Topics for Exam 1

Topics to be covered

- **Problems, Instances, Solutions, Algorithms**
- **Asymptotic Notations**
- **Recurrence Relations**
- **Algorithm Execution and Running Time**
- **Activation Records, Divide-and-Conquer**
- **Insertion Sort, Mergesort, Quicksort**
- **Decision Trees and Sorting Lower-Bound**

Problems, Instances, Solutions, Algorithms

- **These are <mark>taught in Module 1</mark>**

- **Relationship among**
  - **Problems, Instances, Solutions, Algorithms**
- **Properties of an algorithm**
- **Time complexity of an algorithm**
- **Space complexity of an algorithm**

Asymptotic Notations

- **These are <mark>taught in Module 2</mark>**

- **Four basic summations**

- **Definitions of <mark>O, Ω, Θ</mark>**

- **Given a function, find the most accurate asymptotic notation**

- **Given two functions f(n) and g(n), relate them using asymptotic notations**

Recurrence Relations

- **These are <mark>taught in Module 4</mark>**

- **Know the Master method well**
- **Identify the case of the Master method that applies**
- **Obtain the asymptotic notation of a function**

Algorithm Execution and Running Time

- **These are <mark>taught in Module 3 and later modules</mark>**

- **Know the execution of an algorithm precisely**

- **What operations are performed, in what order**

- **Time complexity of an algorithm**

- **Know the algorithms as taught in class**
    - **Insertion Sort**
    - **Mergesort**
    - **Quicksort**

Activation Records, Divide-and-Conquer

- **These are <mark>taught in Module 5</mark>**

- **When an AR is pushed and popped**

- **What happens within an AR**

- **A divide-and-conquer algorithm breaks an instance of the problem into smaller instances of the same problem, and solves the smaller instances recursively**

- **Mergesort (Mergesort and Merge)**

- **Quicksort (Quicksort and Partition)**

Decision Trees and Sorting Lower-Bound

- These are <mark>taught in Module 6</mark>

- Draw the decision tree of a sorting algorithm for a given length of the input

- Know the annotation at each node

- Know the relationship between the running time of a sorting algorithm and the height of the decision tree

- Know the number of leaf nodes

- Know the lower-bound of a decision tree

- Know sorting lower-bound

Format of Exam 1

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- **Close book exam**
  - **One letter-size cheat sheet allowed. Can be double-sided**
  - **Scratch paper allowed**
  - **No {books, notes, computers, phones, calculators}**
  - **Pseudo-codes of algorithms taught will not be provided**
- **You pick a 75-minute span between 12:01am on 9/30/2023 and 11:59pm on 10/1/2023**
- **Via Canvas, with honorlock turned on**
- **Format will be similar to your first two homework assignments**
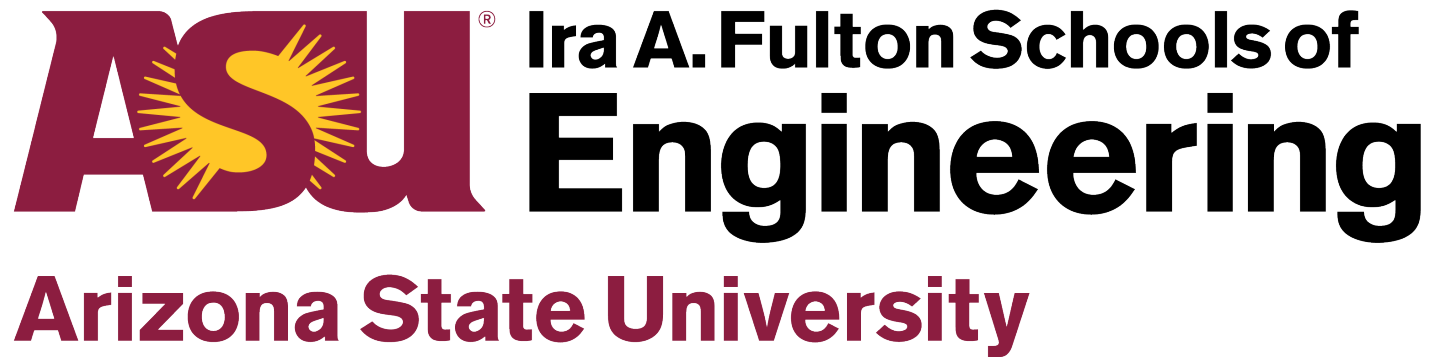
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