Home Work 1

CSE 101, Spring 202

Issued Thursday, April,4, Due in class Tuesday, April, 16.

State your answers legibly and concisely. Your solutions will be graded on correctness, elegance, **clarity** and originality. Your proofs should **avoid getting bogged down in too much detail**. Please note that the work handed in must be your own. Please use *staples* to fasten the pages (any loss of unstapled sheets is at your own risk). **Your handwriting must be legible** and answers must be *in proper order* for full credit to be awarded. Every problem is 20 points.

Problem 1. Give an algorithm for multiplication two polynomials $a_n x^n + a_{n-1} x^{n-1} + \dots a_1 x^1 + a_0$ and $b_n x^n + b_{n-1} x^{n-1} + \dots b_1 x^1 + b_0$ that runs faster than $\Theta(n^2)$.

Problem 2. Find the shortest sequence of moves that transfers a tower of n disks from the left peg A to the right peg B, if direct moves between A and B are disallowed. (Each move must be to or from the middle peg. As usual, a larger disk must never appear above a smaller one.) Solve the corresponding recurrency.

Problem 3. How many pieces of cheese can you obtain from a single thick piece by making five straight slices (while you do all the cutting each slice must correspond to a plane in 3D). Find a recurrence relation for P_n, the maximum number of three-dimensional regions that can be defined by n different planes. Solve the reccurency.

Problem 4. Draw the recursion tree for $T(n) = 4T(n/2) + n$ and provide a tight asymptotic bound on its solution.

Problem 5. Argue that the solution to the recurrence $T(n) = T(n/3) + T(2n/3) + n$ is $\Omega(n \log n)$.