CSE 3010 – Data Structures & Algorithms

Lecture #1

What will be covered today

- Understanding course handout
- Appropriate behavior in class
- Moving from Problems to Programs
- What is data structure
- What language will we use☺ in this course

Course handout – Primary information

- Course number – CSE 3010

- Course Name – Data Structures & Algorithms

- Instructor-in-charge – Usha Subramanian

- Instructors
  - Khine Aye San
  - Yi Yi Myint

Course objectives

- Explain the importance of <u>analysis of algorithms</u> and how to perform algorithm analysis

- Describe the need for <u>abstract data types</u> in computational problem-solving efforts

- Enumerate different types of <u>data structures</u> and their applications in appropriate problem-solving situations

- Use lists as the building block for simple data structures such as <u>stacks</u> and <u>queues</u>

Course objectives ... Contd.

- Explain different types of <u>hierarchical tree structures</u>
- Describe the importance of <u>sorting</u> and <u>searching</u> in software applications
- Describe <u>hashing</u> to find elements in some ordered data structures in a structured manner.
- Enumerate the use of <u>priority queues</u> and <u>heaps</u> as a searching technique
- Describe how <u>graphs</u> can be used as a data structure

Course Description

The main purpose of this course is to teach students about the need for data structures, how to select data structures for appropriate problem-solving situations and how to analyze and apply correct algorithms. Emphasis will be on exposure to different types of data structures from simple lists to complex hierarchical structures. The course also covers the importance of sorting and searching, and their use in software applications. Different techniques used for sorting and searching, and their appropriateness will be covered. Graph as a data structure will be introduced to the students.

Learning outcomes

- Demonstrate the ability to calculate the running time of a program

- Demonstrate the ability to distinguish different data structures

- Demonstrate the ability to implement various sorting techniques

- Demonstrate the ability to implement various searching techniques

- Demonstrate the ability to use graph as a data structure

Lecture plan

#	Topic	# of Lectures
1	Analysis of algorithms and running time calculations	4
2	Recursion and analysis of recursive functions	2
3	Definition of different types of abstract data types – List	3
4	Definition of different types of abstract data types – Stack	4
5	Definition of different types of abstract data types – Queue	3
6	Hierarchical data structures – General trees	1
7	Hierarchical data structures – Binary trees	1
8	Hierarchical data structures – Balanced trees [AVL and BTree]	3
9	Sorting techniques	4
10	Searching techniques – Binary search trees	5
11	Searching techniques – Hashing	4
12	Searching techniques – Priority queues and heaps	4
13	Graph as a data structure	4

Assessment Plan

Assessment	Dates	Time	Total Marks	Remarks
Test [2 tests of 10 marks each]	13th January 2020 (Monday) 16th March 2020 (Monday)	9:00 to 9:50 am	20	**Format:** Quiz Type on MIIT LMS
Assignment [Combination of take-home and in-class assignments]	Continuous	To be specified	20	**Format:** Problem solving **Make-up**: No make-up for this component
Mid-Term Examination	27th January 2020 (FN)	2 hours	20	**Format:** Problem solving using Java (Open-Book Examination)
Comprehensive Examination	30th March 2020 (FN)	3 hours	40	**Format:** **Part A:** Quiz Type on MIIT LMS (Closed-Book Examination) **Part B:** Problem solving using Java (Open-Book Examination)

Other Details

- Learning Resources
  - Textbook: Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson, 1997
- Additional Reading Resources
  - Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, First Edition, Pearson, 1983.
  - Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, First Edition, 1982
  - Others as shared in the class from time to time
- Structure of the Course
  - 3 lecture hours per week (Tuesday, Wednesday and Thursday)
  - 1 practical hour on Friday to apply concepts learnt during the lecture hours
- Lecture Hours
  - Tuesday, Wednesday and Thursday - 9:00 am to 9:50 am
  - Friday - 10:00 am to 10:50 am

Class decorum

- It is mandatory to have 75% attendance, as per the Code of Student Conduct. In the event of non-adherence, you will not be allowed to take the Final Examination and the Improvement Examination for the course. You will have to repeat and clear the course in a future semester.

- Use of mobile phone is NOT allowed in the class. In case of non-adherence, you will be dealt with in accordance with the Code of Student Conduct.

- To empower students who are interested in learning, it is a requirement that everyone:
  - Present in the class within 5 minutes of the start time of the class (9:05 am on Tuesday, Wednesday and Thursday, and 10:05 am on Friday)
  - Maintains silence when the class is in session

Code of Student Conduct

Adherence is MANDATORY

Why data structures

- Working with simple problems
  - Find if a number is prime
  - Find if a list has an input element
  - Find the kth element in a list
  - Count the number of the word 'the' in a given string
- Moving from problems to PROGRAMS
  - Requires high order thinking
  - Needs more than simple data types
  - Involves 'conceptual' constructs of complex nature
  - Necessitates to think and analyze algorithms, ALWAYS keeping in mind 'time' taken or algorithmic performance

Real life examples

- When a user logs into a bank system
- When a customer searches for flights between destination X to destination Y in an online travel booking portal
- When a learner searches for the meaning of a word from Oxford dictionary that has 273,000 words
- When we search for anything on Google
- When players play a game of Scrabble online