CS330 Recitation 7 *

Review any homework questions and questions from zyBook section 6.1

Questions

1. Is the sequence \{a_n\} a solution of the recurrence relation \(a_n = 8a_{n-1} - 16a_{n-2}\) under the following initial conditions?
   1a. \(a_n = 0\)
   1b. \(a_n = 1\)
   1c. \(a_n = 2^n\)
   1d. \(a_n = 4^n\)
   1e. \(a_n = n4^n\)
   1f. \(a_n = (4^n) + 3n4^n\)
   1g. \(a_n = (-4)^n\)
   1h. \(a_n = n^2(4^n)\)

2. Find the solution to each of these recurrence relations and initial conditions. Use an iterative approach.
   2a. \(a_n = 3a_{n-1}\) with \(a_0 = 2\)
   2b. \(a_n = a_{n-1} + 2\) \(a_0 = 3\)
   2c. \(a_n = a_{n-1} + n\) \(a_0 = 1\)
   2d. \(a_n = a_{n-1} + 2n + 3\) \(a_0 = 4\)
   2e. \(a_n = 2a_{n-1} - 1\) \(a_0 = 1\)
   2f. \(a_n = 3a_{n-1} + 1\) \(a_0 = 1\)
   2g. \(a_n = n a_{n-1}\) \(a_0 = 5\)
   2h. \(a_n = 2n a_{n-1}\) \(a_0 = 1\)

3. A factory makes custom sports cars at an increasing rate. In the first month, only one car is made, in the second month two cars are made, and so on, with \(n\) cars made in the \(n^{th}\) month.
   3a. Set up a recurrence relation for the number of cars produced in the first \(n\) months by this factory.
   3b. How many cars are produced in the first year?
   3c. Find an explicit (non-recursive) formula for the number of cars produced in the first \(n\) months by this factory.

4. Discuss problem 5 in homework 6:
   5. 4 points: Suppose that each person in a group of \(n\) people votes for exactly two people from a slate of candidates to fill two positions on a committee. The top two finishers both win positions as long as each receives more than \(n/2\) votes.
   5a. Write out (in pseudocode or words) a divide-and-conquer algorithm that determines whether the two candidates who received the most votes each received at least \(n/2\) votes and, if so, determine who these two candidates are.
   5b. Use the master theorem to give an \(O(\ldots)\) estimate for the number of comparisons needed by the algorithm you devised in part (a).

5. Find the solution to the recurrence relation
   5a. \(a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3}\) \(a_0 = 1, a_1 = -2, a_2 = -1\)
   5b. \(a_n = 2a_{n-1} - a_{n-2}\) \(a_0 = 4, a_1 = 1\)
   5c. \(a_n = a_{n-2}\) \(a_0 = 5, a_1 = -1\)
   5d. \(a_n = -6a_{n-1} - 9a_{n-2}\) \(a_0 = 3, a_1 = -3\)
   5e. \(a_{n+2} = -4a_{n+1} + 5a_n\) \(a_0 = 2, a_1 = 8\)

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