Discussion on Algorithms for Interviews

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Sample Interview Questions

1. My interviews with nVidia

2. My interviews with Google

3. Jagannathan's interview with Google

My interview with nVidia - 1st session

1. Reverse the bits in all pairs in a character variable

2. Algorithm to find the number of duplicates in a list

nVidia - 2nd session

1. C program to swap first and last, second and last but one bits in a character variable

2. O(log(N)) algorithm for the above

3. A program to find whether the given system is Little endian or Big endian

4. Find the missing number from the list of 99 distinct numbers which are from 1-100

5. Matching - 4 bits a time can be read. Given a 4 bit pattern, Algorithm to match any pattern from the input

6. Redefine the structure to increase the efficiency (Cache line size 2 words, word size 32 bits, sizeof(int) = word)

   ```
   struct a{int a; int x; int y; int z; int b;};
   ```

   Only a and b are used in the progs.

nVidia - 3rd session

1. Where will 235 will go? Give the e.g worst case insertion when it is highly in balanced

```
       200
       / \
   10   250
        / \
      225 275
```

Write a C program for the insertion in a binary search tree?
void Insert(struct tree ** T, int Elem); (Iterative version)

2.
```
        s                                                      t

    |+++++|       *      |+++++|       *      |+++++|       *      |+++++|
    |        |--------|           |--------|           |--------|           |
    |+++++|              |+++++|              |+++++|              |+++++|
```
Each node has a single pointer. You are always assured that either you will start from s or t. If you start from s, you should reach t. If you start from t, you should reach s. So, what shold be the representation (Pointer values) such that you can from left to right or right to left.

nVidia - 4th session

1. I have the following code with me.

   ```
   unsigned int a, b, c;
   /* a and b are assume to have some values */
   c = (a + b) / 2; // <- There is a bug in this s
   ```

   What is the bug? and how you debug it?

2. Given a 4x4 matrix? Write a C program to test whether the given matrix is an identity matrix or not with as less number of comparisions as possible?

nVidia - 5th session

1. Multiplication is a costly operation. How can you achieve the same without using multiplication for the following statement.
   x *= 100;

2. You are given two positions a and b which represent the positions where the bits are on (From bit a to b are set to 1).

   ```
   For example a = 2, b = 5.
   bits:       1 1 1 1 0 0   -> is the answer
   positions:  5 4 3 2 1 0
   ```

   You need to write a program that returns the interger that represents the given pattern which defined by a and b.

3. You were given a circular linked list and a pointer to particular node. Write an efficient program to delete the element that points in the list?

my Google interview - 1st session

1. Random sampling from unbounded input stream
   Ref: Random Sampling and Shuffling - TACP Vol.2

2. All possible alphabetical strings, given numeral strings from mobile phones

Google - 2nd session

1. How do you sort Million numbers?

2. With constriant 2 Mega Bytes of Main memory?

3. Algorithm whether we can design a message from a Magazine

4. Expected number of times min variable updated?

Google - Personal Interview - Session 1

1. Given the following recurrence relation, write the algorithm for the efficient implementation

$$B(a, b, k) = \max\left(B(a, c, k-1) + \Sigma_{i=c+1}^{N}(V[i]^2)\right)$$

2. Given 3 Giga URLS with 0/1 to be stored along with it, Give an efficient representation to store and retrieve an URL to find whether it is set to 1 or 0?

Google - Session 2

1. Permuations code

2. Code for - Given in order traversal and post order traversal of the tree, find out what is the tree?

Google - Session 3

1. Linked list - swap first two elements, next two elements, ...

2. What is the nth element in an inorder traversal of the tree?

Google - Session 4

1. Given 1000 million x 1000 million image, What information of this image to be stored such that you can find the locations when the given image has modifications

2. Questions on Image based retrieval

Google - Session 5

1. Given Many 2D rectangles with one of the side is on x-axis, give an algorithm to find the outline of these rectangles

Jagannathan's Google interview - Part 1

1. System Design - (e.g) Orkut
   - Where do you store data
   - Time spent retrieval
   - Access from different locations
   - Minimize the latency and bandwidth issues

Jagannathan's Google interview - Part 2

Snippet of information with every link

Given a page of text and some query (a set of strings) find a continuous set of words(let me call it snippet) that contain all the words in the query andÂă the snippet is the shortest possible. That is the snippet should have the least number of words.

Jagannathan's Google interview - Part 3 - 1

1. You have a dictionary(just a set of strings). Given a string, can you print all its anagrams (all permutations of the string present in the dictionary).
   Ref: Can be found in Programming Pearls Text book.

2. Modification of the above question. You are given a string. Assuming each letter in this string can be used once and only once. Form a set of strings that are present in the dictionary using the characters of the given string. Print all combinations of possible words.

```
Consider a string "MADCAT"
Ouput:
1) MAD CAT
2) MAT CAD
3) AM DACT
// assuming all the 6 words above are
// present in the dictionary.
```

Jagannathan's Google interview - Part 3 - 2

1. Many texts in different languages. If you have webpages with text in different languages all having the same underlying character set, how would you seperate them. You have to automatically learn. Think about how you would resolve proper nouns, errors and misclassifications. Can you detect misclassifications over time and correct them. How would you store these amount of data.

2. There are 4 billion integers in a file. How would you print the integers that are not there in the file. The number of integers that are not there are very small.

Programming Pearls - 1 - Cracking the Oyster

1. Sorting 10^7 numbers - Passes (p4)

2. Initialization of numbers when an element in an array is used first time(More space/ Less time) (p207)

2 - AHA! Algorithms

1. File with atmost four billion 32 bits nos. Find a 32 bit int that isn't in the file(p208)

2. Rotate a one dimensioal vector of n elements left by i positions (p14)

3. Find set of all sets of anagrams in a dictionary (p16)

4. Sequ file containing 43 0000 000, 32-bit ints, how can you find one that appears at least twice? (p209)

5. Given push button encoding of a name and returns the set of possible matching names? (p211)

3 - Data Structures

1. Given a word, it must return suffix hyphenations? (p213)

12 - A Sample Problem

1. Output sorted list of m random numbers in the range 0 to (n-1) (p126)

1. **Sampling - Problem: (p142)** Unbiased choice of n records at random from a file containing N records

2. We cannot even n records in memory

3. Accept/Reject as it comes along

4. probability - n / N

5. **Shuffling - Problem: (p145)** t! permutatoins