ABMS End Sem Exam

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Section 2

Q-1 (a) ABM (Agent Based Modelling)

Agent Based modelling is a simulation paradigm where the models can be modelled by-

→ Agent → individuals / entities with specific properties

→ Environment → The environment is a simulated world where agents are created

→ Agent to Agent Interaction → How agents interact with each other. Do the agents co-operate/ co-exist with other agents

→ Agent to Environment Interactions → How do agents interact with environment. What certain actions/processes agent undertakes that leads to change of state of both agents/environment.

→ When we define these 4 basic rules, they are form building blocks to do Agent based modelling

(4) System Dynamics (SD)

System dynamics is a method for analysing complex systems that make use of computer simulations to model complex structures to produce/replicate unexpected and troublesome structure

→ In system dynamics, mathematical differential equations govern to change the state of the system. All the known dynamics can then be modelled and simulated, through which future states of the system can be predicted.

→ Through system dynamics, we can ~~into~~ enforce feedback loop which can be open/closed positive/negative feedback loop depending on the environment. The basic building blocks are Stocks, Flows, Convertors and connectors.

Q-2 Compare and contrast ABM and system dynamics.

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Ans 2 Modelling Problem →

We want to simulate how the human body reacts to different concentrations of caffeine subjected at different time of a day. Assume infinite amount of caffeine concentration available.

(a) Modelling the Problem using ABM →

Agents → Humans

Environment → ~~There is no env at all~~ We consider a day time as an environment.

Agent to Environment interactions → Different concentrations of caffeine is given to the user from the environment at different timestamps.

Observe → Human body's response to the caffeine and noting all difficulties human face.
We collect results how the caffeine affects human body.

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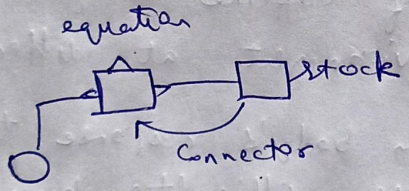
(b) Model the problem using System dynamics →

Stocks → Track human body's response to different caffeine concentration

Flows → We can model how caffeine affects human body at different time instances of the day using differential equations. These govern the change in human body.

Convertors → Constants assumed as → we have infinite amount of caffeine for the simulation.

Connectors →



We can model ~~feedb~~ feedback of human body after being resistant of higher level of concentrations of caffeine using differential equation & System dynamics as well.

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(c) Advantage and disadvantage of ABM and SD

In ABM

→ It forces us to think from environment prespective.

→ We can have no environment in this problem. Only differential equations govern the change in human body due to caffeine

→ Difficult to incooperate the feedback loop mechanism in ABM.

In System Dynamics

→ We can enforce any/all feedback loops.

→ System dynamics favour its working when modelled with equations, as evident in this case as well.

→ Difficult in case we need to construct environment and define agent to environment interactions.