CSCD320 Homework1, Winter 2012, Eastern Washington University. Cheney, Washington.

Name: **EWU ID:** **Due:** 11:59pm, Jan. 22, 2012 (Sunday)

Please follow these rules strictly:

1. Write your name and EWUID on **EVERY** page of your submission.
2. Verbal discussions with classmates are encouraged, but each student must independently write his/her own solutions, without referring to anybody else's solution.
3. The deadline is sharp. Late submissions will **NOT** be accepted (it is set on the Blackboard system). Send in whatever you have by the deadline.
4. Submission must be computer typeset in the **PDF** format and sent to the Blackboard system. I encourage you all to use the LaTeX system for the typesetting, as what I am doing for this homework as well as the class slides. LaTeX is a free software used by publishers for professional typesetting and are also used by nearly all the computer science and math professionals for paper writing.
5. Your submission PDF file must be named as: **firstname_lastname_EWUID_cscd320_hw1.pdf**
   (1) We use the underline '_' not the dash '-'.
   (2) All letters are in the lower case including your name and the filename's extend.
   (3) If you have middle name(s), you don't have to put them into the submission's filename.
6. Sharing any content of this homework and its keys in any way with anyone who is not in this class of this quarter is NOT permitted.

All the solutions are done by myself and there are no other sources to verify the correctness of these solutions. So if you doubt any point in these solutions, please feel free to contact me and I will appreciate your contribution to this course. Thanks. – Bojian Xu

CSCD320 Homework1, Winter 2012, Eastern Washington University. Cheney, Washington.

Name: **EWU ID:** **Due:** 11:59pm, Jan. 22, 2012 (Sunday)

Problem 1 (5 points)**.** *Based on your learning from the CSCD300 Data Structures course, describe your understanding of the connection and difference between the "data structures" and "algorithms". Say your opinions in your own language. Any reasonable opinion is welcome.*

Problem 2 (15 points)**.** *Show:* $3n^2 + n\sqrt{n} = O(n^2)$

Problem 3 (15 points)**.** *Show:* $2(n + 100\sqrt{n}) \log^2 n = o(n\sqrt{n}/\log n)$. (Note: $\log^2 n$ means $(\log n)^2$)

Problem 4 (15 points)**.** *Let* $f(n)$ *and* $g(n)$ *be asymptotically nonnegative functions. Show:* $f(n) + g(n) = \Theta(\max\{f(n), g(n)\})$*, using the definition of* Θ*.*

Problem 5 (15 points)**.** *Let* $f(n)$ *be an asymptotically nonnegative function. Is* $f(n) = \omega(f(\sqrt{n}))$ *always true ? Justify your answer.*

Problem 6 (20)**.** *Finding the maximum in a sequence of* n *numbers is a simple task: simply scan the sequence and pick/return the maximum. The time cost of this simple method is clearly* $\Theta(n)$*, which is optimal because one has to take one look at every number in the sequence in order to find the maximum. Now Dr. Nonsense wants to use the divide-conquer strategy to overkill this task of finding the maximum among the sequence of* n *number.*

1. *Describe the algorithmic idea and give the pseudocode of Dr. Nonsense's algorithm.*
2. *Give the time cost in the* Θ*-notation of Dr. Nonsense's algorithm by using the recursion tree method for solving the recurrence.*
3. *Is this Dr. Nonsense's d-c based algorithm asymptotically slower or faster or identical, compared with the simple* $\Theta(n)$*-time method ?*
4. *How is the time efficiency in practice of Dr. Nonsense's algorithm, compared the simple method ? Why ?*

Problem 7 (15 points total; 5 points for each algorithm.)**.** *Search and learn three existing algorithms that use the divide-conquer strategy (not those covered in the class and/or the textbook, such as merge sort, max subarray finding algorithm, and Strassen's matrix multiplication algorithm). For each algorithm, in your own language, concisely and clearly describe:*

1. *the problem statement*
2. *the algorithmic idea in the solution (don't just copy the code to me)*
3. *the time complexity*
4. *the condition, on which the worst-case running time appears.*
5. *the source of your finding. For example, the url of the webpages, the title and page of a book, the title/author/year of an article, etc.*