I. Introduction to Analysis Framework

- Algorithm analysis is to determine the efficiency of an algorithm
- Our main interest is time efficiency (time complexity)

Common Efficiency Classes

Name	Sample Function	Example
Constant Time	1	Assuming we know size of array, adding a number to end will take the same time regardless of array size
Logarithmic Time	log n	Binary search in a sorted array w/ n numbers
Linear Time	n	Calculate the sum of n nums in array
Linearithmic Time	n (log n)	Merge Sort
Quadratic Time	n^2	Bubble Sort
Cubic Time	n^3	Multiplying two n x n matrices
Exponential Time	2^n	Tower of Hanoi problem w/ n disks
Factorial Time	n!	TSP using brute-force approach

- Basic Idea
  - We count the number of "basic operations" executed while an algorithm runs
    - But since its not trivial to know the exact number, we use approximates

II. "Operation" in Algorithms

- "Operation" means every operation in a pseudocode such as +, -, *, /, %, >, <, =, read, write, return, etc.
  - Exclude assignment operation in this class

- "Basic Operation"
  - Most frequently executed operation among all "operations" in a pseudocode (=algorithm)

III. Analysis Framework

- Algorithm efficiency analysis is to identify the order of growth of the "number of basic operations"
  - Small difference in number of operations not important
  - We get approximate

IV. Worst-Case, Best-Case, & Average-Case Efficiencies

- Some Algorithms can have different execution times depending on the characteristics of the input data
  - Thus, we analyze best, average, and worst case time complexities separately

- **Best Case** Analysis
  - Assuming the best case occurs, what is the minimum number of balls you have to choose to get a matching pair?
    - Best case here would imply that one is very lucky
    - 2 balls

- **Worst-Case** Analysis
  - Assuming the worst case occurs, what is minimum number of balls you have to choose to get a matching pair?
    - Very unlucky scenario

- Average Case
  - NOT average of best & worst case efficiencies
  - Very difficult to obtain