CPS 제어 및 분석 알고리즘 특론

- Simulation 기법 -

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**부산대
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I. Simulation techniques

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ABS, DES & CS

- ### ABS(Agent-based Simulation) modeling
  - **Individual agents are modeled (on a micro level)**
  - **how they interact with each other & their environment are also modeled (on a macro level)**

-**Example:**
Smart mobility system, transport network, urban cycle planning, logistics system, etc.

- where the roads, entry and exit points (onto the roads), how the lanes work and vehicles passing each other **are created as rules** and **the basic frame within which the model** will **be run.**

- **Then the agents** themselves **are created** which could be cars, buses and trucks and **each of these have their unique behaviors**.

- These agents are then pushed into the system and left to see how they react to each other and the roads on which they drive.

request_status: SENT
request_departure_min:
10:31:49.0
request_departure_max:
11:01:49.0
request_arrival_min:
10:20:26.0
request_arrival_max:
10:50:26.0

Directions: To here - From here

Active passengers: 154
Succesfull/failed requests: 194/280

ABS, DES & CS

DES(Discrete Event Simulation) modeling

- The entire system is modeled in detail and the logic is encapsulated within the framework of the system.
- 각 entity 는 각각의 목적에 따라 모델링되지만, 시스템 전체에 참여해야만 각각의 entity는 의미를 가짐
- 매 cycle(혹은 second, time-unit)마다 동작하지는 않고 해당 event 가 발생했을때만 동작됨
  - If there is a 10-hour plant shut down in your model, you as the viewer of the model won't witness this time gap, the model will just jump past it to the next event

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ABS, DES & CS

CS(Continuous Simulation) modeling

- a normal bank queuing problem
- can be modeled with a DES because the number of people in the system at any point in time can only be discrete values.

- Good examples of continuous
- are any type of flow, like the volume in a tanker measured against time as the water is being flushed out of the system

- Example of hybrids of continuous & DES
- A fast-moving bottle filling factory line would be an example of this. The entities themselves represent discrete units entering and exiting the system at discrete moments in time, however, the line pushes so many bottles through per second that the DES model is beginning to look more like a continuous model.

■ Comparison b/w Discrete event simulation & Agent-based simulation

DES models	ABS models
Process oriented (top-down modelling approach); focus is on modelling the system in detail, not the entities	Individual based (bottom-up modelling approach); focus is on modelling the entities and interactions between them
Top-down modelling approach	Bottom-up modelling approach
One thread of control (centralised)	Each agent has its own thread of control (decentralised)
Passive entities, that is something is done to the entities while they move through the system; intelligence (eg. decision making) is modelled as part in the system	Active entities, that is the entities themselves can take on the initiative to do something; intelligence is represented within each individual entity
Queues are a key element	No concept of queues
Flow of entities through a system; macro behaviour is modelled	No concept of flows; macro behaviour is not modelled, it emerges from the micro decisions of the individual agents
Input distributions are often based on collect/measured (objective) data	Input distributions are often based on theories or subjective data

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II. Discrete Event Simulation

Reference: Discrete Event Simulation: A first course by Lawrence Leemis, Steve Park, 2004

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감사합니다
Q & A

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