

MURAT GUNAL August/September LECTURE SCHEDULE at FEL (detailed)

Date & Time	Lecture Block	Lecture / Topics	Abstract
Thr 23 Aug 1330-1700	Introduction to discrete event simulation and agent-based simulation This lecture block will provide an introduction the discrete event simulation (DES) approach. the block will provide a lightweight introduction to key topics covered in more depth in the rest of the series and is therefore recommended also for those who do not want to attend all the lectures.	ABS: Object-Oriented DES or What?	Agent Based Simulation (ABS) is a very popular simulation method in Operational Research community nowadays. Its popularity is due to its power in modelling individual behaviour of entities in a system. In ABS, the analyst can observe the effects of local information perceived by individuals in a community. Although ABS is introduced as a brand-new modelling method, some believe that it is derived from Discrete Event Simulation (DES). In DES, there are entities, as in ABS, and entities are directed by the rules defined in the processes or in the events of the system that are being modelled. In ABS, the rules are embedded in the entity, so that the entity, so called "agent", can make its own decision. In this talk, we will firstly introduce ABS method and secondly take a look at the philosophy behind ABS and DES. The talk will continue with exploring their application domains and introducing a research agenda.
		Discrete Event Simulation (DES) in Operational Research	Discrete Event Simulation (DES) in Operational Research: Simulation is a very general term and is used by many science fields, one thing is common though, simulation is a way to represent a real system on computer. In this talk I will briefly evaluate how Operational Researchers see the "simulation" technique and what research topics have emerged in recent years. Discrete Event Simulation (DES) will be in the center of the talk since I see it as the father of all simulation methods.
Fri 24 Aug 0900-1230	Randomness and probability in simulations This lecture block will explore the fundamental role of random number generators and probability theory in general in DES	Random numbers	DES Models rely on random numbers to mimic stochasticity in systems that are being modeled. Random numbers are uniformly distributed numbers, hopefully randomly, and definitely between 0 and 1. In this lecture we will evaluate properties of random number generators and examine two methods for generating "pseudo" random number generators. Would you like to learn how Excel's "RANDOM" function work?
		Random variate generation	Random numbers are not so useful alone in DES models, since in most real systems, stochasticity is modeled by random distributions. Therefore we need to generate values from probability distributions. In this lecture we will examine properties of well known distributions discrete and continuous distributions such as normal, exponential, erlang, weibull, and poisson.
		Probability distributions	After examining probability distributions, we need to know how these are to be used inside a simulation software. There are two techniques to generate values from distributions; inverse transform and acceptance/rejection techniques. The first one relies on the distribution's cdf and the second one works like playing a dart game.
Tue 29 Aug 0900-1230	Analysis and Validation of DES This lecture block explores techniques for modeling and analyzing data input to simulation models, analyzing and interpreting outputs of simulation models and a range of validation techniques required for building robust DES models.	Input analysis	To create realistic DES models, you need to count on real system data. To get the real data, you collect it first and then analyze it to make some statistical inferences. In fact all the effort to collect real system data ends up with some probability distributions. In this lecture we will examine how you can analyze the data in hand. The topics include histograms, Q-Q plots, distribution fitting, Chi-square test etc.
		Output analysis	As in the input analysis, after generating so much data with a simulation model, we need to analyze simulation output data. Depending on the system's attribute, terminating and non-terminating, the analysis should be done with caution. Warm-up period, number of replication, confidence intervals of simulation output are some of the topics.
		Validation	We need to validate a DES model to make it more realistic and more representative. Techniques and methods for validating simulation models will be examined in this session. These include face validity, white box and black box validation, statistical tests such as Chi-Square and K-S test. These methods will be covered in the lecture.
Thr 31 Aug 0900-1230	Building DES: Methodologies, techniques and tools This lecture block will explore several tools and methodologies for building DES models.	Event graphs and Simkit	If you want to build a DES model by programming, and you like it in Java, then Simkit is your best option. This Java API is developed for building DES simulation components and relies on Event Graphs (EG). EGs are useful to represent a basic DES structure by events (nodes) and transitions (edges). An EG tells what happens after a simulation event occurs. Once an EG is built, it is easy to convert it to a Simkit model. Some real modeling exercises will be demonstrated.
		Modelling with SharpSim	As in Simkit, SharpSim also works with Event Graphs. But if you like programming in C# then SharpSim is best choice. First, the system to be modeled is represented as EGs and then this is converted to C# code manually. During the lecture, SharpSim's connection with a Geographical Information System (GIS) will be shown.
Mon 3 Sep 1330-1700	Case studies and Summary This lecture block will explore real-world examples of DES models from several models and insights related to their development and usage.	Case studies for DES	In this lecture, the DES theory and methodology covered in the previous lectures will be put in practice. Several examples of real-world DES will be presented and practical lessons learned in building and using the shared.
		Summary of the topics in DES	In this lecture, we will summarize the topics presented, outline the likely future developments and make final remarks regarding the DES approach.