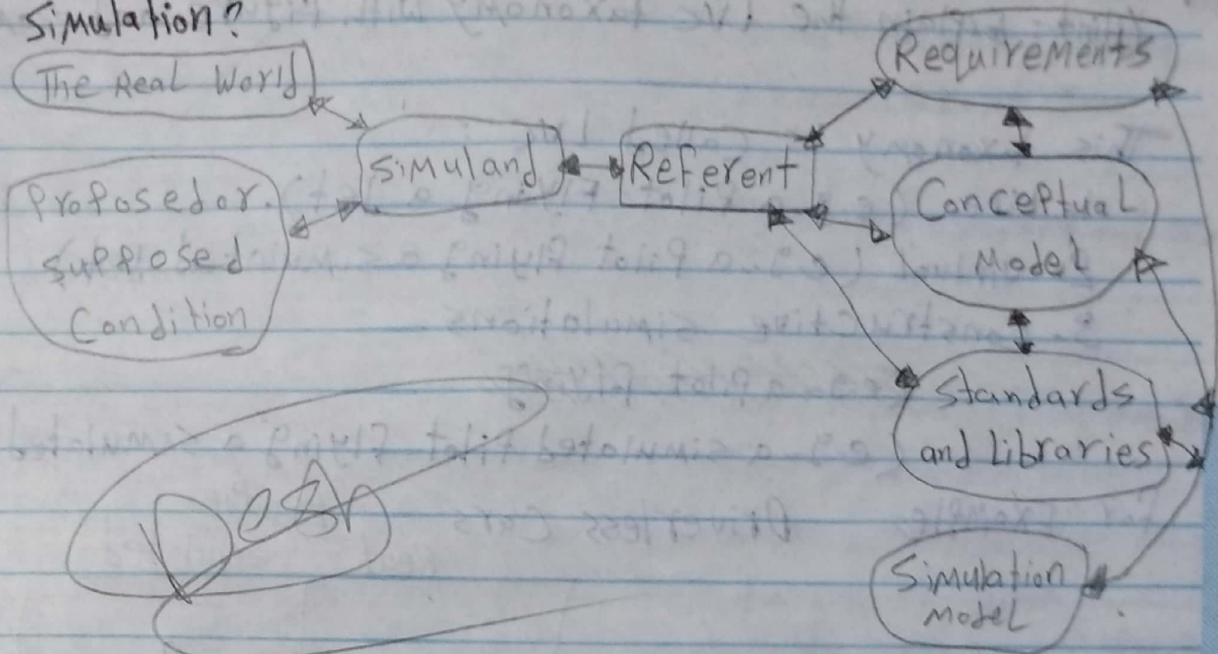


# 1- Define the following terms:

- **Model** is a physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process
- **Simulation** is a method for implementing a model over time
- **MBS** is the discipline that comprises the development and/or use of models and simulation
- **Simplification** is an analytical technique in which unimportant details are removed
- **Abstraction** is an analytical technique that establishes the essential features of a real system and represents them in a different form
- **Simulation Plan** The simulation project plan is a document that includes time to be required - people to be used - hardware - software - output at each stage - cost of the study
- **Verification** is the process of determining that a model or simulation implementation and its associated data accurately
- **Validation** is the process of determining the degree to which a model or simulation and its associated data are an accurate
- **Conceptual model** is an abstraction of the real-world system under investigation
- **Simulation Conceptual Model** is a living document that grows from an informal description to a formal description
- **DES** A discrete-event simulation (DES) is characterized by changes in the simulation's state at discrete time points
- **M&S fidelity** The accuracy of the model or simulation when compared to the real world
- **Dynamic system** is a collection of different parts that work together to transform some input into the system.



2- Discuss in detail the relationship of system, Model and Simulation?



3- The Simulation Conceptual definition state that:

$$\text{Simulation} = \text{Model} + \text{Data} + \text{Method} + \text{Implementation} + \text{Realization}$$

Ex Plain these Concepts in brief with example?

**Model** → is a physical, mathematical or otherwise logical representation of a system, entity, phenomenon or process

**Data** → represent model inputs and are constrained so that the combination of model plus data results in a unique solution independent of method.

**Method** → There are different numerical methods that may be used to solve the model's equations.

**Implementation**

**Realization** → Model realization is the final act in the modeling process

**Ex** Estimate the area under a curve.

Solve Model equation include: interpolation  
extrapolation

#### 4- How users Interact With Simulations?

(Hint: Explain the LVC taxonomy with figure and examples)

This taxonomy is called LVC :

- 1- Live (e.g. a Pilot Flying a Jet).
- 2- Virtual (e.g. a Pilot Flying a simulated Jet).
- 3- Constructive simulations

~~(e.g. a Pilot Flying)~~

(e.g. a simulated Pilot Flying a simulated Jet)

For Example      Driverless Cars      People

Real      Simulated

SYSTEMS	Real	Live	?
	Simulated	Virtual	Constructive

*[Handwritten signature]*



5. In your opinion, which one of the steps in the Modeling and Simulation Life Cycle Process do you consider the most important? Explain and give a reason about your choice

The Conceptual Model making step is the most important as it describes the idea behind the system

Develop Documentation is a very important part in Simulation Process - it defines how simulation model operates

- ⊙ all simulation inputs are documented
- ⊙ specified units or dimension of data
- ⊙ identified all simulation interfaces and format of all input data

Dezhe



\* 2/26/1

6-1

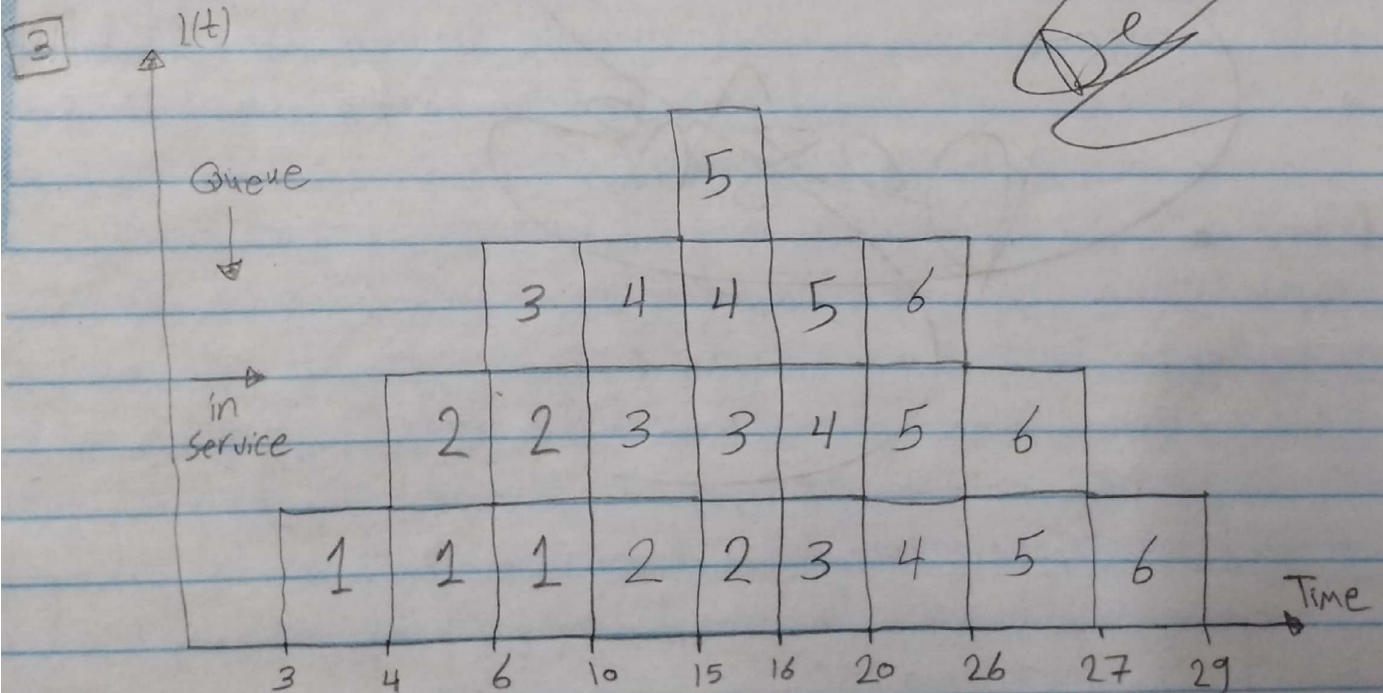
i	$A_i$	$S_i$
1	4:03	7
2	4:04	6
3	4:06	4
4	4:10	6
5	4:15	1
6	4:20	2

1

i	$A_i$	$T_i$	$W_i$	$S_i$	$D_i$
1	4:03	4:03	0	7	4:10
2	4:04	4:10	6	6	4:16
3	4:06	4:16	10	4	4:20
4	4:10	4:20	10	6	4:26
5	4:15	4:26	11	1	4:27
6	4:20	4:27	7	2	4:29

2

$$W_{avg} = \frac{0+6+10+10+11+7}{6} = 7.33$$





\* [3]

Time	Event	$L(t)$
4:00	Simulation begins	0
4:03	Customer 1 arrives	1
4:04	Customer 2 arrives	2
4:06	Customer 3 arrives	3
4:10	4 arrives, 1 departs	3
4:15	5 arrives	4
4:16	2 departs	3
4:20	6 arrives, 3 departs	3
4:26	4 departs	2
4:27	5 departs	1
4:29	6 departs, simulation ends	0

*Me*

*8 of 20*

*Doc*

[4] Percentage of time that the server is busy

$$\frac{\text{Total time server is busy}}{\text{Total simulation time}} \times 100 = \frac{26}{29} \times 100 = 89.65\%$$

\*  
7-In simulation we typically focus on: objects, behavior interactions, environment, and time. Explain in brief with example

- objects refer to the individual components of the system or process of interest
- objects have behavior which defines their action and activity over time
- an interaction is any action taken by an object
- the environment refers to the notion of place where objects are located

\*

- The environment refers to this place
- Clock maintains a local notion of time and coordinate time between each event

8-Discuss in detail the use of models and simulation in systems engineering?

Simulations can be used to design and implement a system effector by exploring feasibility of new concepts.





Page: .....

Date: .....

\*  
(Aban K)

فکله من علها آست

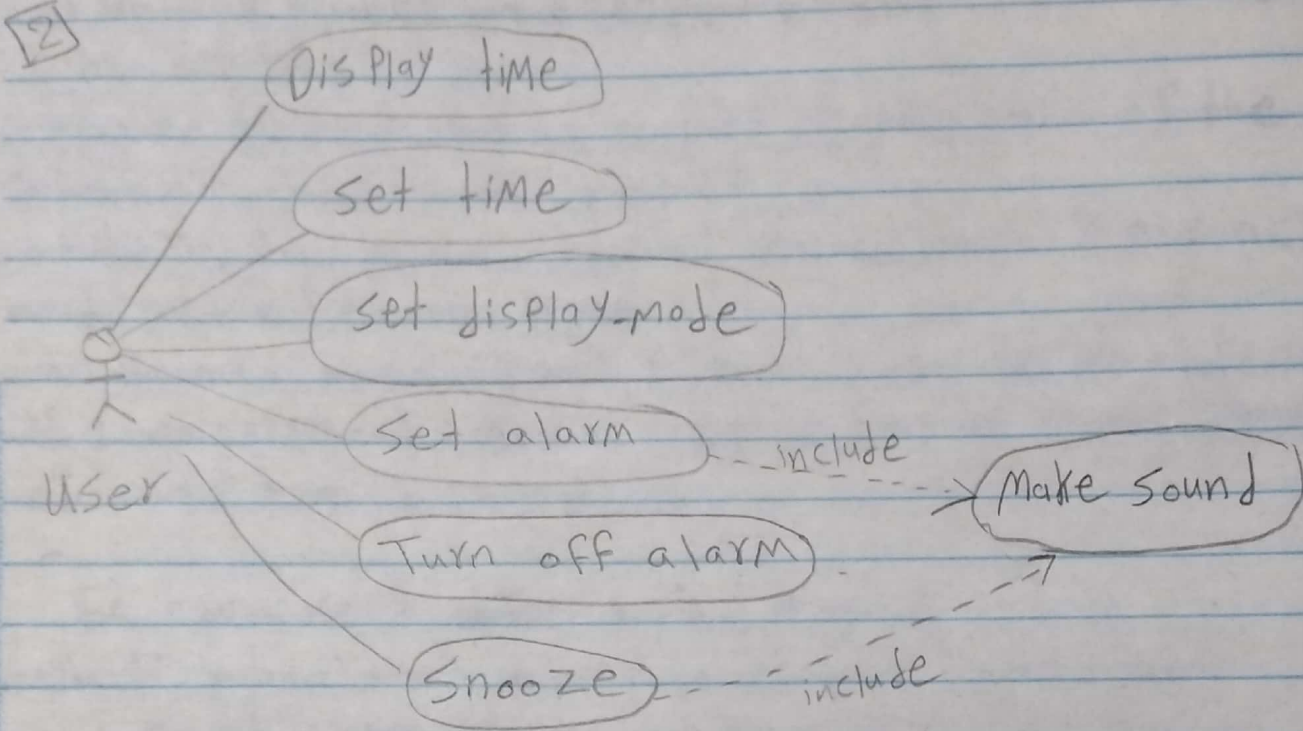
- a) A bank is planning its requirements for ATMs (automated teller machines) in a new branch. Three types of ATM can be purchased: general ATMs (giving cash, balances, mini statements and PIN change facilities), ATMs for paying money into accounts and ATMs that provide full account statements.

Develop a conceptual model for this problem outlining:

1. The objects, processes (Process Name, Start, End, and Effect) and relations.
2. Three different Use Cases (Giving Cash, PIN Change, and Paying Money into Account) using Use-Case Diagram.



## 9- The clock



II

- Set the hours and minutes fields
- Choose between 12 and 24-hour display
- Possible to set one or two alarms
- It will sound some noise when an alarm fires
- Turn off by user or snooze
- The alarm will turn off itself after 2 minutes

*Most of the set keys*

A large, abstract, scribbled mark on lined paper, possibly a stylized signature or a large letter 'S'. The mark is drawn with a dark pen and consists of several overlapping loops and curves. It is located in the lower right quadrant of the page.





11- Any model is characterized by three essential attributes. Explain and mention these attributes.

A discrete event simulation (DES) is characterized by changes in the simulation's state at discrete time points.

Example of DES

- 1- Any queueing system
- 2- Manufacturing system
- 3- Inventory system

A model is characterized by three essential attributes

1- Reference + Definition model

A model has a referent, some real or imagined system

2- Purpose

A model should have purpose with respect to its referent

3- Cost-Effectiveness

