Syllabus for the CS111 Quiz 4

Topics:

- Linear non-homogeneous recurrences equations
  - Solve the recurrence \( D_n = 3D_{n-1} + 1 \), \( D_0 = 0 \).
  - Find a general solution of the recurrence \( f_n = 5f_{n-1} - 6f_{n-2} + 2^n \).
  - Find a particular solution of the recurrence \( g_n = 5g_{n-1} - 6g_{n-2} + 2^n \).
- Divide-and-conquer recurrence equations
  - State the Master Theorem
  - Give an (asymptotic) solution to the following recurrence: \( f(n) = 3f(n/2) + 3n \)
  - Give an (asymptotic) solution to the following recurrence: \( f(n) = 8f(n/2) + 5*n^4 \)
  - Given the pseudo-code below, what is the (asymptotic) number of lines printed on input \( n \)? ...
- Inclusion-Exclusion
  - Give a complete statement of the inclusion-exclusion principle.
  - Suppose that we have sets \( A, B, C \) such that \(|A|= 22, |B| = 36, |C| = 26, |A \cap B| = 2|A \cap B \cap C|, |A \cap C| = 3|A \cap B \cap C|, |B \cap C| = 4|A \cap B \cap C|, |A \cup B \cup C| = 13|A \cap B \cap C| \). Determine the number of elements in the of these three sets.
  - Compute the number of permutations of \( \{1,2,3,4,5,6,7,8,9\} \) in which either 2,3,4 are consecutive or 4,5 are consecutive or 8,9,2 are consecutive.
  - We have a group of 53 people, including 22 US citizens, 15 Mexican citizens, and 27 Canadian citizens. Among them, 4 people have a dual US-Mexican citizenship, 5 have US-Canadian citizenship, and 6 have Canadian-Mexican citizenship. How many people have a triple citizenship?
  - Compute \( \phi(440) \) (\( \phi(n) \) is the Euler totient function).
  - Give the number of solutions of \( x+y+z = 30 \), for \( 4 \leq x \leq 14, 3 \leq y \leq 17, 10 \leq z \leq 25 \).