Sixth Semester

BTCS 601 Simulation and Modeling

Objectives: This course should provide the students with good understanding of various techniques of Simulation.

Module1: Introduction- When simulation is appropriate and when not, advantages and disadvantages of simulation, application areas in communication, computer and software design, systems and systems environment, components of a system, discrete and continuous systems, model of a system, types of models, discrete-event simulation, steps in a simulation study. Simulation Examples- Simulation of queueing systems, on-demand and inventory systems, simulation for reliability analysis etc

Module 2: General Principles- Concepts in discrete event simulation: event scheduling/time advance algorithms, world views. List Processing: properties and operations, data structures and dynamic allocation, techniques;

Module 3: Simulation Software- Integrated environments. Examples and review of some existing software popular and useful in the industry, e.g., Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc. Simulation using languages and environments like C++/Java/GPSS/SSF etc. Experimentation and Statistical-Analysis Tools: common features and relevant current products.

Module 4: Statistical Models in Simulation- Terms and concepts. Statistical Models. Review of discrete and continuous distributions. Review of Poisson (stationary and non-stationary) processes. Empirical Distributions; Elementary Queueing Theory- Basic Structure of Queueing Models. Input Source (Calling Population). Queue, Queue Discipline, Service Mechanisms. Notations and relationships between *L, W, Lq,* and *Wq.* Little's Formula. Role of Exponential Distribution and Properties. Birth and Death Processes. M/M/s queues. Finite queue variation in M/M/s/K models with different s values. Finite Calling Population cases. Queueing Models involving Non-Exponential Distributions: M/G/1, M/D/s, M/Ek/s (involving Erlang distribution), Models without a Poisson Input, Models involving hyperexponential distributions, Priority Discipline Queueing Models: Preemptive and Non- Preemptive with results, properties and server number variations, Queueing Networks:Equivalence Property. Infinite Queues in Series and Product Form Solutions. Jackson Networks,

Module 5: Application of Queueing Models- Review of Characteristics (calling population system capacity, arrival processes, behavior and disciplines, service times and mechanisms etc) and notations, Application of Long-Run Measures of Performance: Time average in system, average time spent per customer, Little's Formula and server utilization, costs. Steady State behaviour of Infinite (M/G/1, M/M/c/infinity, M/M/c/N/infinity) and finite (M/M/c/K/K) Calling Population Models, Use of Network of Queues.

Module 6: Random Number Generation- Properties. Generation of Pseudo-Random Numbers, Techniques for Generation of Pseudo-Random Numbers: Linear Congruential, Combined Linear Congruential, Random Number Streams. Tests for Random Numbers: Frequency Tests and Tests for Autocorrelation. Random Variate Generation- Inverse Transform Techniques for Exponential, Uniform, Weibull, Triangular and for Empirical Continuous Distributions. Acceptance-Rejection Techniques for Poisson (Stationary and Non-Stationary) Distribution and Gamma Distribution. Special Properties like the Direct Transformation for the Normal and Lognormal Distributions, Convolution Method and others.

Module 7: Input Modeling- Data collection, Identifying the Distribution with Data: Histograms, Selection of the Appropriate Family of Distributions, Quantile-Quantile Plots.100 Parameter Estimation: Sample Mean and Sample Variance and various biased and unbiased Estimators. Goodness of Fit Tests applied to

Simulation inputs: Chi-Square and Chi-Square with Equal Probabilities, Kolmogorov-Smirnov Tests, p-Values and Best Fits.Verification and Validation of Simulation Models- Verification and Validation of Simulation Models. Calibration and Validation: Face Validity, Validation of Assumptions, Input-Out Transformation Validation.

Module 8: Output Analysis of a Single Model- Output analysis and types of simulation. Stochastic Nature of the Output Data. Measures of Performance and Estimation: Point Estimation and Confidence-Interval Estimation. Output Analysis for Terminating Simulations and Estimation of Probabilities. Output Analysis of Steady State Simulations: Initialization Bias, Error Estimation, Replications, Sample Size and Batch Means for Interval Estimation.

Module 9: Comparison and Evaluation of Alternative System Designs- Comparison of Two System Designs.; Sampling with Equal and Unequal Variances. Common Random Numbers. Confidence Intervals with Specified Precision. Comparison of Several System Designs: Bonferroni Approaches to Multiple Comparisons and to Screening and to Selection of the Best. MetamodelingL Sample Linear Regression, Testing for Significance, Multiple Linear Regression. Random Number Assignment for Regression. Optimization via Simulation: Robust Heuristics.

Module10: Simulation of Computer Systems- Simulation Tools: Process Orientation and Event Orientation. Model Input: Modulated Poisson Process and Virtual-Memory Referencing. High-Level Simulation. CPU and Memory Simulations. Simulation of Computer Networks- Traffic Modeling, Media Access Control: Token-Passing Protocols and Ethernet, Data Link Layer, TCP, Model Construction.

Simulation Languages: Basic Introduction to Special Simulation Languages:-GPSS/ MATLAB/ Network Simulators.

Suggested Readings/ Books:

1. 1.Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, *Discrete-Event System and Simulation,* Prentice Hall of India, New Delhi, 2005
2. Averill M. Law, *Simulation modeling and analysis (SIE),* Tata McGraw Hill India, 2007
3. David Cloud, Larry Rainey, A*pplied Modeling and Simulation,* Tata McGraw Hill, India.
4. Gabriel A. Wainer, *Discrete-event modeling and simulation: a practitioner's approach,* CRC Press, 2009.
5. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, *Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems,* Academic Press, 2000.
6. Walter J. Karplus, George A. Bekey, Boris Yakob Kogan, *Modeling and simulation: theory and practice,* Springer, 2003.
7. Stanislaw Raczynski, *Modeling and simulation: the computer science of illusion,* Wiley, 2006.
8. Mohammad Salameh Obaidat, Georgios I. Papadimitriou, *Applied system simulation: methodologies and application,* Springer, 2003.
9. van Dijk, Nico M.; Boucherie, Richard J. (Eds.) 2011. *Queueing Networks: A Fundemental Approach*. 798 p. 148 illus. Springer.
10. Bhat, U. Narayan, *An Introduction to Queueing Theory: Modeling and Analysis in Applications,* Springer 2008 (Birkhäuser Boston).
11. James J. Nutaro, *Building software for simulation: theory and algorithms, with applications in C++*. Wiley, 2010.

BTCS 602 RDBMS–II

Objectives: This course offers a good understanding of advanced database concepts and technologies. It prepares the student to be in a position to use and design databases for a variety of applications.

Introduction to Database Systems: Database System Concepts and Architecture, Data Models, Data Independence, SQL: DDL, DML, DCL, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF. (6)

Query Processing and Optimization:

Query Processing, Syntax Analyzer, Query Decomposition, Query Optimization, Heuristic Query Optimization, Cost Estimation, Cost Functions for Select, Join, Query Evaluation Plans. (6)

Transaction Processing and Concurrency Control:

Transaction Processing Concepts, Concurrency Control Techniques: Two-phase Locking, Timestamp Ordering, Multiversion, Validation, Multiple Granularity Locking. (5)

Object Oriented and Object Relational Databases:

Object Oriented Concepts, Object Oriented Data Model, Object Definition Language, Object Query Language, Object Relational Systems, SQL3, ORDBMS Design. (5)

Distributed Databases:

Distributed Database Concepts, Advantages and Disadvantages, Types of Distributed Database Systems, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Five Level Schema Architecture, Query Processing, Concurrency Control and Recovery in Distributed Databases. (6)

Backup and Recovery:

Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management. (5)

Introduction to Data Warehousing and Data Mining:

Introduction to OLAP, OLTP, Data Warehouse, Data Marts, Data Mining, Data Mining Process, Big Data. (5)

Enterprise Database Products:

Enterprise Database Products, Familiarity with IBM DB2 Universal Database, Oracle, Microsoft SQL Server, MySQL, their features. (7)

Suggested Readings/ Books:

1. Ramez Elmasri, Shamkant Navathe, Fundamentals of Database Systems, Fifth Edition, Pearson

Education, 2007.
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, Tata McGraw-Hill.
3. C.J. Date, An Introduction to Database Systems, Eighth Edition, Pearson Education.
4. Alexis Leon, Mathews Leon, Database Management Systems, Leon Press.
5. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Tata McGraw-Hill.
6. S. K. Singh, Database Systems Concepts, Design and Applications, Pearson Education.
7. Chris Eaton, Paul Zikopoulos, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data

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BTCS 603 Software Engineering

Module1: Evolution and impact of Software engineering, software life cycle models: Waterfall, prototyping, Evolutionary, and Spiral models. Feasibility study, Functional and Non-functional requirements, Requirements gathering, Requirements analysis and specification.

Module2: Basic issues in software design, modularity, cohesion, coupling and layering, function-oriented software design: DFD and Structure chart, object modeling using UML, Object-oriented software development, user interface design. Coding standards and Code review techniques.

Module3: Fundamentals of testing, White-box, and black-box testing, Test coverage analysis and test case design techniques, mutation testing, Static and dynamic analysis, Software reliability metrics, reliability growth modeling.

Module4: Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management, ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.

Suggested Readings/ Books:

1. Roger Pressman, **"Software Engineering: A Practitioners Approach,**(6th Edition), McGraw Hill, 1997.
2. Sommerville,"**Software Engineering, 7th edition**", Adison Wesley, 1996.
3. Watts Humphrey,**" Managing software process**", Pearson education, 2003.
4. James F. Peters and Witold Pedrycz, **" Software Engineering – An Engineering Approach"**, Wiley.
5. Mouratidis and Giorgini. **"Integrating Security and Software Engineering–Advances and Future"**, IGP. ISBN – 1-59904-148-0.
6. Pankaj Jalote, **"An integrated approach to Software Engineering"**, Springer/Narosa.

Elective-I

BTCS 901 Web Technologies (Elective-I)

INTERNET AND WORLD WIDE WEB: Introduction, Internet Addressing, ISP, types of Internet Connections, Introduction to WWW, WEB Browsers, WEB Servers, URLS, http, WEB applications, Tools for WEB site creation. (4)

HTML: Introduction to HTML, Lists, adding graphics to HTML page, creating tables, linking documents, frames, DHTML and Style sheets. (6)

Java Script: Introduction, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, introduction to Cookies

JAVA: Introduction to java objects and classes, control statements, arrays, inheritance, polymorphism, Exception handling. (6)

XML: Why XML, XML syntax rules, XML elements, XML attributes, XML DTD displaying XML with CSS. (6)

AJAX : Introduction, HTTP request, XMHttpRequest, AJAX Server Script, AJAX Database.

PHP: Introduction, syntax, statements, operators, sessions, E-mail, PHP and MySQL, PHP and AJAX.

Suggested Readings/Books:

1. Deitel,Deitel, Nieto, and Sandhu: XML How to Program, Pearson Education.
2. Herbert Schildt: Java 2: The Complete Reference, Fifth Edition, TMH
3. Ivan Bayross: Web Enabled Commercial Application
4. Schafer: Development, BPB
5. HTML,CSS, JavaScript,Perl, Python and PHP, Wiley India Textbooks.

BTCS 902 Mobile Applications Development (Elective-I)

Unit I:

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features.

Unit II:

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova, Offline access, Encrypted cache deprecated, Using JSONStore

Unit III:

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization, WebView overlay , Creating Authentication application: development for Apple iOS by using a login module, Device Analytics, Worklight Server Administration

Unit IV:

Windows Phone: Introduction to Windows Phone, Architecture, memory management, communication protocols, application development methods, deployment.
Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages

Unit V:

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment.
Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages

Unit VI:

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment.
Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages

Suggested Readings/Books:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition: I
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
3. Barry Burd, "Android Application Development All in one for Dummies", Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS
5. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
6. Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, 2012.
7. Jochen Schiller,"Mobile Communications", Addison-Wesley, 2nd edition, 2004.
8. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.
9. Worklight resources

BTCS 903 Ethical Hacking (Elective-I)

Introduction: Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking

Foot printing: Authoritative, Non -Auth reply by DNS, Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase.

Scanning: Detecting live systems on the target network, Discovering services running /listening on target systems, Understanding port scanning techniques, Identifying TCP and UDP services running on the target network, Understanding active and passive fingerprinting.

System Hacking: Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

Hacking Wireless Networks: Introduction to 802.11,Role of WEP, Cracking WEP Keys, Sniffing Traffic, Securing Wireless Networks.

Cryptography: Understand the use of Cryptography over the Internet through PKI, RSA, MD-5, Secure Hash Algorithm and Secure Socket Layer.

Suggested Readings/Books:

1. Network Security and Ethical Hacking, Rajat Khare , Luniver Press
2. Ethical Hacking, Thomas Mathew ,OSB Publisher
3. Hacking Exposed: Network Security Secrets & Solutions, Stuart McClure, Joel Scambray and George Kurtz, McGraw-Hill

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BTCS 904 Information Security (Elective-I)

Objectives: Upon completion of this course, students will have gained knowledge of information security concepts and understanding of Information Security principles and approaches.

Module1: Symmetric Ciphers - Overview: Services, Mechanisms and Attacks, The OSI Security Architecture, A Model of Network Security. Classicial Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. Block Cipher and the Data Encryption Standard: Simplified DES, Block Cipher Principles, The DES, The Strength of DES, Differential and Linear Cryptanalysis. Symmetric Ciphers: Triple DES, Blowfish. Confidentiality using Conventional Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation.

Module2: Public Key Encryption, Digital Signatures - Number Theory, Prime Numbers Format‟s and Euler‟s Theorems, Testing for Primality. Public Key Cryptography and RSA: Principles of Public Key Cryptosystems, The RSA Algorithms, Key Management, Diffie Hellman Key Exchange.

Module3: Authentication Protocols - Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, MD5 Message Digest Algorithms, Digital Signatures and Authentication Protocols: Digital Signatures, Authentication Protocols, Digital Signature Standards.

Module4: Network Security - Authentication Applications: Kerberos, X.509 Directory Authentication Service. Electronic Mail Security: Pretty Good Privacy. IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulation Security Payload. Web Security: Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

Module5: System Security- Intruders, Malicious Software, Viruses and Related Threats, Counter Measures, Firewalls and its Design Principles.

Suggested / Readings & Books

1. William Stallings, Network Security Essentials, Applications and Standards Pearson Education.
2. William Stallings, Cryptography and Network Security Principles and practice. 2/e,Pearson Education.
3. Bishop, Matt, Introduction to Computer Security. Addison-Wesley, Pearson Education, Inc. ISBN: 0-321-24744-2. (2005)
4. Michael. E. Whitman and Herbert J. Mattord Principles of Information Security, Cengage Learning

5. Atul Kahate Cryptography & Network Security, TMH, 2nd Edition
6. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in Public World, 2nd Edition, 2011, Pearson Education.

BT*** Open Elective

BTCS 604 RDBMS-II Lab

1. Case studies on normalization
2. Study and usage of query optimization techniques
3. Study and usage of backup and recovery features of database management software
4. Server administration of any database management software
5. Study and usage of any object oriented or object relational database management software
6. Study and usage of open source data mining tool: Weka
7. Study of web databases
8. Development of a project by making use of tools studied above

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BTCS 605 Free/Open Source Software Lab

Students will be doing the practicals related to the **Elective-I** opted by them by using open source technologies available in the area of the subject.

BTCS 606 Software Engineering Lab

1. Study and usage of OpenProj or similar software to draft a project plan
2. Study and usage of OpenProj or similar software to track the progress of a project
3. Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents for some problems
4. Preparation of Software Configuration Management and Risk Management related documents
5. Study and usage of any Design phase CASE tool
6. To perform unit testing and integration testing
7. To perform various white box and black box testing techniques
8. Testing of a web site

Suggested Tools - Visual Paradigm, Rational Software Architect. Visio, Argo UML, Rational Application Developer etc. platforms.

BTCS 607 Simulation and Modeling Lab

1. **Programming in MATLAB:** Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.
2. Introduction regarding usage of any Network Simulator.
3. Practical Implementation of Queuing Models using C/C++.