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Statement of Teaching Philosophy

Introduction

I, the undersigned, would like to express my enthusiastic aspiration to apply for the Non-tenure-track - Instructor - Computer Science - College of Arts and Sciences, The University of Alabama at Birmingham (UAB). My academic ambition drives me to decide to apply for the post to be moving forward to facilitate my teaching and learning in the field of Computer Science. I got admitted to this University as a prestigious Blazer Graduate Research Fellow in Fall-2022. Having been part of this University through my fellowship, I have gained invaluable insights into the university's culture of academic excellence and innovation. I am eager to bring my teaching expertise, research acumen, and dedication to community engagement to this role. Additionally, I am excited about the prospect of collaborating with colleagues to develop initiatives that strengthen the department's impact in both academic and industry settings.

Background

Before joining here, I have had eight years of experience in teaching. I taught a range of undergraduate and graduate-level courses, including Fundamentals of Computer Systems, Structured Programming Language, Data Communications, Compiler Design, Algorithm Design, Data Structures, Database Management, and Operating Systems, which enhanced my ability to address diverse learning needs and incorporate practical, hands-on experiences into the classroom. My teaching philosophy emphasizes fostering critical thinking, promoting interdisciplinary collaboration, and cultivating an inclusive learning environment. Teaching is a passion of mine, and I have had the privilege of designing and delivering courses. I strive to create an inclusive and engaging learning environment that caters to diverse student needs.

With a strong background in teaching Computer Science, my work is dedicated to developing innovative solutions. My research has resulted in 9 (nine) peer-reviewed publications (including two book chapters) in prestigious venues, and I have actively contributed to advancing knowledge in the field. My current work focuses on cybersecurity analysis, which I believe aligns well with the department's priorities.

Qualifications

According to the requirements of a Ph.D. student, I have completed all of the coursework with an overall CGPA of 3.87. I have earned Bachelor of Science with Honors and Master of Science in Engineering degree in Computer Science & Engineering from the University of Chittagong, Bangladesh with CGPA respectively 3.71 and 3.72 out of 4.00. In my Master's, I got the highest CGPA in that session. As a teacher, I have worked in the Department of Computer Science & Engineering at Southern University Bangladesh for three years and, in the Department of Information & Communication Technology (ICT) at Comilla University for two years. Before getting admitted here at UAB, I worked in the Department of Computer Science & Engineering, University of Chittagong, Bangladesh for three years.

During my 8 years of teaching period, I got the opportunity to supervise plenty of students by providing some innovative ideas like – a person recognition by his handwriting, a liquid vending machine, different services providing Android apps, merging wireless communication with neural networks, vehicular ad-hoc network, satellite image segmentation and so on. Some of my research works are published in different Conferences and Journals and some are in the queue for publication. In my undergraduate life, I developed a *Distributor Management System* and *Mass Transportation and Traffic Model.* In my Master's, I completed a thesis work on Computational Biology for DNA sequence alignment. Though I have conducted many courses in teaching life, I found a special interest in Algorithm Design, Data Structures, Database Management, Data Mining, Operating Systems, and so on.

Having a profound interest in Computer Networking, I have completed the Cisco Certified Network Associate (CCNA) program, and this hands-on, lab-oriented program prepared me to gather extensive and pragmatic knowledge on Network Fundamentals, Routing Protocols and Concepts, LAN Switching and Wireless and Accessing the WAN. Throughout the program, I learned - how communication works in data networks, what are the purpose, nature, and operations of router and routing protocols, how to identify and describe common switched networks and wireless networks, and how to configure and verify WAN connections.

Volunteer Works and Extra-curricular activities

I was the only student in my Master's achieving 100% attendance on coursework. As a regular and attentive student in classes, I got the opportunity to help my classmates understand and prepare their lessons. I also helped my neighboring boys and girls with Physics and Mathematics. I have proved my quality in leadership throughout my academic and professional periods. In my professional life, I worked as an advisor of the ICT Association, Comilla University. As well, I was also efficaciously active in the

Computer Club and Cultural Group of Comilla University, and Southern University Bangladesh. I have been serving as a volunteer judge in the Undergraduate Research Expo, organized by UAB Service Learning, from the very beginning of my journey here at UAB as a graduate student. I was also a voluntary member of Sandhani (a blood donation society in Bangladesh), and now I am a volunteer in UAB Health Donor Cohort, and LifeSouth Community Blood Centers. I was a member of building up an Outcome-based Education (OBE) curriculum plan for the Department of Computer Science & Engineering, University of Chittagong, Bangladesh, and a coach of a programming team at this University in ICPC also. I have participated in different trainings and workshops organized by the Institutional Quality Assurance Cell of different universities I worked for.

Conclusion

Having confidence, I can say that if the right opportunity is given to me, I will be a skillful personnel and academician in the areas of Computer Science. I believe the search committee would be kind enough to consider my application for the opportunity to commence my odyssey as an Instructor in this department. I have my trust that I can adopt the motto of our UAB "We observe the Universe from within it" and promote that as well through the experience inhered from my teaching, training, and leadership. I would be grateful for the opportunity to discuss how my skills and experiences align with your expectations for this role.

(N M Istiak Chowdhury)
December 5, 2024.

CSE 111: INTRODUCTIONS TO COMPUTER SYSTEMS
75 Marks, 3 Credits, 3 Hours/Week

Introduction to computations: Early History of Computing Devices, Computers, Different Types of Computers, Major Components of a Computer.

Hardware: I/O devices, Memory Devices, Storage Devices, Processor

Software: Operating System, Application Software, Basic Architecture of a Computer, Basic Information Technology, The Internet.

Number system: Binary, Octal, Hexadecimal, Binary Arithmetic Operation, r's and (r-1)'s Compliment Operations,

Text Book:
1. Computer Fundamentals: M. Lutfur Rahman.

Reference Books:
1. Introduction to Computers: Peter Norton
2. Computer Science: C.S. French.
3. Computer Science: Warford.

CSE 113: STRUCTURED PROGRAMMING LANGUAGE
75 Marks, 3 Credits, 3 Hours/Week

Programming Language: Basic Concept, Overview of Programming Languages, Problem Solving Techniques and Data Flow Diagram.

C-Language: Preliminaries, Program Constructs Variables and Data Types in C. Input and Output. Character and Formatted I/O, Arithmetic Expressions and Assignment Statements, Loops and Nested Loops, Decision Making, Arrays

Functions: Arguments and Local Variables, Calling Functions and Arrays. Recursion and Recursive Functions, Structures within Structure.

Files: File Functions for Sequential and Random I/O.

Pointers: Pointers and Structures, Pointer and Functions, Pointer and Arrays, Operation and Pointer, Pointer and Memory Addresses.

Operations on Bits: Bit Operation, Bit Field, Advanced Features; Standard and Library.

Text Book:
1. Programming with C: Gottfried

Reference Books:
1. The C programming language: B. Kernighan & D. Ritchie.
2. Teach yourself C: H.Schildt.
3. C how to Program: Deitel & Deitel.
4. Programming in ANSI C: L. Balagurushami.

Dept. of Computer Science & Engineering, University of Chittagong

CSE 311: DATA STRUCTURES
75 Marks, 3 Credits, 3 Hours/Week

Basic: Basic Data Structures and Representation of Data. Data Structures Operations.
Linear Data Structures: Arrays, Records, Pointer, Linked Lists, Linked Lists with Sentinels, Stack, Queue, Dequeue and Priority Queue, Recursion, Data Structures' Operations on Them.
Non Linear Data Structures
Trees: Binary Tree, Traversing Binary Trees, Insertion Deletion and Searching, Binary Search Trees, B+ Trees, Indexing, Red-Black Trees, Operations on Red-Black Trees, Heap, Heapsort, Heap Property, Heapify, Building and Maintaining a Heap, Huffman's Algorithm, Binomial Heaps.
Graphs: Introduction to Graph, Sequential and Linked Representation of a Graph on Memory, Operations on Graph, Traversing a Graph,
Hashing Techniques: Characteristics of Hash Functions, Collision Resolution, Probing Chaining, Perfect Hashing.
Data Structures for Disjoint Sets: Disjoint Set Operations, Linked List Representation of Disjoint set, Disjoint Set Forests.
Augmenting Data Structures: Dynamic order Statistics, How to Augment a Data Structure, Interval Trees.
Searching and Sorting Techniques in Different Structures.

Text Book:

1. Data Structure: Seymour Lipschetz.

Reference Books:
1   Introduction to Algorithms: T. Cormen et. al..
2   Fundamentals of data structures in C++: Ellis Horowitz & Sartaj Sahni Mehta.
3   Data structures in C: Tanenbaum.
4   Fundamentals of Computer Algorithms: Ellis Horowitz & Sartaj Sahni.
5   Data Structures and Algorithms: Aho, Hopcroft, Ullman.
6   Algorithms.: Robert Sedgwick

CSE 411: COMPUTER ALGORITHMS
75 Marks, 3 Credits, 3 Hours/Week

Foundations: The Role Of Algorithms in Computing, Analyzing and Designing Algorithms, Time and Space Complexity, Growth Of Functions. Notations For Describing Growth Of Functions.

Recurrences: The Substitution Method, The Recursion-Tree Method, The Master Method, Proof Of The Master Theorem.

Divide & Conquer Method: Binary Search. Finding The Maximum and Minimum. Merge Sort,. Quicksort and Randomized Quicksort and Their Analytic Comparison.

The Greedy Method: Knapsack Problem. Minimum Cost Spanning Trees :Prim and Kruskal's Algorithms. Single Source Shortest Paths – Dijkstra's Algorithm.

Dynamic Programming: Single Source Shortest Paths – Bellman-Ford Algorithm. All Pairs Shortest Paths. 0/1 Knapsack Problem. Matrix Chain Multiplication and Longest Common Subsequence Algorithms.

Graph Algorithms: Breadth First and Depth First Search in Graphs, topological Sort, Strongly Connected Components,

Theory Of NP-Completeness. Coping with NP-Hardness. Approximation Algorithms. Heuristic Algorithms,

Text Book:
1   Introduction to Algorithms: T. Cormen et. al..

Reference Books:
1. Fundamentals of Computer Algorithms: Ellis Horowitz & Sartaj Sahni.
2. Algorithms: Robert Sedgwick.
3. The algorithm design manual: Steven Skiena.
4. Introduction to the Design and analysis of Alogrithms: Goodmann.

CSE 413: DATABASE SYSTEMS
75 Marks, 3 Credits, 3 Hours/Week

Introduction: Purpose of Database Systems, Data Abstraction, Data Models, Instances and Schemes, Data Independence, Data Definition Language, Data Manipulation Language, Database Manager, Database administrator, Database Users, Overall System Structure, Advantages and Disadvantage of a Database Systems. Data Mining and analysis, Database Architecture, History of Database Systems

Relationship Entity-Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Composite and Multivalued Attributes, Mapping Constraints, Keys, Entity-Relationship Diagram, Reducing of E-R Diagram to Tables, Generalization, Attribute Inheritance, Aggregation, Alternative E-R Notatios, Design of an E-R Database Scheme.

Relational Model: Structure of Relational Database, Fundamental Relational Algebra Operations, The Tuple Relational Calculus, The Domain Relational Calculus, Modifying the Database.

Relational Commercial Language: SQL, Basic structure of SQL Queries, Query-by-Example, Quel., Nested Sub queries, Complex queries, Integrity Constraints, Authorization, Dynamic SQL, Recursive Queries, Overview of PL/SQL.

Relational Database Design: Pitfalls in Relational Database Design, Functional Dependency Theory, Normalization using Functional Dependencies, Normalization using Multivalued Dependencies, Normalization using join Dependencies, Database Design Process.

File and System Structure: Overall System Structure, Physical Storage Media, File Organization, RAID, Organization of Records into Blocks, Sequential Files, Mapping Relational Data to Files, Data Dictionary Storage, Buffer Management.

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ -Tree Index Files, B-Tree Index Files, Static and Dynamic Hash Function, Comparison of Indexing and Hashing, Index Definition in SQL, Multiple Key Access.

Query Processing and Optimization: Query Interpretation, Equivalence of Expressions, Estimation of Query-Processing Cost, Estimation of Costs of Access Using Indices, Join Strategies, Join Strategies for parallel Processing, Structure of the query Optimizer, Transformation of Relational Expression

Concurrency Control: Schedules, Testing for Serializability, Lock-Based Protocols, Timestamp-Based Protocols, Validation Techniques, Multiple Granularity, Multiversion Schemes, Insert and Delete Operations, Deadlock Handling.

Distributed Database: Structure of Distributed Databases, Trade-off in Distributing the Database, Design of Distributed Database, Transparancy and Autonomy, Distributed Query Processing, Recovery in Distributed Systems, Commit Protocols, Concurrency Control, Shared Server Configuration.

Data Mining: Data analysis and OLAP, Data Warehouse, Data Mining, Overview of Data Mining Techniques Information Retrieval and Structured Data. Basic of Ontology.

Administrative Functionalities: Architecture of a Database, Concept of Physical and Logical Databases Tablespaces, Database Creation, Maintaining Data Dictionary, Database Backup/Recovery, Database maintaining and Performance Tuning, Data Guard-Physical, logical and Standby Database.

Text Book:
1 Database System Concepts (5th edition): Abraham Silberschratz, Henry K. Korth, S. Sudarshan.

Reference Books:
1. OCA Oracle 10g Administration 1, BPB Publications: Chip Dawes, Bob Bryla et al.
2. Fundamentals of Database Systems 1994: Benjamin/Cummings.
3. Database Principles, Programming, 1994: Performance: Morgan Kaufmann.
4. A First Course in Database Systems, 1997: Prentice Hall.
5. Database Management Systems, 1996: McGraw Hill.
6. Data Mining Concepts and Techniques: Jiawei Han, Micheline Kamber, Jian Pei.

CSE 511: OPERATING SYSTEMS
75 Marks, 3 Credits, 3 Hours/Week

introduction: Operating Systems Concept, Computer System Structures, Operating System Structures, Operating System Operations, Protection and Security, Special-Purpose Systems.

Fundamentals of OS: OS Services and Components, Multitasking, Multiprogramming, Time Sharing, Buffering, Spooling.

Process Management: Process Concept, Process Scheduling, Process State, Process Management, interprocess Communication, interaction Between Processes and OS, Communication in Client-Server Systems, Threading, Multithreading, Process Synchronization.

Concurrency Control: Concurrency and Race Conditions, Mutual Exclusion Requirements, Semaphores, Monitors, Classical IPC Problem and Solutions, Dead Locks - Characterization, Detection, Recovery, Avoidance and Prevention.

Memory Management: Memory Partitioning, Swapping, Paging, Segmentation, Virtual Memory - Concepts, Overlays, Demand Paging, Performance of Demand Paging, Page Replacement Algorithm, Allocation Algorithms.

Storage Management: Principles of I/O Hardware, Principles of I/O Software, Secondary Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Reliability, Stable Storage Implementation.

File Concept: File Support, Access Methods, Allocation Methods, Directory Systems, File Protection, Free Space Management

Protection & Security *:* Goals of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights, The Security Problem, Authentication, One-Time Passwords, Program Threats, System Threats, Threat Monitoring, Encryption, Computer-Security Classification.

Distributed Systems: Types of Distributed Operating System, Communication Protocols, Distributed File Systems, Naming and Transparency, Remote File Access, Stateful Versus Stateless Service, File Replication.

Case Studies: Study of A Representative Operating Systems,

Text Book:
1   Operating System Concepts (7th Edition), 2000: Silberschatz & Galvin Wiley.

Reference Books:
> 1. Operating System Internals: William Stallings.
> 2. Operating Systems Design & Implementation: Andrew Tanenbam, Albert S. Woodhull Pearson.
> 3. Modern Operating System: Andrew S. Tanenbaum.

CSE 513: DATA COMMUNICATION
75 Marks, 3 Credits, 3Hours/Week

Synchronous and Asynchronous Communications: Hardware interfaces, Multiplexers, Concentrators and Buffers, Communication Mediums and Their Characteristics;

Data Communication Services: SONET, ISDN, SMDS and ATM;

Error Control Codes: Linear Block Codes, Cyclic Codes, MLDC Codes, Convolution Codes, Trellis Code Modulation; Switching Systems: Space and Time Division Switching;

Digital Switching Technologies: ATM Switches, Signaling System 7(SS7); Radio System Design;

Fiber Optics Communication: Transmitter, Receives, Network Components, WDM; Line Coding, Trunks, Multiplexing; VSAT;

Satellite Communication: Frequency Bands and Characteristics, Types of Satellites, Multiple Access Techniques;

Cellular Communications: FDMA, TDMA, GSM, CDMA, GPRS, EDGE.

Text Book:
1. Data Communication and Networking, McGraw Hill: Behrouz A. Forouzan.

Reference Book:
2. Data Communication Technology: James Martin.

CSE 711: COMPILERS
75 Marks, 3 Credits, 3 Hours/Week

Introduction to Compilers: Introductory Concepts, Types of Compilers, Applications, Phases of A Compiler.

Lexical Analysis: Role of The Lexical Analyzer, Input Buffering, token Specification, Recognition of tokens, Symbol Tables.

Parsing: Parser and Its Role, Context Free Grammars, top-Down Parsing.

Syntax-Directed Translation: Syntax-Directed Definitions, Construction of Syntax Trees, top-Down Translation.

Type Checking: Type Systems, Type Expressions, Static and Dynamic Checking of Types, Error Recovery.

Run-Time Organization: Run-Time Storage Organization, Storage Strategies.

Intermediate Code Generation: Intermediate Languages, Declarations, Assignment Statements. **Code Optimization:** Basic Concepts of Code Optimization, Principal Sources of

Optimization. **Code Generation. Features of Some Common Compilers:** Characteristic Features of C, Pascal and Fortran Compilers.

Text Book:
1. Principle of Compiler Design: Aho, Ulman & Ravishethi.

Reference Books:
1. Compiler Design Theory: Philip.
2. Compiler Construction, Theory and Design: Willam A. Barrette.