**Sam Lazrak**

**CS 303-2D Algorithms and Data Structures**

**Homework Assignment 1**

**1/16/18**

1. *Work the following Exercises from Chapter 1 of the text:*
   1. *(2 points) The difference between an algorithm and a heuristic:* An algorithm is a set of well-defined instructions for carrying out a particular task. An algorithm is typically deterministic and proven to yield an optimal result. A heuristic is finding a solution to a problem which has no proof of correctness, often involves random elements, and may not yield optimal results.
      1. *Exercise 1.1-5, page 11:* *Come up with a real-world problem in which only the best solution will do. Then come up with one in which a solution that is “approximately” the best is good enough.* 
         1. A patient requires surgery at exactly four hours before something related to their illness happens. In this situation only the best solution will do.
         2. Optimizing how much laundry one can do effectively in one day at home is a problem where the solution that is “approximately” the best is good enough because it is not the end of the world if slightly more or less laundry is done.
   2. *(2 points) Practice using lg (log2) on your calculator: Do Exercise 1.2-3, page 11.* 
      1. *Exercise 1.2-3, page 11:* *What is the smallest value of n such that an algorithm whose running time is 100n^2 runs faster than an algorithm whose running time is 2n on the same machine?*
         1. At n=15, 100n2 < 2n
2. *(15 points) Why better hardware is not the answer: Solve Problem 1-1, page 14 by preparing a table following the outline of that given in the book:*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 second | 1 minute | 1  hour | 1  day | 1  month | 1  year | 1  century |
| lg n |  |  |  |  |  |  |  |
|  |  | 3600 | 1296 | 7.4 | 6.7 |  | 9.9 |
| n | 106 |  |  |  |  |  |  |
| n lg n | 62746 |  |  |  |  |  |  |
| n2 | 1000 | 7745 | 60000 | 293938 | 1609968 | 5615692 | 56175382 |
| n3 | 100 | 391 | 1532 | 4420 | 13736 | 31593 | 146677 |
| 2n | 19 | 25 | 31 | 36 | 41 | 44 | 51 |
| n! | 9 | 11 | 12 | 13 | 15 | 16 | 17 |

*Sources: Introduction to Algorithms, Third Edition, Terrance Blount, James Ward.*