

**Department of Computer Science
University of Peshawar**

UNDERGRADUATE CURRICULUM

BCS

Code: BCS361

Credit Hours: 3

Computer Architecture

Computer Architecture Introduction

- a) Introduction to Computer Architecture
- b) Evolution of computers (form Mechanical to Electronic)

Basics of Computer Architecture

- a) Hardware and firmware
- b) Basics of computer architecture
- c) Introduction
- d) Computer structure
- e) Type of computers and future trend computer instruction se

Detailed Study of different Instruction types

- a) I/O instructions reduced instruction sets computers
- b) case study: RISC (University of California Berkeley)

Execution

- a) Introduction to Execution unit (EU)
- b) Register sections
- c) General register design
- d) Combinatorial Design of Adders

ALU Design & BIT SLICE Processor Control Unit

- a) ALU design
- b) BIT SLICE Processor Control Unit
 - 1. Basic concept
 - 2. Design Methods (Hardware control design and micro programmed control unit)

Memory Organization

- a) Primary memory design (ROM/RAM)
- b) Secondary memory (Hard disk, floppy disk, CD-ROM) Cache Memory, Virtual Memory Management

Input/Output Design

- a) Cache Memory
 - 1. Associative mapping
 - 2. Direct mapping
- b) Segmentation and Mapping, and input / output design
 - 1. Programmed I/O
 - 2. Standard I/O unconditional programmed I/O
 - 3. Interrupt I/O
 - 4. Computer Organization
 - 5. Microprocessor and its supports circuitry
 - 6. Peripheral devices

Books:

1. *M. Moris Mano, Modern Computer architecture, 3rd Edition, Prentice Hall, 1992.*
2. *William Stallings, Computer Organization and Architecture, 3rd Edition, Macmillan Publishing Company, 1993.*

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Numerical Analysis**Error Analysis**

- a) Definition of error, Sources of error, Significant digits, Precision and accuracy
- b) Effect of Rounding errors in arithmetic operations, Numerical Cancellation
- c) Evaluation functions by series expansion and estimation of errors

Non-Linear Equations

- a) Methods to solve Non-Linear equations, Simple interactive procedure
- b) Acceleration of convergence, Newton's Raphons Methods, the Bisection method
- c) The Secant methods, methods of False portion, Multiple Roots, Zeros of Polynomials

Linear System of Equations

- a) Basic concept, Methods to solve a system of linear equations, Cramer's rule
- b) Guassian elimination method, Triangular decomposition method
- c) Triangular decomposition for symmetric matrices
- d) Solution of Tridiagonal system of equation, Jacobi's method, Guass-seidel method

Finite Differences

- a) Difference table, Detection and correction of error in a difference table
- b) Forward difference operator, Backward difference operator, Central difference operator
- c) Shift operator, Mean operator, Relationship between operators

Interpolation

- a) Choice of a / suitable interpolation Formula
- b) Type of interpolation Formulas for Equally-paced data points
- c) Type of interpolation Formulas for Unequally – spaced data points
- d) Newton's Forward Difference interpolation Formula
- e) Newton's Backward Difference interpolation Formula
- f) Interpolation with Central Difference Formula, Stirling's interpolation Formula
- g) Bessel's Interpolation Formula, Everett's interpolation Formula
- h) Guassian Interpolation Formula, Lagrange's Formula Iterative, Interpolation Method
- i) Error Estimation in Interpolation

Numerical Differentiation

- a) Derivation of Differentiation Formulas, Relationship Between Operator E and D
- b) Derivatives Using Newton's Forward Difference Formula
- c) Derivatives Using Newton's Backward Difference Formula
- d) Derivatives Using Central Difference Formula

Numerical Integration-I

- a) Derivative of Integration Formulas, Trapezoidal Rule, Simpson's 1/3rd Rule
- b) Boole's Rule, Weddle's Rule, Estimation of error in some Newton-cotes formula
- c) Error in Trapezoidal Rule, Error in Simpson's 1/3rd Rule, Automatic Subdivision of Interval

Numerical Integration-II and Ordinary Differential Equation

- a) Repeated use of Trapezoidal Rule, Romberg's Integration Method
- b) Ordinary Differential Equations
 1. Classification of differential equations, Categories of ODEs
 2. Linear and Non-Linear ODEs, Boundary Conditions, Methods to solve ODEs,
 3. Numerical Methods to solve ODEs, Picard's Method
- c) Taylor Series Methods, Euler's Methods and variations

Ordinary Differential Equations

- a) Runge-Kutta Methods, Predictor-Corrector Methods
- b) Milne-Simpson Predictor-corrector Method, Adams-bashforth
- c) Adams-Moulton Method
- d) Solution of simultaneous and Higher-order ordinary differential equations
- e) Solution of First order Simultaneous differential equations, Solution of an nth order differential equations

Books:

Richard L. Burden, Faires J. Douglas, Numerical Analysis, 5th Edition, PWS-KENT Publishing Company, 1993.

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Automata Theory

Regular Languages

Regular Grammars

Finite-State Automata

Compiler-Writing Tools

Lex, Yacc, etc

Transducers and Relationship among Them

Context-Free Languages and Grammars

Language Recognition

Parsers

Properties of Formal Languages

Turning Computability and Undesirability

Books:

1. *Dean Kellye, Automata and Formal Languages: An Introduction, 1st Edition, Prentice Hall, 1998.*
2. *Dexter C.Kozen, Automata and Computability, 1st Edition, Springer Verlag, 1987.*
3. *M.W.Shields, An Introduction to Automata Theory (Computer Science Texts), Alfred Waller Ltd, 1988.*

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Credit Hours: 4

Computer Graphics

Fundamentals

- a) Introduction, Points and Lines
- b) Planes and Co-Ordinates, Lines Segments

Fundamentals (Continued)

- a) Perpendicular Lines, Vectors, Pixels and Frame Buffers
- b) Vector Generation Character Generation, Displaying The Frame Buffer

Graphic I/O Device

- a) Calligraphic Refresh Display
- b) Raster Refresh Display
- c) Keyboard
- d) Graphic Tablet

Drawing Algorithms

- a) Lines
- b) Bresenham's Algorithm
- c) Curves
- d) Rectangle
- e) Rounded Rectangles

2-D Transformations

- a) Uses for Transformations
- b) Modeling, Mapping
- c) 2-D Co-Ordinate Transformations
- d) Matrix Representation
- e) Homogeneous Co-Ordinates

3-D Transformations and Projections

- a) Parallel and Perspective Projections
- b) Rotations

Scan Conversion Techniques

- a) Real – Time Scan Conversion
- b) Run – Length Encoding

Polygons

- a) Inside Test
- b) Algorithm for Filling Polygons
- c) Seed Fill Algorithms
- d) Inclusion of Polygons as Graphics System Primitive

Clipping and Windowing

- a) Viewing Transformation
- b) Specification of Window and View Port
- c) Clipping Algorithms
- d) Sutherland-Cohen Algorithm for Clipping Lines
- e) Sutherland-Hodgman Algorithm for Clipping Polygons
- f) Addition of Clipping
- g) Windowing to Graphic System

Books:

Harrington, Computer Graphics: A Programming Approach, McGraw Hill, 1983.

Object Oriented Analysis and Design

Introduction

- a) Introduction & Definitions
- b) OO Modeling Concepts
- c) OO Developments

Modeling as a Design Technique

- a) Object Modeling Technique

Object Modeling

- a) Objects & Class
- b) Links & Associations
- c) Generalization & Inheritance
- d) Grouping Constructs
- e) Aggregation
- f) Abstract Class
- g) Multiple Inheritance, Meta Data, Candidate Key

Dynamic Modeling

- a) Events & States.
- b) Operations, Nested State Diagram
- c) Concurrency, Advanced Dynamic Modeling Concepts

Functional Modeling

- a) Functional Models, DFD
- b) Specifying Operations, Constraints
- c) Relation of Functional to Object and Dynamic Model

Design Methodology

- a) Methodology review
- b) OMT as Software Engineering Methodology
- c) OMT Methodology, Impact of OO approach

System Design

- a) Overview of System Design
- b) Breaking of System into Sub Systems
- c) Identifying Concurrency
- d) Allocating Subsystems to Processors and Tasks
- e) Management of Data Store
- f) Handling Global Recurs
- g) Choosing Software Control Implementation
- h) Handling Boundary Conditions
- i) Settling Traded-off Priorities
- j) Common Architectural Framework
- k) Architecture of ATM System

Implementation

- a) Form Design to Implementation
- b) Implementation using programming languages
- c) Implementation using Database System
- d) Implementation using Outside a Computer

OO Testing

- a) Testing OOA and Models
- b) OO Testing Strategies
- c) Test Case Design for OO Software

- d) Testing methods applicable at class levels
- e) Inter class test case design

Object Diagram Compiler

- a) Background
- b) Problem Statement
- c) Analysis
- d) System Design
- e) Object Design
- f) Implementation

Books:

1. *James Rumbaugh, Object Oriented Modeling and Design, 6th Edition, Prentice Hall International, 2000.*
2. *Craig Larman, Applying UML and Patterns: An introduction to Object-Oriented analysis and Design, 2nd Edition, Prentice Hall International, 2001.*
3. *James R.Rumbaugh, Michael R.Blaha, William Premerlani, Frederick Eddy, William Lorensen, Object Oriented Modeling and Design with UML, 2nd Edition, Prentice Hall, 2004.*