

## 2021 Spring CSE Viva Voice Questions

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Animesh Mukherjee - AM

Abir Das - ABD

Debdeep Mukhopadhyay: DM

Bivas Mitra - BM

Sourangshu bhattacharya : SB

Bhargab B bhattacharya : BBB

Pawan Goyal: PG

Aritra Hazra - AH

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Partha Pratim Chakraborty - PPC

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Debasis Samanta : DSM

Shamik Sural : SSL

PM - Pabitra Mitra

### I. Algo - 1

- SS: Knapsack problem statement and optimal substructure etc? Is it NP hard? What happens if weights are real numbers (not integers)? What changes are needed?
- AM: Given a dictionary of words and a string. See if it can be segmented into a sequence of words in the dict. Time complexity
- Given two functions  $f, g$  tell if any of these is big O of other. Then asked how Big O works
- Given an array that works as  $A[i] = A[i-1]+1$  or  $A[i]...$  You need find where "this step" occurs...basic Binary search question
- PPC: Explain Dijkstra. Why does Dijkstra not work with a negative edge cost in a DAG? Explain Bellman Ford. Explain Floyd Warshall. Prove why Floyd Warshall gives the minimum path.
- Dijkstras and time complexity and implementation.
- SS: Given a MST, we change one edge weight of MST, find the new MST ([ans](#))
- Somindu: Given  $n$  objects with size  $w_1, w_2, .. w_n$ , and bucket of size  $W$ . How many buckets are required to contain all. Note: You can't split an object.
- RM : List some operations for the Abstract Data Type , Set. How do you implement it?
- AG : Explain why Dynamic programming should be used. Give an example of DP.(LCS). Explain what LCS is. How do you solve LCS? Can LCS be solved in less time than  $O(mn)$ ?
- SSL :  $f_n = O(g_n)$ ,  $g_n = O(f_n)$  then  $f_n = \Theta(g_n)$  . Is this true and under what condition?
- SSL : Given  $f(n) = O(g(n))$ , can we say that  $g(n) = \Omega(f(n))$ ? Prove it.

- PM: Given an array where  $a_{i+1} = \{a_i, a_i + 1\}$  there exists an element in the array for which this property is not followed ( $a_j = a_{j-1} + c$  where  $c > 0$ ). Determine the position of this  $j$ th element. (Soln: Binary search) (find peak in array)
- PPC: Find LCS of N strings.
- PB: Explain the Floyd Warshall algorithm

## II. Discrete Structures

- PM: What is a partial order? Lattice? Distributed lattice and bounded lattice? Examples for everything.
- What is an equivalence relation? Why does it induce a partial order?
- P & C question...given 5 boys and 5 girls find the arrangement in which they can sit...alternative in this question was i) all boys and all girls are identical ii) boy and girls sit alternatively
- AM : There are 20 people and each can have different amounts of friends. Friendship is mutual. Prove that 2 people at least have the same number of friends.
- AM: Prove that for all perfect square numbers, its remainder upon being divided by 4 is either 0 or 1? Keep your notation consistent. (Answer: Divide to odd or even cases and then do mod 4 on both cases)
- ...
- Is the set of Integers a group under multiplication? (No, Inverse may not exist)
- AM: Given  $n \geq 2$ , prove either  $n$  is prime or can be written as the product of primes.
- BBB <3 : 10 strings in set, how many substrings?
- PM : There is a  $2 \times 2$  square which has 5 points inside it. Prove that there exists 2 points which has a distance of less than  $\sqrt{2}$  between them (divide them into 4  $1 \times 1$  square)

## III. FLAT

- AD : Given a lang i.e.  $\{abab^2ab^3ab^4 \dots ab^n \mid n \geq 1\}$ , what type of lang is it? Find its grammar. How do you say if a lang is CFL? What is pumping lemma?
- Soumyajit (AKA: Danger): what kind of language is  $\{ab^nc^nb, n \geq 0\}$ ? (CFL hai) . Write the CFG. Prove using pumping lemma it is not regular
- AD :  $L : a^i b^j c^k (i \neq j \text{ or } j \neq k)$ . What type of language is  $L$  (I answered CFG). Write the grammar for it.
- AD: Given two DFA  $D_1$  and  $D_2$ , how will you efficiently find whether those two DFAs are equivalent, give its algo?

- AD: (Follow-up to above): Are Minimal DFA unique?(For each regular language, there also exists a **minimal automaton** that accepts it, that is, a DFA with a minimum number of states and this DFA is unique (except that states can be given different names).)
- AD: (Follow-up to above): How to find graph isomorphism of two graphs?
- AD: Given a dfa and a relation (definition of relation is given) on DFA, prove it is equivalence relation.
- PG : Prove Language  $L=\{a^i b^j \mid i \neq j\}$  is not regular.

#### IV. Switching Circuits

- DM: Output expression for a 2x1 mux in terms of select line and inputs. Does it remain the same if I replace some operator?
- Given a function, find the minterms in it? Also recreate the functions using nand gates?

#### V. Software Engineering

- UML diagram and sequence diagram i don't know this language
- DSM: Define object, class, relations, blah blah blah....
- DSM: Why is java object oriented?
- DSM: Why do we require object oriented programming?
- DSM: Describe spiral model
- DSM: Describe iterative waterfall model
- DSM: Difference between iterative waterfall and spiral? How can you identify them?
- DSM: Given a choice between spiral and waterfall, which one would you choose to employ and why?
- DSM: How is testing done?

#### VI. Algo - 2

- PPC : NP completeness : how to prove? Travelling salesman problem, how to verify in polynomial time.
- PPC :  $N^{\log n}$  complexity. Is it polynomial?
- Convex hull def, algorithms, time complexity. (Divide and conquer)
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#### VII. COA

- Given two 32 bit numbers A,B the circuit you designed forgot to bring out the  $c_{out}$  . How do you compute it easily with the sum bits and A,B?
- How does the CPU know what to do with an instruction(given the instruction set)(i answered through OpCode). What are the steps taken if an exception occurs while processing an instruction(single core CPU , no threading, Coa oriented answer)(idk)
- BM: Given a memory module of 4Kbx8, design a circuit for 16Kbx16 :(

- DM: Explain the various stages involved in a pipeline. For a given instruction (**ld r1, 0(r2)**), show how exactly these individual components contribute towards the successful completion of this command.
- **SD-Problem on AMAT** 90% L1 1 cycle 90% L2 say 5 cycles main memory 50 cycles
- page size = 1KB, cache size = 1MB, 4 to 1 set associative cache. Tell the number of offset, index and tag bits.
- BBB :A,B,C are positive integers.. [(A+B)-C] gives error, [A+(B-C)] runs without error, can this situation occur? - (Ans: yes, if (A+B) result in overflow)
  - How is overflow detected? - (check sign bit of A, B, (A+B))
- DM: What is the shortcoming of ripple carry adder? Give an alternative architecture of an adder that will overcome this shortcoming? (I said carry look ahead adder and he asked me to explain the different signals in the adder)

## VIII. Compilers

- PPD : Synthesized and inherited attributes, difference & example.(ppd)
- PPD : If a grammar can be used for an LL(1) parser, can that be used for LR parsers? What about vice versa?
- PPD : Given control flow graph, how will you find live variable
- ...

## IX. OS

- BM: Number of page entries given the ram size,page size and virtual address?What does page entries depend on
- BM: Belady's anomaly and why does it happen
- AH: o
- SB - What is virtual addressing? Size of virtual address?
- SB - Advantages of virtual address? What are pages and frames?
- SB - How do we get physical address from virtual address?
- SB - What is a page table? What is a page fault? What happens in case of a page fault?
- SB - What is an interrupt? How is it handled? What are interrupt handlers? What is kernel mode and user mode? How does it change?
- BM: What variable are Semaphores? Explain the working of Semaphore and the implementation of Wait and Signal. How are Wait and Signal ensured to be atomic?
- Sourangshu: Diff between process and thread? And job scheduling algos
- MM - what is shared between parent and child process when fork is done

- Saptarshi - Why is a dirty bit required in the page table? What is Belady's anomaly?
- AH: How system interrupts process like "while(1);"
- AH: deadlock conditions.
- AH: Explain how you can avoid deadlock? Ans : banker algo
- SB: Why is process synchronization needed? What is semaphore and how semaphores work?
- SB: What is PCB and what elements are stored in it? Name a few.
- SB: What is context-switching and how is the process state restored?
- SB: What are file descriptors and what do they correspond to?
- SB: Are local variables stored in PCB?
- SB: Define preemptive scheduling and non-preemptive scheduling.
- SB: Name a good preemptive scheduling algorithm? (Said SRTF)
- SB: What is the factor that SRTF has the best? (Avg Wait Time)
- SB: What are some other factors that we use to benchmark OS scheduling?

## **X. Networks**

- SKG : How does the internet(web) work? Or What happens when you enter a url in the browser?
- Function of TCP? And how many layers and shit
- SC- How to detect congestion control in tcp and how packets are routed to multiple applications open on browser
- SKG - What is CSMA/CD?
- SKG - Asked me whether I know the application layer - Said Yes. Asked about sockets in C. About the arguments and all, Create the socket, connect and bind. Etc. he wanted to hear.

## **XI. ThoC / FLAT last chapter**

- AD : r.e. and recursive languages - definition
- AD : prove if L and  $\sim L$  are re then it is recursive

## **XII. C programming(PDS?)**

- PPD:What is Local static variable?Difference between global and static variable?
- PPD:Two types of parameter passing?differences between two and difference between pointers and reference of variable

## **XIII. Elective - 1 (ML)**

- PM: Explain information gain in the decision tree.
- Explain how you stop overfitting in decision trees (define and explain)

- Given  $\theta$  and a data set. How do you calculate predicted values( $\theta \cdot x$ )? Extend this to matrix form.
- SB : Svm + rbf kernel in very detail with formulas and what each term means. And is it a linear classifier? How do you predict after applying the kernel...
- SB: What is a linear classifier?
- PM: Explain overfitting in the case of a decision tree. Suggest some algorithms to prevent it.

#### **XIV. Elective - 2 (HPPP)**

- What changes need to be done in a neural network code to run it in a gpu?
- ...
- ...
- ...

#### **XV. Elective - 3 (Cryptography and Network Security)**

- Explain how encrypted connections happen between your device and gmail. Explain how gmail send in encrypted message and how keys are shared
- ...
- ...
- ...

#### **XVI. Elective - 4 (Distributed Systems)**

- Define CAP theorem
- ...
- ...
- ...
- SSL: Describe any one leader election algorithm.
- SSL: What will happen to the leader election algorithm if the system divides into two partitions of 7+3 (10 nodes originally)?

#### **XVII. Elective - 5 (Image Processing)**

- ABD: What does a box filter do?
- How do you soft-shadow text in an image (like we do in ppt)

#### **XVIII. Elective - 6 (comp geo)**

- Triangulation of polygon( both convex and simple)
- Some basic questions on time complexities and diagonal detection.
- ...
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DEEEEEEP Learning:

ABD: Difference between Avg pool and global Average Pool. Input and Output size, and number of params.

Information Retrieval

AM : In inverted index, why do we use terms to index and not docs?

AI :

DSamanta : a\* search with heuristic in detail. For TSP. Asked to draw graphs and shit. Does it guarantee global minima? How? Is the heuristic underestimate or overestimate?

Social computing :

Sourangshu : pagerank. Explain the idea behind algo. What is authoritativeness? How is pagerank computed? How do we get transition probabilities? How are they used in the formula? What is teleportation probability? [A very detailed explanation was expected.]

### **Advanced Graph Theory -**

BBB: What is a simple graph? Given 20 vertices and 102 edges , can it be a bipartite graph? How to find if a given graph is bipartite or not?