

CS-105 (New) : Network Programming

Prerequisites:

- Working Knowledge of C
- Basic Understanding of Networking Concepts
- User Level Knowledge of Linux

Syllabus:

[Total Lectures: 48]

UNIT 1: Introduction

[2]

- A Simple Daytime Client, Protocol Independence, Error Handling: Wrapper Functions, A Simple Daytime Server [Book-1]

UNIT 2: Sockets Introduction

[6]

- Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, inet_aton, inet_addr, and inet_ntoa Functions, inet_pton and inet_ntop Functions, sock_ntop and Related Functions, readn, writen, and readline Functions, isfdtype Function [Book-1]
- What is a Socket?, Using Sockets [Book-2]

UNIT 3: Elementary TCP Sockets

[4]

- socket Function, connect Function, bind Function, listen Function, accept Function, fork and exec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions [Book-1]

UNIT 4: TCP Client-Server Example

[6]

- TCP Echo Server: main Function, TCP Echo Server: str_echo Function, TCP Echo Client: main Function, TCP Echo Client: str_cli Function, Normal Startup, Normal Termination, Connection Abort before accept Returns, Termination of Server Process, SIGPIPE Signal, Crashing of Server Host, Crashing and Rebooting of Server Host, Shutdown of Server Host [Book-1]

UNIT 5: I/O Multiplexing: The select and poll Functions

[6]

- I/O Models, select Function, str_cli Function (Revisited), Batch Input, shutdown Function, str_cli Function (Revisited Again), TCP Echo Server (Revisited), pselect Function, poll Function, TCP Echo Server (Revisited Again) [Book-1]

UNIT 6: Socket Options

[4]

- getsockopt and setsockopt Functions, Checking If an Option Is Supported and Obtaining the Default, Socket States, Generic Socket Options, IPv4 Socket Options, ICMPv6 Socket Option, IPv6 Socket Options, TCP Socket Options [Book-1]

UNIT 7: Elementary UDP Sockets

[8]

- recvfrom and sendto Functions, UDP Echo Server: main Function, UDP Echo Server: dg_echo Function, UDP Echo Client: main Function, UDP Echo Client: dg_cli Function, Lost Datagrams, Verifying Received Response, Server Not Running, Summary of UDP example, connect Function with UDP, dg_cli Function (Revisited), Lack of Flow Control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server Using select [Book-1]
- User Datagram Protocol, File Transfer, Error Handling [Book-2]

UNIT 8: Protocols, Sessions, State, and Implementing Custom Protocols

[4]

- State vs. Stateless, Methods for Maintaining State, What Is a Protocol?, Designing a Custom Protocol, Our Chat Protocol, Protocol Registration [Book-2]

UNIT 9: Elementary Name, Address Conversions and design decisions

[8]

- Domain Name System, gethostbyname Function, RES_USE_INET6 Resolver Option, gethostbyname2 Function and IPv6 Support, gethostbyaddr Function, uname Function, gethostname Function, getservbyname and getservbyport Functions [Book-1]
- TCP vs. UDP, Application Protocol Choices, Client-Server Architecture, Client-Side Considerations, Server-Side Considerations [Book-2]

References:

T1: Unix Network Programming, Volume 1: The Sockets Networking API, 3/E by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, PHI

T2: The Definitive Guide to Linux Network Programming by KEIR DAVIS, JOHN W. TURNER, AND NATHAN YOCOM, Apress.

Elective Course [CS-205]: Programming with DOT NET

Objectives:

- To understand the DOTNET framework, C# language features and Web development using ASP.NET

Prerequisites –

- Knowledge of object-oriented programming concepts such as data abstraction, encapsulation, inheritance, and polymorphism.

- Familiarity with programming language such as C++ and/or Java.

- Knowledge of web development

Topics to be covered:

Part I : C#

Unit 1. DOTNET Framework (2)

- a. Introduction to DOTNET
- b. DOT NET class framework
- c. Common Language Runtime
 - i. Overview
 - ii. Elements of .NET application
 - iii. Memory Management
 - iv. Garbage Collector : Faster Memory allocation, Optimizations
- d. Common Language Integration
 - i. Common type system
 - ii. Reflection API
- e. User and Program Interface

Unit 2. Introduction to C# (8)

- a. Language features
 - i. Variables and Expressions, type conversion
 - ii. Flow Control
 - iii. Functions, Delegates
 - iv. Debugging and error handling, exception handling (System Defined and User Defined)
- b. Object Oriented Concepts
 - i. Defining classes, class members, Interfaces, properties
 - ii. Access modifiers, Implementation of class, interface and properties
 - iii. Concept of hiding base class methods, Overriding
 - iv. Event Handling
- c. Collections, Comparisons and Conversions
 - i. Defining and using collections, Indexers, iterators
 - ii. Type comparison, Value Comparison
 - iii. Overloading Conversion operators, as operator
- d. Generics
 - i. Using generics
 - ii. Defining Generics, generic Interfaces, Generic methods, Generic Delegate

Unit 3. Window Programming (6)

- a. Window Controls
 - i. Common Controls
 - ii. Container Controls
 - iii. Menus and Toolbars
 - iv. Printing
 - v. Dialogs
- b. Deploying Window Application
 - i. Deployment Overview
 - ii. Visual studio setup and Deployment project types
 - iii. Microsoft windows installer architecture
 - iv. Building the project : Installation

Unit 4. Data Access (6)

- a. File System Data
- b. XML
- c. Databases and ADO.NET
- d. Data Binding

Unit 5. Web Programming (6)

- a. Basic Web programming
- b. Advanced Web programming
- c. Web Services
- d. Deployment Web applications

Unit 6. .NET Assemblies (3)

- a. Components
- b. .NET Assembly features
- c. Structure of Assemblies
- d. Calling assemblies, private and shared assemblies

Unit 7. Networking (2)

- a. Networking overview
- b. Networking programming options
 - i. WebClient
 - ii. WebRequest and WebResponse
 - iii. TcpListener &TcpClient

Unit 8. Introduction to GDI+ (2)

- a. Overview of Graphical Drawing
- b. Pen Class, Brush Class, Font Class
- c. Using Images
- d. Clipping, Drawing2D, Imaging

Part II : ASP.NET

Unit 1. Introduction to ASP.NET (1)

Unit 2. Server Controls and Variables, control Structures & Functions (4)

- a. Forms, webpages, HTML forms, Webforms
- b. Request & Response in Non-ASP.NET pages
- c. Using ASP.NET Server Controls
- d. Datatypes : Numeric, text, arrays, datacollections
- e. Overview of Control structures

f. Functions : web controls as parameters

Unit 3. Even Driven Programming andPostBack (3)

- a. HTML events
- b. ASP.NET page events
- c. ASP.NET Web control events
- d. Event driven programming and postback

Unit 4. Reading from Databases (3)

- a. Data pages
- b. ADO.NET

Unit 5. ASP.NET Server Controls (4)

- a. ASP.NET Web Controls
- b. HTML Server Controls
- c. Web Controls

Unit 6. DOTNET assemblies and Custom Controls (2)

- a. Introduction to Cookies, Sessions
- b. Session events
- c. State management Recommendations

Unit 7. Web Services (2)

- a. HTTP, XML & Web services
- b. SOAP
- c. Building ASP.NET web service
- d. Consuming a web service

Recommended Text and Reference books:

- Beginning Visual C#, Wrox Publication
- Professional Visual C#, Wrox Publication
- Inside C#, by Tom Archer ISBN: 0735612889 Microsoft Press © 2001, 403 pages
- Beginning ASP.NET 3.5, Wrox Publication
- Programming ASP.NET 3.5 by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly
- Illustrated C# 2008, Solis, Publication APRESS, ISBN 978-81-8128-958-2
- Professional C# 4.0 and .NET 4 by Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, WROX
- Beginning C# Object-Oriented Programming By Dan Clark , Apress
- ADO.NET Examples and Best Practices for C# Programmers, By Peter D. Blackburn Apress
- Database Programming with C#, By Carsten Thomsen, Apress

Elective Course [CS-206]: Artificial Intelligence

Prerequisites –

- Concepts of Data structures and Design and Analysis of algorithms

Objectives-

- To understand and gain the knowledge of the subject

Course contents –

Unit 1. Introduction to Artificial Intelligence

- What is AI?
- Early work in AI
- AI and related fields
- AI problems and Techniques

Unit 2. Problems, Problem Spaces and Search

- Defining AI problems as a State Space Search: example
- Production Systems
- Search and Control Strategies
- Problem Characteristics
- Issues in Design of Search Programs
- Additional Problems

Unit 3. Heuristic Search Techniques

- Generate-and-test
- Hill Climbing
- Best First Search
- Problem Reduction
- Constraint Satisfaction
- Mean-Ends Analysis

Unit 4. Knowledge Representation

- Representations and Mappings
- Approaches to Knowledge Representation
- Knowledge representation method
- Propositional Logic
- Predicate logic
- Representing Simple facts in Logic
- Representing Instances and Isa relationships
- Computable Functions and Predicates
- Resolution
- Forward and backward chaining

Unit 5. Slot – and – Filler Structures

- Weak Structures
- Semantic Networks
- Frames
- Strong Structures
- Conceptual Dependencies
- Scripts

Unit 6. Game Playing

- Minimax Search Procedures
- Adding alpha-beta cutoffs

- Uncertainty Reasoning: Basic Probability Axioms, Baye's Rule, Bayesian Classification, Certainty Factor Theory, Dempster Shafar Theory.

Unit 7. Learning

- What is learning?
- Rote Learning
- Learning by taking advice
- Learning in problem solving
- Learning from examples
- Explanation based learning

Internal evaluation

- To implement the AI concepts using programming language PROLOG.

Reference books –

1. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
2. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901
3. Artificial Intelligence, Tata McGraw Hill, 2nd Edition, by Elaine Rich and Kevin Knight
4. Introduction to Artificial Intelligence and Expert System, Prentice Hall of India Pvt. Ltd., New Delhi, 1997, 2nd Printing, by Dan Patterson.

Elective Course [CS-207]: Advance Algorithms

Unit 1 : Advanced data structures (Fibonacci heaps, splay trees, dynamic trees, B-Trees) in-memory representations and persistence of DS, Revision of Graph algorithms: Network flows (max flow and min-cost flow/circulation) **(10 Hrs)**

Unit 2 . String algorithms: **(10 Hrs)**

- 1 String searching - (Knuth–Morris–Pratt algorithm, Boyer–Moore string search algorithm, Rabin–Karp string search algorithm)
2. Suffix trees - mathematical properties of suffix trees
3. Applications of Suffix trees:
Regular expression searches using suffix trees;
Finding all maximal pairs and maximal repeats, Patricia trees

Unit 3 : Intractable problems: approximation algorithms **(14 Hrs)**

1. Steiner tree and TSP
2. Steiner forest
3. Group Steiner trees
4. Set cover via primal-dual
5. k-median on a cycle

Unit 4: Integer programming and optimization algorithms **(14 Hrs.)**

1. Formulations, complexity and relaxations
2. discrete optimization,
3. cutting plane methods,
4. enumerative and heuristic methods
5. Convex programming algorithms: ellipsoid method, interior-point methods, proximal point methods.

Preliminary reading:

- Introduction to Algorithms: by Cormen, T.H., C.E. Leiserson, R.L. Rivest, and C. Stein; MIT Press; ISBN: 9780262032933
- The Algorithm Manual, Steven Skiena, Springer ISBN:9788184898651

Reference Books:

- Theory of Linear and Integer Programming: by Schrijver; John Wiley & Sons. ISBN: 9780471982326
- Convex Optimization: by Boyd and Vandenberghe; Cambridge University Press; ISBN: 9780521833783
- Approximation Algorithms: by Vazirani; Springer-Verlag: ISBN: 9783540653677
- Advances in Steiner Trees (Combinatorial Optimization) by Ding-Zhu Du (Editor), J.M. Smith (Editor), J. Hyam Rubinstein (Editor); Springer; ISBN: 978-0792361107
- Algorithms On Strings, Trees, And Sequences; by D. Gusfield; Cambridge University Press,(ISBN 052158519)

Additional reading:

- Algorithmic Number Theory: by Bach and Shallit; MIT Press; ISBN: 9780262024051