:

$$X_{i+1} = aX_i + c \mod m$$

18. why should we perform different types of test on pseudo random number? Name of the test

It is necessary to test random numbers because the random numbers we generate are pseudo random numbers and not real and pseudo random number generator must generate a sequence of such random numbers which are uniformly distributed and they should not be correlated, they should not repeat itself.
In short we can say test is necessary to determine whether the stream of number is random.



19. Difference between run up down and run above below

20. Explain discrete random variable and continuous random variables?

A discrete random variable is a variable that can take any whole number values as outcomes of a random experiment. The discrete random variable takes a countable number of possible outcomes and it can be counted as 0, 1, 2, 3, 4, ...

Continuous random variable is a random variable that can take on a continuum of values. Continuous random variables are used to denote measurements such as height, weight, time, etc.

21. Explain chi-square test for randomness?

22. Why pseudo-random is suitable?

With the advent of computers, programmers recognized the need for a means of introducing randomness into a computer program. However, surprising as it may seem, it is difficult to get a computer to do something by chance as computer follows the given instructions blindly and is therefore completely predictable. It is not possible to generate truly random numbers from deterministic thing like computers so PRNG is a technique developed to generate random numbers using a computer.

23. Discuss some application of continuous system simulation