College of Computing and Information Technology

Lecturer: **Dr. Nahla Belal**

Course: **Computing Algorithms (CS312)**

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Sheet 3

1. Implement and analyze the bubble sort algorithm.
2. *A stack of fake coins:* There are *n* stacks of *n* identical-looking coins. All of the coins in one of these stacks are counterfeit, while all the coins in the other stacks are genuine. Every genuine coin weighs 10 grams; every fake weighs 11 grams. You have an analytical scale that can determine the exact weight of any number of coins.
    a. Devise a brute-force algorithm to identify the stack with the fake coins and determine its worst-case efficiency class.
    b. What is the minimum number of weighings needed to identify the stack with the fake coins?
3. *Alternating disks:* You have a row of *2n* disks of two colors, *n* dark and *n* light. They alternate: dark, light, dark, light, and so on. You want to get all the dark disks to the right-hand end, and all the light disks to the left-hand end. The only moves you are allowed to make are those which interchange the positions of two neighboring disks. Design an algorithm for solving this puzzle and determine the number of moves it makes.

4. Determine the number of character comparisons made by the brute-force algorithm in searching for the pattern GANDHI in the text THERE_IS_MORE_TO_LIFE_THAN_INCREASING_ITS_SPEED (Assume that the length of the text–it is 47 characters long–is known before the search starts.

5. How many comparisons (both successful and unsuccessful) are made by the brute-force string-matching algorithm in searching for each of the following patterns in the binary text of 1000 zeros?
    a. 00001
    b. 10000
    c. 01010

6. Consider the problem of counting, in a given text, the number of substrings that start with an A and end with a B. (For example, there are four such substrings in CABAAXBYA.)
    a. Design a brute-force algorithm for this problem and determine its efficiency class.
    b. Design a more efficient algorithm for this problem.

7. Let $x_1 < x_2 < \ldots < x_n$ be real numbers representing coordinates of n villages located along a straight road. A post office needs to be built in one of these villages.
    a. Design an efficient algorithm to find the post-office location minimizing the average distance between the villages and the post office.
    b. Design an efficient algorithm to find the post-office location minimizing the maximum distance from a village to the post office.