IIT Delhi MS by Research CSE Dept Written Test+Interview

Date May 22, 2022, Time 10 am to 11.30pm 1.5 hours test

My GATE2022 CSE Score 701 Rank 578

To get shortlisted for verbal interviews, you must get 20% in each of the three sections and 30% overall

Syllabus

Programming Questions (3 questions, 10 marks each)

MCQs evaluating your knowledge on basic maths, statistics, linear algebra, etc. (15 questions, 2 marks each, -1 for incorrect answers)

Reasoning: Here you will be given a paragraph of text, and an accompanying MCQ that requires analytical reasoning over the information provided in the paragraph (5 questions, 4 points each. -2 for incorrect answers)

Basics of math, computer science, ability to comprehend and analyze technical writing, and programming tests. Please revise probability, statistics, basics of linear algebra and optimization, fundamentals of math (~class XII level), programming (any one of C, Java or Python), and computer science fundamentals (data structures, DBMS, Networks, Compilers, OS, etc.)

Questions 2 marks each -1 for wrong

1) no. of edges in undirected graph?

2) graph drawing que

3) s= 1/(2 + (1/ (2 + (1/ (……..)))))

Answer s=? s= (1 / 2 + s)

4)venn diagram

5)graph theory true or false

sum of degree or vertices even? No. of odd degree vertices are even ?

6) two triangle and their angle given find x angle (10^{th} class basic geometry)

7) 5) bayes theorem basic probability question

8)2 dice of abhishek rolls 6 side dice and Ishan rolls 8 side dice.

Probability of number on abhis dice > than number on ishans dice

Probability of number on abhis dice < than number on ishans dice

Probability of number on abhis dice == than number on ishans dice

9)counting question-- 15 chocolates divided in 3 kids(A,B,C) such that A gets 5 always?

10) two dice rolled find E(X) where X is sum of numbers got on dice?

Paragraph Questions 4 marks each -2 for wrong

1) cache direct and fully associative paragraph given MSQ question

2) deep learning and ANN paragraph MSQ

3) page table do light weight process has separate page table?

4) some word and rules to convert it into crypt is given. find the code word for given Word(very easy aptitude like que)

5)

Programming ques: 10 mark each

1)Floyd triangle print the pattern

Example Given n=5

0

10

010

1010

01010

```
void FloydTriangle(int N)
{
    //write your code here
    int p1=0;
    for(int i=0;i<N;i++)
    {
        int print=!p1;
        for(int j=0;j<=i;j++)
        {
            cout<<print;
            print=!print;
        }
        cout<<"\n";
        p1=!p1;
    }
```

```
}
```

2) Counting Number of words in a string

```
 int countNumberOfWords(string story, char delim)

{
    int count=0;
    // write your code here
    for(int i=1;i<story.size();i++)
    {
        if(story[i]==delim && story[i-1]!=delim)
            count++;
    }
    if(story[story.size()-1]!=delim)
        count++;
    return count;
}
```

Eg : Input ??ho'w?are?????? you??? Delim=?

Output no. of words = 3

3) questionTranspose of matrix of m*n

```
vector<vector<int>> correctArrangement(vector<vector<int>> table){
    //write your code here
    int m=table.size(),n=table[0].size();
    vector<vector<int>> correctedTable(n,vector<int>(m,0));
    for(int i=0;i<m;i++)
    {
        for(int j=0;j<n;j++)
        {
            correctedTable[j][i]=table[i][j];
        }
    }
    return correctedTable;
}
```

Result declared on 23 May 1pm **(Selected for Interview)**

Interview

on 25th May 3.30 pm ~30 min interview 5 people in panel 3 asked.

I said I am good at OS and Programming Data structures.

Asked me about virtual memory, demand paging, what is paging how address translation happens etc.

he then asked that page table is stored in main memory then to look into page table and to get the page we need two memory visits, how can this be improved (I think TLB is the answer but discussion never went ahead of this.)

second professor asked this:

draw an undirected graph, what is degree, what is max degree, min degree of any vertex etc some basic graph theory questions.

Now give a proof that there are at least two nodes which will definitely have the same degree.

N nodes degrees can be 0,1,2, 3,…….n-1

Answer was pigeonhole principle

Asked what is it exactly and in this question, what is pigeon and what is hole and some follow ups?

What are your interests and with whom you want to work with etc…?

Since my research interests were inconclusive and I was open to work in any field 5 profs mailed me individually for a talk/ interview (further interaction)

They also said that I had cleared the first official interview, but someone(professor) should be interested in working with me and then only I can get final selection for MSR, and I will be working under that prof (whoever interested in me) for next 3 yrs.

Else if no one is interested in me, I might not be selected.

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1) Prof Vireshwar sir 28th May 5pm

This was a very casual conversation for 15minutes only. He said If I am interested in his areas which was cyber security privacy adversarial machine learning etc. I was not sure of this I asked

what I will be studying under him, which courses, what project etc. (Didn't liked it much plus I had no knowledge/interest in this so told him I will get back to you (so almost no))

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2) Prof Nikhil Balaji and Prof Aashish chiplunkar 28th May 3 pm 1hour

They were interested in TOC, complexity theory algorithms etc

They took my interview for about 1 hour

Asked same pigeonhole question but I said its repeated. Then he said will ask another question based on it.

What is regular language, give one example of language which is not regular, (I said a^n b^n).

Now prove this is not a regular language using pigeonhole.

Hint: use proof by contradiction.

Assume it is regular DFA possible and for every a^i and a^j it will reach to same state of DFA if i==j,

Now let i!=j if a^i Z and a^j Z to reach same state what should be value of Z in terms of b^n

But they are reaching at different states etc hence assumption is wrong

Next question on Cumulative distributed function F(x)=p(X<=x)

Given x1,x2 and f1(x1) and f2(x2) find CDF in terms of f1 and f2 such that prob of X<max(x1,x2)

F(X)=p(max(x1,x2) < x)

F(X)=p(p(x1) < x and p(x2) < x)

F(x)=f1(x1)*f2(x2)

Done

(I was very tired that day as just reached back from Bangalore CDS interview so could not think these easy things too but still they were giving hints and helping)

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3) Abhilash Jindal 29 May 2.30pm phone call 30 min discussion

His interest in systems.

He asked while(true) is an infinite loop which should not be running on single core cpu, how does OS handle this problem?

I said interrupt generation.

What hardware come into picture? Timer is hardwired dumb hardware who just generates the signal upon a very long-time execution. How does OS do this? After some discussion and cross ques, he said that my answer is not right/inconclusive so if you want you read and draft your answer and mail it to me.

Here is what I mailed him:

What is the Infinite loop problem? How does a single core CPU deal with this using a timer?

1) Finding if the loop is there is an undecidability problem, so no algorithm/program can be devised to check if the process has gone into the infinite loop.

2)Timers used in OS, when a process exceeds the threshold execution time, generates the interrupt, which helps kernel take control of CPU and decide to schedule the next process or not. In short, the timer makes sure the OS maintains control over the CPU.

3) Timer cannot be compromised as only privileged instructions will have access to the timer attributes and the mode shifting mechanism comes into picture.

4)When the timer generates an interrupt, control passes to the interrupt service routine (Part of OS). The kernel examines the interrupting instruction to determine what system call has occurred. Then the kernel decides if to give it a fatal error (infinite loop) or to give some more time to execute.

5) another approach can be following by preventing it:

5.a) manually interrupting like we press CTRL + C in terminal when running program is in infinite loop

5.b) can kill process with $ kill pid

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4) Kolin paul 30 May 9am

10-15 minutes Interview.

Asked what your interests are. Do you know scheduling algorithms, how does the round robin work, how it calculates the time quantum (timer), now process completed its time quantum time now what happens?

In terminal you press ctrl+c when a program is not stopping, what does that mean, what happens at that time at cpu level, do you know signals?

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5) Subodh Kumar 30 May 11am

His interest in parallel computing, computer graphics, virtual reality etc. 35 minutes interview

He started by asking what are your interests etc. have you done any kernel/ OS programming? What are the largest lines of code you have written (Web dev portfolio website doesn't count)?

Have you done anything on parallel computing any code/programs or course or any experience (I said no)?

have you written any synchronization codes semaphores etc? what is condition variables in synchronization?

What is AVL tree? Explain with proper definition? What is balancing factor? Max-min node?

How do you find min no. of nodes in AVL of height h? recurrence relation how to solve?

(I tried taking approximations, but the approach was totally wrong and by master theorem we cannot solve direct by any formula)

How do you get that recurrence relation for min nodes and don't say I see the pattern for h=0,1,2,3… as 1,2,4,7

Do you know heap tree? (Yes) explain define? Do you know array indexing of it?

For index I where do its children lies?

Now AVL tree of n nodes given, we must do array indexing of it just like we do for heap tree, now there are holes in between as AVL is not full/complete BT. How many no. of indices of array are needed (including indices for null value nodes)?

(Max height h of AVL is possible when we equate the n nodes with the min no. of node of h height AVL tree. Now with h height a full BT has 2^(h+1) – 1 node, hence 2^(h+1) – 1) indices require. To find height If there are n nodes in AVL tree, maximum height can't exceed **$1.44*\log_2 n$**. which is equal to h of previous equation)

I got Final Selection mail on 9th June 2022 from IIT Delhi CSE Dept for MS by Research. I had already accepted the IIT Bombay MS by Research in CSE offer so I did nothing with the IID offer.

Later IIT Delhi mailed for my reasons for not joining (like a feedback form to be filled anonymously)