SYSTEM SIMULATION AND MODELLING

LECTURE 3

Section B

TOPIC COVERED :Concepts in Discrete Event Simulation, Event Scheduling /Time

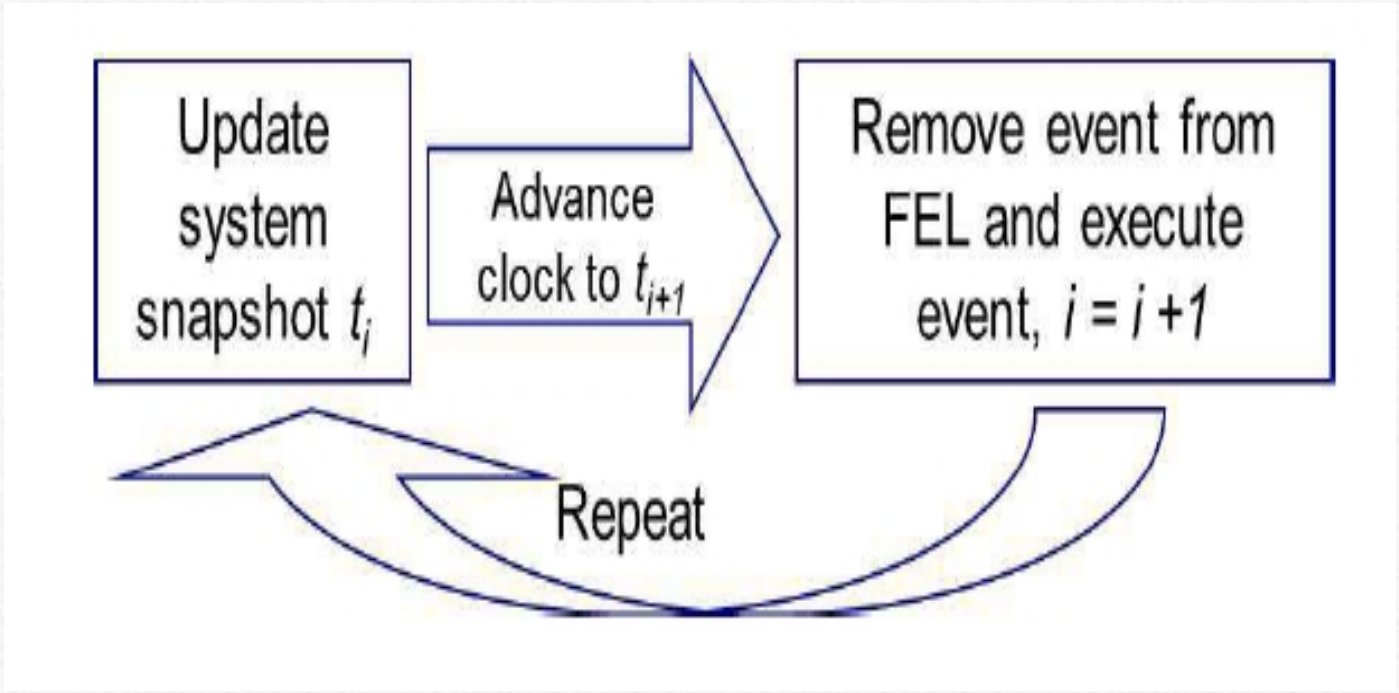
CONCEPTS IN DISCRETE EVENT SIMULATION

- The concepts of discrete event simulation is described as follows:
- **Model:** An abstract representation of a system, usually containing structural, logical or mathematical relationships that describe a system in terms of state, entities and their attributes, sets, processes, events, delays and activities.

- **System:** A collection of entities that interact together over time to accomplish one or more goals.
- **System state:** A collection of variable that contain all the information necessary to describe the
- system at any time.
- **Entity:** Any object or component in the system that requires explicit representation in the model (e.g.
- a customers a server, a machine).
- **Attributes:** The properties of a given entity is called *attributes*.
- **Event:** An instantaneous occurrence that changes the state of a system.
- **List:** A collection of associated entities, ordered in some logical fashion.
- **Activity:** A duration of time of specified length which is known when it begins.
- **Delay:** A duration of time of unspecified indefinite length which is not known until it ends.
- **Clock:** A variable representing simulated time is called *clock*.

Event Scheduling/Time Advance Algorithm

- The mechanism for advancing simulation time and guaranteeing that all events occur in correct chronological order.
- At any given time t, the future event list (FEL) contains all previously scheduled future events and their associated event times $(t_1, t_2, \ldots)$:
  - FEL is ordered by event time, and the event time satisfy: $t \leq t_1 \leq t_2 \leq \cdots \leq t_n$ where t is the value of the Clock.


Update system snapshot t_i
Advance clock to t_{i+1}
Remove event from FEL and execute event, $i = i + 1$
Repeat

Old system snapshot at time t

CLOCK	System State	. . .	Future Event List	. . .
t	(5, 1, 6)		$(3, t_1)$ – Type 3 event to occur at t_1 $(1, t_2)$ – Type 1 event to occur at t_2 $(1, t_3)$ – Type 1 event to occur at t_3 . . . $(2, t_n)$ – Type 3 event to occur at t_n	

New system snapshot at time t_1

Step 1 –Remove the event notice for the imminent event (event 3, time t_1) from FEL.

Step 2 –Advance CLOCK to imminent event (i.e., advance CLOCK from t to t_1).

Step 3 –Execute imminent event: update system state, change entity attributes, and set membership as needed.

Step 4 –Generate future events (if necessary) and place their event notices on FEL, ranked by event time.
(Example: Event 4 to occur at time t^*, where $t_2 < t^* < t_3$.)

Step 5 –Update cumulative statistics and counters.

New system snapshot at time t1

CLOCK	System State	. . .	Future Event List	. . .
t_1	(5, 1, 5)		$(1, t_2)$ – Type 1 event to occur at t_2 $(4, t^*)$ – Type 4 event to occur at t^* $(1, t_3)$ – Type 1 event to occur at t_3 . . . $(2, t_n)$ – Type 3 event to occur at t_n	