EE509: Data Network Protocol Analysis & Simulation

Module Details

Title:	Data Network Protocol Analysis & Simulation PENDING APPROVAL
Long Title:	Data Network Protocol Analysis & Simulation
Module Code:	EE509
Credits:	7.5
NFQ Level:	9
Field of Study:	Electronic Engineering
Valid From:	2017/18 (Sep 2017)
Module Delivered In	no programmes
Administrator:	Noel Murphy
Module Coordinator:	Jennifer McManis
Module Department:	20 - ELECTRONIC ENGINEERING
Module Description:	The ability to predict how a data communications network will perform in terms of delay, throughput or packet loss is an important aspect of the engineering practice of computer and telecommunications network design. Given the complexity of operation of communications protocols, coupled with the randomness of data traffic transported by a network, gaining a reliable estimate of system performance requires careful analysis with appropriate modelling techniques. The aim of this module is to firstly review the operating principles of data communications protocols and then to develop the basic theory and practice required for evaluating the performance of communications systems and data networks, using discrete-state mathematical and computer simulation modelling methods.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
LO1	Describe the basic operating principles of the protocols used to implement various layers of the OSI model and identify their basic performance parameters,
LO2	design and implement a disrcete-event computer simulation model for performance evaluation of a data communications network and be able to analyse the simulation output using statistical methods,
LO3	derive results relating to single server queuing models and networks of queues,
LO4	apply the analytic techniques of probability and queuing theory to calculate the performance characteristics of selected communications systems or protocols,
LO5	compare the achievable accuracy of the results from simulation models to that of analytic models that employ approximations to achieve a tractable solution.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.*
No recommendations listed
Co-requisite Modules
No Co-requisite modules listed
Pre-Requisite *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.*
none

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Module Content & Assessment

Indicative Content and Learning Activities
Review of Data Network Protocols and Introduction to Performance Evaluation Network layer functions and an intrduction to circuit and packet switching, link layer protocols, IP, routing, TCP, and application protocols. Future network trends. Motivation for the use of analysis and simulation methods: performance measures, resource allocation/dimensioning, deployment costs.
Mathematical Fundamentals for Performance Analysis Probability spaces, probability functions, random variables, probability laws, stochastic processes, renewal processes, Poisson process, Markov processes and Birth-Death processes.
Discrete-Event Stochastic Simulation Methods Introduction to simulation modelling methodologies, random variates, pseudo-random number generators, non-uniform variates: inverse transform sampling and rejection sampling, event-lists, event scheduling and implementation, simulation validation, confidence intervals, and analysis of results.
Queueing Analysis Methods Performance measures and objectives, Kendall's notation, Little's law, Markovian queueing systems, M/M/1, M/M/infinity, M/M/n, M/M/1/K, M/M/m/m, priority queues, the M/G/1 and M/D/1 queue. Product-Form Queueing networks.
Analysis of Network Protocol Performance Examples such as LAN/MAN random access and polling networks, packet switched network throughput, and router queue management.

Assessment Breakdown	%
Continuous Assessment	25.00%
End of Academic Session	75.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome Addressed*	*% of total*	*Assessment Date*
Project	simulation assigment	2	17.00	Week 9
Project	analysis assignment	5	8.00	Week 12

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome Addressed*	*% of total*	*Assessment Date*
Formal Examination	End-of-Semester Final Examination	5	75.00	End-of-Semester

DCU reserves the right to alter the nature and timings of assessment

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Module Workload

Full Time hours per semester		
WorkLoad Type	*WorkLoad Description*	*Hours*
Lecture	No Description	36
Assignment Completion	For the simulation assignment you will write your own basic discrete event simulator. Java is the supported language, but it is possible to complete the assignment in another language such as C or C++.	40
Directed learning	No Description	3
Independent Study	No Description	109
	Total Hours	188.00

This module has no Part Time workload.

Module Resources

Essential Book Resources
James Kurose and Keith Ross 2017, *Computer Networking: A Top-Down Approach*, 2017 Ed., Addison Wesley [ISBN: ISBN-13: 9780] **Harry Perros, *Computer Simulation Techniques--The Definitive Introduction*, http://www4.ncsu.edu/~hp/books.html** **Analysis of Computer Networks 2015, *Analysis of Computer Networks*, Springer [ISBN: 978-3-319-156]**
Supplementary / Recommended Book Resources
Kishor Trivedi 2002, *Probability and Statistics with Reliability, Queuing, and Computer Science Applications*, 2 Ed., Wiley-Interscience [ISBN: 0471333417]
This module does not have any article/paper resources
This module does not have any other resources

Module Managers & Teachers

Module Managers		
Semester	*Staff Member*	*Staff Number*
Semester 1	Jennifer McManis	75034956
Semester 2	Jennifer McManis	75034956
Autumn	Jennifer McManis	75034956

Module Teachers	
Staff Member	*Staff Email*
Jennifer McManis	Jennifer.McManis@dcu.ie