CS1340: DISCRETE STRUCTURES II

PRACTICE QUESTIONS II

(1) *Rosen - 2012 ed, Section 8.2, Q 21* What is the general form of the solutions of a linear homogeneous recurrence relation if its characteristic equation has roots $1, 1, 1, 1, -2, -2, -2, 3, 3, -4$?

(2) *Rosen - 2012 ed, Section 8.2, Q 27* What is the form of the particular solution of the linear nonhomogeneous recurrence relation $a_n = 8a_{n-2} - 16a_{n-4} + g(n)$ if $g(n) = n^3$?

(3) *Rosen - 2012 ed, Section 8.2, Q 33* Find the solution of the recurrence relation $a_n = 4a_{n-1} - 4a_{n-2} + (n+1)2^n$.
When we guess the particular solution we first guess a constant multiple of $g(n)$ if the guess doesn't work then a linear factor in n, if that fails then consider a quadratic in n, and so on. Basically, If we find a set of coefficients which works, that is the solution. If we cannot find a ***consistent set of coefficients****, we guessed poorly.* ***There will be no undetermined coefficients in the particular solution - if we have any, then what we have found isn't the particular solution.*** *Proof of this - Theorem 6 in Sect 8.2.*

(4) *Rosen - 2012 ed, Section 8.3, Q 17* Suppose that the votes of n people for different candidates (where there can be more than two candidates) for a particular office are the elements of a sequence. A person wins the election if this person receives a majority of the votes.
   (a) Devise a divide-and-conquer algorithm that deter- mines whether a candidate received a majority and, if so, determine who this candidate is. [Hint: Assume that n is even and split the sequence of votes into two sequences, each with $n/2$ elements. Note that a candidate could not have received a majority of votes without receiving a majority of votes in at least one of the two halves.]
   (b) Use the master theorem to give a big-O estimate for the number of comparisons needed by the algorithm you devised in part (a).

(5) *Rosen - 2012 ed, Section 8.3, Q 22* Suppose that the function f satisfies the recurrence relation $f(n) = 2f(\sqrt{n}) + logn$ where n is a perfect square greater

than 1 and $f(2) = 1$. Find a big-0 estimate for $f(n)$. *Make the substitution* $m = logn$.