Seventh/Eighth Semester

BTCS 701 Artificial Intelligence

Module1: Introduction- What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

Module2: Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning

Module3: Reasoning-Representation, Inference, Propositional Logic, predicate logic (first order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools - Lisp, Prolog, CLIPS

Module4: Planning- Basic representation of plans, partial order planning, planning in the blocks world, heirarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints

Module5: Uncertainty - Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decisiontheoretic expert systems.

Module 6: Inductive learning - decision trees, rule based learning, current-best-hypothesis search, least-commitment search , neural networks, reinforcement learning, genetic algorithms; Other learning methods - neural networks, reinforcement learning, genetic algorithms.

Module7: Communication - Communication among agents, natural language processing, formal grammar, parsing, grammar

Suggested / Readings & Books

1. Stuart Russell and Peter Norvig. *Artificial Intelligence – A Modern Approach,* Pearson Education Press, 2001.
2. Kevin Knight, Elaine Rich, B. Nair, *Artificial Intelligence, McGraw Hill, 2008.*
3. George F. Luger, *Artificial Intelligence,* Pearson Education, 2001.
4. Nils J. Nilsson, *Artificial Intelligence: A New Synthesis,* Morgan Kauffman, 2002.

BTCS 702 Theory of Computation

Objectives: To give the students knowledge of number of areas in theoretical computer science and their interconnections.

Module 1: Basics of Strings and Alphabets

Module2: Finite Automata – DFA, transition graphs, regular languages, non-deterministic FA, equivalence of DFA and NDFA

Module3: Regular grammars, regular expressions, equivalence between regular languages, properties of regular languages, pumping lemma.

Module4: Context Free Languages – Leftmost and rightmost derivation, parsing and ambiguity, ambiguity in grammar and languages, normal forms

Module5: Pushdown Automata – NDPDA, DPDA, context free languages and PDA, comparison of deterministic and non-deterministic versions, closure properties, pumping lemma for CFL

Module6: Turing Machines, variations, halting problem, PCP

Module7: Chomsky Hierarchy, LR(k) Grammars, properties of LR(k) grammars, Decidability and Recursively Enumerable Languages

Suggested Readings/Books

1. K.L.P. Mishra and N. Chandrasekaran, **"Theory of Computer Science, Third Edition"**, PHI Learning Private Limited, 2011.
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, **"Introduction to Automata Theory**", Languages and Computation, Pearson Education.
3. M. Sipser, **"Introduction to the Theory of Computation"**, Second Edition, Cengage Learning.
4. K. V. N. Sunitha , N. Kalyani, **"Formal Languages and Automata Theory"**, McGraw-Hill, 2010.
5. Stephen Wolfram, **"Theory and Applications of Cellular Automata"**, World Scientific, 1986.
6. G.E. Revesz, **"Introduction to Formal Languages"**, Dover Publications, 1991.
7. M. A. Harrison, **"Introduction to Formal Language Theory"**, Addison-Wesley, 1978.
8. R.K. Shukla,**" Theory of Computation"**, Cengage Learning.
9. An Introduction to Formal Languages and Automata, by Peter Linz, Third Edition, Narosa Publishers (1998)

BTCS 703 Project

BTCS704 Artificial Intelligence Lab

1. Write A Program For DEPTH FIRST SEARCH
2. Write A Program For Best First Search
3. Write A Program to Generate the output for A* Algorithm.
4. Write a Lisp Program to solve Water Jug Problem Using Heuristic Function.
5. Write a Program To Show the Tic Tac Toe Game for 0 and X.
6. Write A Program For Expert System By Using Forward Chaining.
7. Write a program to implement tower of hanoi.
8. Write a program to implement a heuristic search procedure.
9. Write a program to implement a production system.
10. Write a program to implement search problems of 3 x 3 puzzle.

Elective-II

BTCS 905 Software Testing and Quality Assurance (Elective–II)

Objectives: This course offers a good understanding of the concepts, methods and techniques of software testing and quality assurance and prepares students to be in a position to develop error free and quality software.

Introduction: Overview of Software Engineering, Software Process, Process Models, Overview of Project Management Process and its Phases. (7)

Software Quality Assurance Concepts and Standards: Quality Concepts, Quality Control, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, Review Guidelines, Software Reliability, Software Safety, Quality Assurance Standards, ISO 9000, ISO 9001:2000, ISO 9126 Quality Factors, CMM, TQM, Six Sigma, SPICE, Software Quality Assurance Metrics. (8)

Risk Management and Change Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, The RMMM Plan, Software Configuration Management, Baselines, Software Configuration Items, SCM Process: Version Control, Change Control, Configuration Audit, Configuration Management for Web Engineering. (7)

Software Testing: Testing, Verification and Validation, Test Strategies for Conventional and Object Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha and Beta Testing, System Testing, Recovery Testing, Security Testing, Stress Testing, Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies. (7)

Testing Techniques: Software Testing Fundamentals, Black Box and White Box Testing, Basis Path Testing, Flow Graph Notation, Independent Program Paths, Graph Matrices, Control Structure Testing, Condition Testing, Data Flow Testing, Loop Testing, Graph Based Testing Methods, Equivalence Partitioning, Boundary Value Analysis. (8)

Object Oriented Testing Methods: Applicability of Conventional Test Case Design Methods, Issues in Object Oriented Testing, Fault-Based Testing, Scenario-Based Testing, Random Testing and Partition Testing for Classes, InterClass Test Case Design. (8)

Testing Process and Specialized Systems Testing: Test Plan Development, Requirement Phase, Design Phase and Program Phase Testing, Testing Client/Server Systems, Testing Web based Systems, Testing Off-the-Shelf Software, Testing in Multiplatform Environment, Testing for Real Time Systems, Testing Security.

(8)

Case studies: Design test cases for: ERP, Traffic controller, University Management system etc.

Suggested Readings/Books

1. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
2. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.
3. William E. Perry, Effective Methods for Software Testing, Second Edition, John Wiley & Sons.
4. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Third Edition, Auerbach Publications, Taylor and Francis Group, 2010.
5. Yogesh Singh, Software Testing, Cambridge University Press.

6. K.K. Aggarwal, Yogesh Singh, Software Engineering, Second Edition, New Age International.
7. Pankaj Jalote, An Integrated Approach to Software Engineering, Second Edition, Narosa.
8. S. Limaye, Software Testing, McGraw-Hill.
9. A. C. Gillies, Software Quality: Theory & Practice, Cengage Learning.
10. Graham, Foundations of Software Testing: ISTQB Certification, Cengage Learning.
11. R. Shende, Software Automation Testing Tools for Beginners, Shroff Publishers.
12. A. P. Mathur, Foundations of Software Testing, Pearson Education.

Suggested tools: XUnit/ rational functional tester.

BTCS 906 Object Oriented Analysis and Design (Elective–II)

Module1: Introduction to object oriented systems, Classes, Objects, Abstraction, Inheritance, Polymorphism, Encapsulation, Message Sending, Association, Aggregation, Iterative development and the Unified Process (UP), UP phases: Inception, Elaboration, Construction and Transition, Object-oriented metrics

Module2: Introduction to UML, Use Cases and functional requirements, Identifying and writing Use Cases, Decomposition of use cases, Modeling System Workflows using Activity Diagrams, Modeling a System's Logical Structure using Classes and Class Diagrams, Modeling Interactions using Sequence Diagrams and Communication Diagrams, Timing Diagrams, Interaction Overview Diagrams, Component Diagram, Package diagram, State Machine Diagrams, Deployment Diagrams.

Module3: Introduction to Patterns, GoF Patterns, Creational Patterns, Structural Patterns, Behavioral Patterns, Software Architectural patterns, The Observer Pattern, The Template Method Pattern , Factory Patterns: Factory Method and Abstract Factory , The Singleton Pattern , The Iterator Pattern , The Composite Pattern , The Facade Pattern , The State and Strategy patterns , Command Pattern , The Adapter Pattern , The Proxy Pattern , The Decorator Pattern, The Visitor Pattern , AntiPatterns, Patterns for Assigning Responsibilities: GRASP Patterns

Module4: Domain modeling, assigning responsibility using sequence diagrams, mapping design to code, CASE tools, Unit, Cluster, and System-level testing of Object-oriented programs, Aspect- oriented and Service-oriented software.

Suggested Readings/Books

1. Grady Booch, James Rumbaugh, Ivar Jacobson ,“The Unified Modeling Language User Guide”, Pearson Education.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, “UML 2 Toolkit”, WILEY-Dreamtech India Pvt. Ltd.
3. Meilir Page-Jones,“Fundamentals of Object Oriented Design in UML”, Pearson Education.
4. Pascal Roques, “Modeling Software Systems Using UML2”, WILEY- Dreamtech India Pvt. Ltd
5. Atul Kahate, “Object Oriented Analysis & Design”, The McGraw-Hill Companies.
6. John W. Satzinger, Robert B Jackson and Stephen D Burd, “Object-Oriented Analysis and Design with the Unified Process”, Cengage Learning
7. Gamma, et. al., Design Patterns - Elements of Reusable Object-Oriented Software, , Addison-Wesley. (1994)
8. Craig Larman, Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and iterative development, Pearson Education. (1998)

BTCS 907 Software Project Management

Objective- Software development is a complex process involving such activities as domain analysis, requirements specification, communication with the customers and end-users, designing and producing different artifacts, adopting new paradigms and technologies, evaluating and testing software products, installing and maintaining the application at the end-user's site, providing customer support, organizing end-user's training, envisioning potential upgrades and negotiating about them with the customers, and many more. The proposed subject will take students through the various processes involved in project management.

Module1: Project Evaluation and Planning - Activities in Software Project Management, Overview Of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam‟s equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

Module2: Monitoring And Control- Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types Of Contracts, Stages In Contract Placement, Typical Terms of A Contract, Contract Management and Acceptance.

Module3: Quality Management and People Management- Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety. ISO and CMMI models, Testing, and Software reliability, test automation, Overview of project management tools.

Suggested Readings/Books

1. Bob Hughes, Mike Cotterell, “Software Project Management”, Tata McGraw Hill. (2009)
2. Royce, “Software Project Management”, Pearson Education. (2005).
3. Robert K. Wysocki, “Effective Software Project Management”, Wiley.(2006)
4. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
5. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.
6. Kassem, Software Engineering, Cengage Learning.

Suggested Tools – Rational Team Concert, MS Project

BTCS 908 Business Intelligence

Introduction to Business Intelligence: Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities. (8)

Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL, Introduction to data quality, data profiling concepts and applications. (8)

Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS. (8)

Basics of Enterprise Reporting: Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, and overall architecture. (6)

Data Mining Functionalities: Association rules mining, Mining Association rules from single level, multilevel transaction databases, Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, Types of data in clustering, categorization of clustering methods. (15)

Suggested Readings/Books

1. R N Prasad, Seema Acharya: Fundamentals of Business Analytics, Wiley India, First Edition, 2011
2. J.Han and M. Kamber: Data Mining: Concepts and Techniques By Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition
3. David Loshin: Business Intelligence: The Savvy Manager's Guide., Latest Edition By Knowledge Enterprise.
4. Larissa Terpeluk Moss, Shaku Atre: Business Intelligence roadmap by Addison Weseley
5. Cindi Howson: Successful Business Intelligence: Secrets to making Killer BI Applications by Tata McGraw Hill
6. Mike Biere: Business intelligence for the enterprise by Addison Weseley, Ausgust 2010

BTCS-909 Agile Software Development

Fundamentals of Agile: The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools (6)

Agile Scrum Framework: Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management . (8)

Agile Testing: The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester. (8)

Agile Software Design and Development: Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation

Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control. (10)

Industry Trends Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies. (4)

Suggested Readings/Books:

1. Agile Software Development with Scrum By Ken Schawber, Mike Beedle Publisher: Pearson
2. Agile Software Development, Principles, Patterns and Practices By Robert C. Martin Publisher: Prentice Hall
3. Agile Testing: A Practical Guide for Testers and Agile Teams By Lisa Crispin, Janet Gregory Publisher: Addison Wesley
4. Agile Software Development: The Cooperative Game By Alistair Cockburn Publisher: Addison Wesley
5. User Stories Applied: For Agile Software By Mike Cohn

Elective-III

BTCS 910 Multimedia and Application (Elective-III)

Objectives: This Course introduces the multimedia systems and their applications to students. This course covers the different compression standards used in multimedia, some current technology and related issues.

Introduction: Multimedia and its types, Introduction to Hypermedia, Hyper Text, Multimedia Systems and their Characteristics, Challenges, Desirable Features, Components and Applications, Trends in Multimedia. (4)

Multimedia Technology: Multimedia Systems Technology , Multimedia Hardware devices, Multimedia software development tools, Multimedia Authoring Tools, Multimedia Standards for Document Architecture, SGML, ODA, Multimedia Standards for Document interchange, MHEG, Multimedia Software for different media. (6)

Storage Media: Magnetic and Optical Media, RAID and its levels, Compact Disc and its standards, DVD and its standards, Multimedia Servers. (4)

Audio: Basics of Digital Audio, Application of Digital Audio, Digitization of Sound, Sample Rates and Bit Size, Nyquist's Sampling Theorem Typical Audio Formats Delivering Audio over a Network , Introduction to MIDI (Musical Instrument Digital Interface), Components of a MIDI System Hardware Aspects of MIDI, MIDI Messages. Audio Compression, Simple Audio Compression Methods, Psychoacoustics, MPEG Audio Compression. (8)

Basics of Compression: Classifying Compression Algorithms, Lossless Compression Algorithms, Entropy Encoding, Run-length Encoding, Pattern Substitution, Basics of Information theory, Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Lempel-Ziv-Welch (LZW) Algorithm, Source Coding Techniques: Transform Coding, Frequency Domain Methods, Differential Encoding. (6)

Image and Graphics Compression: Colour in Images, Types of Colour Models, Graphic/Image File Formats: TIFF, RIFF, BMP, PNG, PDF, Graphic/Image Data, and JPEG Compression, GIF Compression. (6)

Video Compression: Basics of Video , Video Signals, Analog Video, Digital Video, TV standards, H. 261 Compression, Intra Frame Coding, Inter-frame (P-frame) Coding, MPEG Compression, MPEG Video, The MPEG Video Bitstream , Decoding MPEG Video in Software. (6)

Multimedia Communication: Building Communication network, Application Subsystem, Transport Subsystem, QOS, Resource Management, Distributed Multimedia Systems. (5)

Suggested Readings/Books

1. Ralf Steinmetz amd Klara Nahrstedt,**" Multimedia Computing Communications and Applications"** Pearson Educations.
2. Parag Havaldar, Gerard Medioni,**"Multimedia Systems Design"**, PHI, Latest Edition

BTCS-911 Soft Computing (Elective-III)

Module1: Introduction - What is soft computing? Differences between soft computing and hard computing, Soft Computing constituents, Methods in soft computing, Applications of Soft Computing.

Module2: Introduction to Genetic Algorithms- Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators- methods of selection, crossover and mutation, simple GA(SGA), other types of GA, generation gap, steady state GA, Applications of GA

Module 3: Neural Networks- Concept, biological neural system,. Evolution of neural network, McCulloch-Pitts neuron model, activation functions, feedforward networks, feedback networks, learning rules – Hebbian, Delta, Perceptron learning and Windrow-Hoff,winner-take-all.

Module 4: Supervised learning- Perceptron learning, single layer/multilayer perceptron, linear separability, hidden layers, back propagation algorithm, Radial Basis Function network; Unsupervised learning - Kohonen, SOM, Counter-propagation, ART, Reinforcement learning, adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in image processing.

Module 5: Fuzzy systems - Basic definition and terminology, set-theoretic operations, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules & Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making; Neuro-fuzzy modeling- Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rulebase Structure Identification and Neuro-Fuzzy Control , Applications of neuro-fuzzy modeling.

Module 6: Swarm Intelligence- What is swarm intelligence? Various animal behavior which have been used as examples, ant colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant-based routing, particle swarm optimization

Suggested Readings/Books

1. S.N. Shivanandam, *Principle of soft computing*, Wiley. ISBN13: 9788126527410 (2011)
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edn., 2003.
5. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
6. David E. Goldberg, Genetic Algorithms in Search, Optimization & Machine Learning, Addison Wesley, 1997.

BTCS 912 – Cloud Computing (Elective-III)

Overview of cloud computing : What is a cloud, Definition of cloud , Definition of cloud ,characteristics of cloud ,Why use clouds, How clouds are changing , How clouds are changing , Driving factors towards cloud, Comparing grid with cloud and other computing systems, workload patterns for the cloud, “Big Data”, IT as a service.

Cloud computing concepts: Concepts of cloud computing, Cloud computing leverages the Internet, Positioning cloud to a grid infrastructure, Elasticity and scalability, Virtualization, Characteristics of virtualization, Benefits of virtualization, Virtualization in cloud computing, Hypervisors, Multitenancy, Types of tenancy, Application programming interfaces (API), Billing and metering of services , Economies of scale, Management, tooling, and automation in cloud computing, Management: Desktops in the Cloud, Security.

Cloud service delivery: Cloud service , Cloud service model architectures, Infrastructure as a service (IaaS) architecture, Infrastructure as a service (IaaS) details, Platform as a service (PaaS) architecture, Platform as a service (PaaS) details, Platform as a service (PaaS) , Examples of PaaS software, Software as a service (SaaS) architecture, Software as a service (SaaS) details, Examples of SaaS applications, Trade-off in cost to install versus , Common cloud management platform reference architecture: Architecture overview diagram, Common cloud management platform.

Cloud deployment scenarios: Cloud deployment models, Public clouds, Hybrid clouds, Community, Virtual private clouds, Vertical and special purpose, Migration paths for cloud, Selection criteria for cloud deployment.

Security in cloud computing : Cloud security reference model, How security gets integrated , Cloud security , Understanding security risks, Principal security dangers to cloud computing, Virtualization and multitenancy, Internal security breaches, Data corruption or loss, User account and service hijacking, Steps to reduce cloud security breaches, Steps to reduce cloud security breaches, Reducing cloud security, Identity management: Detection and forensics, Identity management: Detection and Identity management, Benefits of identity, Encryption techniques, Encryption & Encrypting data , Symmetric key encryption, Asymmetric key encryption, Digital signature, What is SSL?

IBM Smart Cloud, Amazon Web Services, Google Cloud platform, Windows Azure platform, A comparison of Cloud Computing Platforms, Common building Blocks.

Suggested Readings/Books

1. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Cloud Computing: Principles and paradigms, 2011
2. Michael Miller, Cloud Computing, 2008.
3. Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, Cloud Computing for dummies, 2009.
4. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud Computing: A practical Approach, McGraw Hill, 2010.
5. Barrie Sosinsky, Cloud Computing Bible, Wiley, 2011.
6. Borko Furht, Armando Escalante (Editors), Handbook of Cloud Computing, Springer, 2010.

BTCS 913 Compiler Design (Elective-III)

Objectives: This course will provide the in-depth knowledge of different concepts involved while designing a compiler.

Module1: Overview of compilation- The structure of a compiler and applications of compiler technology; Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, hand-written lexical analyzers, LEX, examples of LEX programs.

Module2: Introduction to syntax analysis -Role of a parser, use of context-free grammars (CFG) in the specification of the syntax of programming languages, techniques for writing grammars for programming languages (removal left recursion, etc.), non- context-free constructs in programming languages, parse trees and ambiguity, examples of programming language grammars.

Module3: Top-down parsing- FIRST & FOLLOW sets, LL(1) conditions, predictive parsing, recursive descent parsing, error recovery. LR-parsing - Handle pruning, shift-reduce parsing, viable prefixes, valid items, LR(0) automaton, LR-parsing algorithm, SLR(1), LR(1), and LALR(1) parsing. YACC, error recovery with YACC and examples of YACC specifications.

Module 4: Syntax-directed definitions (attribute grammars)-Synthesized and inherited attributes, examples of SDDs, evaluation orders for attributes of an SDD, dependency graphs. S-attributed and L-attributed SDDs and their implementation using LR-parsers and recursive descent parsers respectively.

Module5: Semantic analysis- Symbol tables and their data structures. Representation of "scope". Semantic analysis of expressions, assignment, and control-flow statements, declarations of variables and functions, function calls, etc., using S- and L-attributed SDDs (treatment of arrays and structures included). Semantic error recovery.

Module6: Intermediate code generation - Different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses. Translation of expressions (including array references with subscripts) and assignment statements. Translation of control-flow statements – it- then-else, while-do, and switch. Short-circuit code and control-flow translation of Boolean expressions. Back patching. Examples to illustrate intermediate code generation for all constructs.

Module 7: Run-time environments:- Stack allocation of space and activation records. Access to non-local data on the stack in the case of procedures with and without nesting of procedures.

Module 8: Introduction to machine code generation and optimization- Simple machine code generation, examples of machine-independent code optimizations.

Suggested Readings/Books

1. Aho, Ullman:Principles of Compiler Design. Narosa Publication.
2. Dhamdhere:Compiler Construction- Principles and Practice ,Macmillan, India
3. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2004.
4. Holub:Compiler Design in C, PHI.
5. K.C. Louden, Compiler Construction: Principles and Practice, Cengage Learning, 1997.
6. D. Brown, J. Levine, and T. Mason, LEX and YACC, O"Reilly Media, 1992.

BTCS-914 Big Data (Elective-III)

BigData Overview

Analysis of data at Rest- Hadoop analytics: Limitations of existing distributing systems, Hadoop Approach, Hadoop Architecture, Distributed file system: HDFS and GPFS, Internals of Hadoop MR engine, Need for High level language- JAQL and PIG

Introduction to Text Analytics: Using Regular expressions, Using AQL, Sentiment analysis

No SQL: JSON store, MongoDB, RDF, HBASE

Analytics: Clustering, Classification, Segmentation, Linear regression, ML

Search: Indexing and Indexing Techniques, Create inverted index using JAQL, Lab using Data Explorer

Bundling Hadoop job: Application, Use BI tooling to create application, Publish applications.

Analysis of data in motion – Real time analytics

Introduction to streams computing, Challenges/limitations of conventional Systems, Solving a real time analytics problem using conventional system, Challenges to be solved - scalability, thread pooling, etc., Understanding the challenges in handling streaming data from the real world and how to address those using stream computing**,** Benefits of stream computing in Big Data world**,** Realtime Analytics Platform(RTAP).

Suggested Readings/Books

1. Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, by Chris Eaton, Paul Zikopoulos
2. Big Data Analytics: Turning Big Data into Big Money By Frank J. Ohlhorst
3. Ethics of Big Data By Kord Davis
4. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends, By Michael Minelli, Michele Chambers, Ambiga Dhiraj

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BTCS 915 Digital Image Processing (Elective-III)

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation (8)

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, color models, Pseudo coloring, color transforms, Basics of Wavelet Transforms (12)

Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphic Filtering (5)

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression. (8)

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors, Regional (12)

Suggested Readings/Books

1. Gonzalez and Woods: Digital Image Processing ISDN 0-201-600- 781, Addison Wesley 1992.
2. Boyle and Thomas: Computer Vision - A First Gurse 2nd Edition, ISBN 0-632-028-67X, Blackwell Science 1995.
3. Pakhera Malay K: Digital Image Processing and Pattern Recogination, PHI.
4. Trucco & Verri: Introductory Techniques for 3-D Computer Vision, Prentice Hall, Latest Edition
5. Low: Introductory Computer Vision and Image Processing, McGraw-Hill 1991, ISBN 0-07-707403-3.
6. Jain, Kasturi and Schunk: Machine Vision, McGraw-HiII. 1995 ISBN 0070320187.

7. Sonka, Hlavac, Boyle: Digital Image –Processing and Computer Vision First ed. ISBN 978813150557, Cengage Learning,2011

BTCS 916 Enterprise Resource Planning (Elective-III)

ERP AND TECHNOLOGY : Introduction – Related Technologies – Business Intelligence – E-Commerce and EBusiness – Business Process Reengineering – Data Warehousing – Data Mining – OLAP – Product life Cycle management – SCM – CRM (10)

ERP IMPLEMENTATION: Implementation Challenges – Strategies – Life Cycle – Pre-implementation Tasks – Requirements Definition – Methodologies – Package selection – Project Teams –Process Definitions – Vendors and Consultants – Data Migration – Project management – Post Implementation Activities. (10)

ERP IN ACTION & BUSINESS MODULES: Operation and Maintenance – Performance – Maximizing the ERP System – Business Modules – Finance – Manufacturing – Human Resources – Plant maintenance – Materials Management – Quality management – Marketing – Sales, Distribution and service. (8)

ERP MARKET: Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc – SSA Global – Lawson Software – Epicor – Intutive. (9)

ERP Application: Enterprise Application Integration – ERP and E-Business – ERP II – Total quality management – Future Directions – Trends in ERP. (6)

Suggested Readings/Books

1. Alexis Leon, “ERP DEMYSTIFIED”, Tata McGraw Hill, Second Edition, 2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.
3. Jim Mazzullo,”SAP R/3 for Everyone”, Pearson,2007.
4. Jose Antonio Fernandz, “ The SAP R /3 Handbook”, Tata McGraw Hill, 1998.
5. Biao Fu, “SAP BW: A Step-by-Step Guide”, First Edition, Pearson Education, 2003.