

In your own words, citing proper references when necessary, answer the following two questions with a maximum of 250 words per question:

Q1. What is meant by a "Discrete-Event Simulation"? How does it work? Note its advantages and critical drawbacks. What other alternatives are there to the discrete-event simulations? [3 pts]

Discrete-Event simulation is to simulate a system as a series of time-based events, each event happens in an instant time and change the system state. It assumes there is no change between consecutive events, it derives to two modes, one is called next-event time progression in which it jumps directly to the next event without respect to the time between, second one is called fixed-increment time progression mode, where time is broken into fixed small pieces and the system is updated periodically at each fixed time point by the events happened during the previous fixed piece.

The advantage is the fast simulation speed as it moves directly to the next event without paying attention to the details between consecutive time points.

The critical drawback is it might not work for certain scenarios where time smooth and continuation is critical for a success of simulation.

Alternatives are three-phased approach which is a refinement of event-based simulation, in which turn is divided into three phases and simultaneous events are ordered so as to make most efficient use of computing resources. Continuous simulation is another approach as well.

[1] - [https://en.wikipedia.org/wiki/Discrete-event\\_simulation](https://en.wikipedia.org/wiki/Discrete-event_simulation)

[2] - <https://www.tandfonline.com/doi/pdf/10.1586/14737167.2016.1165608?needAccess=true>

Q2. The term "Emergence" is commonly used in agent-based models. Elaborate on its meaning and significance, support your answer with at least 2 references (in IEEE citation format). [2 pts]

## Emergence in Agent-Based Model

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***Abstract***—This article is to explain the term Emergence in Agent-Based model context, to explore its meaning and significance.

***Keywords***—*Emergence, Agent-Based, Model*

#### I. EMERGENCE IN AGENT-BASED MODEL

In Agent-Based Model, Emergence specifically means in a certain degree of simulation, in the model it eventually displays certain steady pattern or phenomenon by the simulation. For example, in this paper [1], it says “Fashion Cycle emerged in the simulation results of the competition model”

#### II. SIGNIFICANCE

Usually when there is an emergence in the simulation results, it conceals certain hidden pattern in the model by the simulation, which stands for a positive result or a success of the simulative work.

[1] – Emergence of Fashion Cycle By Agent-Based model of WoM Dissemination  
<https://ieeexplore.ieee.org/document/6903171>