CS 1501 Summer 2017: Quiz 1 Solution

1) Fill in the Blanks and True/False (22 points -- 2 points each).

Complete the statements below with the MOST APPROPRIATE words/phrases.

a) Order the following growth rates from smallest (best) to greatest (worst): n2 nlgn lgn n! 2n

\_\_\_\_\_lgn < nlgn < n2 < n3 < 2n < n! \_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) We can reduce the run-time of a brute-force algorithm by \_\_\_\_\_\_\_\_\_\_\_\_pruning\_\_\_\_\_\_\_\_\_\_\_ branches

from its execution tree.

c) Given a multiway radix search trie in which 32-bit keys are compared 4 bits at a time, the maximum

height of the tree is \_\_\_32/4 = 8\_\_\_\_\_\_ and interior nodes will each have up to \_\_\_2^4 = 16\_\_\_ children.

d) Consider an empty separate chaining hash table of size M = 100. If we hash 500 keys into this table, the

average chain length will be \_\_\_\_500/100 = 5\_\_\_\_ and the worst-case chain length will be \_\_500\_\_\_\_\_\_.

e) Given an empty hash table of size M and a good hash function, the probability that a random key will be

hashed to an arbitrary location k is \_\_\_\_\_\_\_\_\_1/M\_\_\_\_\_\_\_\_.

f) An example text string and pattern string that will produce the worst case for the brute force string

matching algorithm are:

A (text) = \_\_\_\_\_\_XXXXXXXXXXXXY\_\_\_\_\_\_\_\_\_\_\_

P (pattern) = \_\_\_\_\_XXXY\_\_\_\_\_\_\_\_

Indicate whether each of the following is TRUE or FALSE, explaining why in an informative way for

false answers.

g) In the 8-Queens problem solution, if a queen cannot be placed onto column k, we skip forward to column k+1.  
False, we would backtrack to column k-1 (one queen has to be placed in each column, so all columns must have a queen)

h) If we consider the first level only of a trie storing words in an English language dictionary, the memory

required for a DLB will be greater than the memory required for a multi-way trie.   
True

i) Due to the Pigeonhole Principle, I cannot avoid collisions in hashing if the size of my key space is larger than

the size of my hash table.

True.

j) Hashing a string by adding the ASCII values of its characters results in a good hash function, since it

utilizes the entire key.  
False, that would result in hash collisions if characters produce anagrams.

k) To fix the problem of clustering in a linear probing hash table, we can change the increment from 1 to a large

fixed prime number such as 17 (mod the table size).

False, any fixed increment would cause clustering

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2) (8 points) Consider an emtpy de la Briandais Tree, which uses the lower case letters (plus a string termination

character) as its alphabet, using the implementation that we discussed in lecture. Also consider the following

strings: rain grain rained greed rainy reed

3) (12 points – 6 + 6) Consider the two open addressing hash tables, with h(x) = x mod 13, shown below. Also

consider the following keys (in order): 28, 15, 29, 42, 17, 32

a) Assume that linear probing is being used for collision resolution. Show the table after the keys shown above

are inserted in the order shown above.

b) Assume that double hashing is being used for collision resolution, with increment h2(x) = (x mod 11) + 1.

Show the table after the keys shown above are inserted in the order shown **above**.