For each of the preferred research labs you have chosen in this form, please list:

(1) A brief description of the lab's research area.
(2) The reason you are selecting the lab.
(3) The specific research topics of the lab you are interested in.
(4) Your prior training relevant to the topics of the lab.
(5) Why are you a good fit for the lab?

DREAM Lab

1) Primary focus is on distributive systems for scaling and optimizing machine learning applications.

2)

i) I have interest in systems, which aligns towards the work happening here, and I am curious to explore more in it.

ii) I am also good at the pre-requisites this lab demands.

iii) This lab has some project such as SATVAM, EqWater where given an opportunity, I might be making actual contribution society.

iv) Has active collaboration to industries such as Microsoft research, VMware and Facebook.

3) I am more interested in Designing Distributed platforms for GNN training and then their optimizations.

4) I am good at Operating systems, scheduling and graph algorithms and C++ language which is some of pre requisites this lab demands.

5) The reason I am good fit at this lab is my interest and my skillset/pre-requisite knowledge align to this lab. And apart from this I have good communications skill, strong problem-solving ability and an experience in working in teams which, I believe, are necessary while working as research student.

MARS Lab

1) Primary focus on Large scale parallel application and parallel computing for applications like climate modelling, molecular dynamics, graph algos, ML/DL etc.

2)

i) I know programming language(c/c++) very well and also I have a background in operating systems, which aligns towards the work happening here, and I am curious to explore more in parallel computing.

ii) I am also good at the pre-requisites this lab demands.

3)I am interested in multi node multi gpu frameworks for CS and AI/ML based applications

4)I am good at Programming and Data structures, Operating systems, Computer architectures, algorithms and C++ language which is some of pre requisites this lab demands.

5) The reason I am good fit at this lab is my interest and my skillset/pre-requisite knowledge align to this lab. And apart from this I have good communications skill, strong problem solving ability and an experience in working in teams which, I believe, are necessary while working as research student.

VCL Lab

1) Video surveillance in real time, computer vision and Machine learning for video analytics

2)

i) I am good at the pre-requisites this lab demands.

ii) This lab has project on real world problems like video analytics surveillance.

iii) Has active collaboration to other research labs.

3)person identification problem in both visible and thermal spectrums.

4) I am good at linear algebra and probability and also in programming too.

5) The reason I am good fit at this lab is my interest and my skillset/pre-requisite knowledge align to this lab. And apart from this I have good communications skill, strong problem solving ability and an experience in working in teams which, I believe, are necessary while working as research student.

IISc Banglore MTech CSA Coursework

Date 18 April 2022 9:00 – 12:00 slot

Duration 90 min (anytime between 9 to 12)

4 programming questions each 100 marks on hacker earth platform

Que 1)

https://www.geeksforgeeks.org/minimum-number-deletions-make-string-palindrome/

Que 2)

A collection of integers is taken as input (say vector<int> collection) and the first element integer is N.

You must find if all the factors of N are present in collection.

Output three integers result x y with one space in them.

1) If all factors of N present, then result=1 and x=0 and y=0.

2) if all factors not present result=0 and x is the smallest factor does not present in collection and y is the largest factor does not present in the collection. Note that x and y can be same.

Que 3)

Given an array of intervals where intervals[i] = [starti, endi], all overlapping intervals require one camera only. Return minimum no of cameras required.

Refer this similar question https://leetcode.com/problems/merge-intervals/

Que 4)

Dynamic Programming: Rod cutting variation

Given array of n elements where arr[i] is profit you get after making pieces of mysore-pak for length of I. Find maximum Profit for n pieces.

Example

input 1) n=4 {1,5,7,8}

output 2) max=10 (5+5) two pieces of size=2;

IISc Banglore MTech Research CDS

Written test

Date 10 May 2022 3:00pm

Duration 75 min (start anytime between 3 to 3.30) T

12 MCQ (each with 5 points) and 2 Programming questions (5+10 points).

4 Probability Combinatorics questions

Person forgot last digit of his phone number. Prob of getting the number in <= 4 trials is?

5 colors unlimited t shirts are there. U have basket of size 10 t shirts. Possible ways of taking t shirt? pow(5,10)

3 Linear Algebra/System of Equations questions

Trace of A and A^3 given find determinant of A?

M=A - A^T + AA^T (T is transpose). M is what symmetric/ skew symmetric / symmetric only if A is symmetric etc options given.

1 general aptitude/logic question

2 calculus + function plotting questions

dy/dx=u d2y/dx2=v then d2x/dy2==?

Plot function f(x) =sin(x)* log(|x|)

2 Data Structure, algorithms, programming MCQ.

Worst case time complexity for searching in BST? --O(n)

2 coding questions (5 points and 10 points).

Que 1)

rotate array by m position right (O(n) space allowed)

https://www.geeksforgeeks.org/array-rotation/

Que 2)

Graph is given as adjacency matrix. Standard All pair shortest path Floyd warshall algorithm. After calculating it find the largest of the calculated distances.

Result Cleared Test

Interview 27th May Friday 9am in person interview at CDS IISc lasted for 50 minutes

Prof Yogesh simmhan one mam and another sir was there.

Reached IISc at 7 am security allowed us after 8 am only.

At First, they checked degree certificate and aadhar and then allotted room 201A panel.

I waited for almost 3 hours they were taking interviews for almost 30-40 minutes.

My preferences were DREAM lab, MARS Lab, VCL Lab.

They started with the form they sent earlier that I filled out and read everything that I wrote there and asked some basic questions on it.

I mentioned I studied Programming C++, data structure and scheduling algos etc.

Prof1: asked question, find the kth largest element from an given unsorted array.

Starting with basic approach of O(n^2) complexity then by sorting O(nlogn) complexity asked basic questions all the time.

Then I said we use max heap so to build heap O(n) and k times popping up the topmost element k*(logn) so int total O(n+klogn) is optimal approach. He said compare this with the sorting approach which one is better in which cases?

Prof Yogesh asked then on scheduling algos.

Prof: Name the scheduling algos you know?

FCFS,SJF,round robin, pre-emptive SJF etc.

Prof: Which one is better?

I said everyone have their own advantage like FCFS easy to implement, SJF is optimal, RR is responsive etc.

Prof: How SJF is optimal, can we implement it?

Practically no because we don't know the BT before execution.

Prof: is there any other algo which gives better performance than SJF?

as of now I don't know if there is any better than this sir but among the algos I studied SJF is better.

Prof: Okay can you mathematically prove haw SJF is optimal, and no other algorithm can give better performance than this?

I tried explaining my intuitions that since processes with small BT burst time are executing first later processes wait for less time (gave one example too).

Prof: That's okay but can you write mathematically take BT as Ti and n processes arriving at time 0 etc and show me?

Prof: Okay find the throughput from the equations.

(Similar type of discussion happened for a while he was more emphasizing on the mathematical proof also the way he was asking questions were somewhat philosophical and you probably might not have had thought of it from this perspective when you were learning the same)

Then mam asked what system calls is, user/kernel mode, is the addition expression in your c++ program also has some underlying system call etc.

Declared results on next day 3 pm 28th may 2022

Verdict: **Not selected after interview.**

IIT Bombay MS by Research CMINDS Dept Written Test+Interview

Date May 2, 2022, Time 2 pm to 4pm 2 hours test

Each question 2 marks

28 questions MCQ MSQ NAT

total 56 marks paper

The qualifying mark to be considered for an interview is 30% of the total marks of the online test. only the top 90 candidates based on the online test scores will be shortlisted for the interview stage.

Syllabus:

Calculus Differentiation, Integration, Partial derivatives, Nested integration, Polar coordinates, etc.

Linear algebra Vectors, Linear equations, Vector spaces and subspaces, Orthogonality, Determinants, Eigenvalues and eigenvectors.

Probability Basic probability, Random variables, Sampling, Parameter estimation, Regression.

Algorithms Asymptotic notation, Divide and conquer, Sorting, Searching.

Questions

1) Given three linear eqn find unique solution exist or not ?

2) time required to sort 100000 using merge sort? (nlogn)

3) T(n)= 2T(n/2) + n what is complexity?

4) limit (sin(2z) + 4*z^2 -2z) / ((z^2)*(z+1)^2)

z--→0

5) f(x)= 1 if(x>0)

0 if(x==0)

-1 if (x < 0) find limit of f(x) at x=0,1,-1,+infinity -infinity ?

6)direct formula-based langrage's mean value theorem calculus

7) asymptotic ordering of f1, f2, f3, f4.

F1=1/x f2= (x^2)/(e^x) f3= (x^4)/((e)^(x^2)) f4=1/logx

8) matrix given find maximum eigen value?

9)two coins are there with p of head of coin 1 is 0.7 and p of head of coin 2 is 0.2. p of choosing coin1 is 0.3 and coin2 is 0.7 then probability of getting head provided the coin used is coin 1?

10) binary search tree is there to find element 363 which can be search path possible options given.

2-3 que on normal distribution and probability.

2 questions on basic differentiation.

Result declared on 4 May 6pm **(Selected for Interview)**

Interview

Interview Date 10 May 10, 2022 10.15 pm 25 minutes

1) a fair coin tossed 333 times what is probability that no. of heads more than no. of tails?

2) two arrays given. Each array individually has unique elements. find Intersection/common elements of these two?

I gave two approaches first one with unordered map time O(n) space O(n)

Another sort two arrays and use two pointer (similar to merging in merge sort) time O(nlogn) space O(1)

Similar que with some addons for practice

https://leetcode.com/problems/intersection-of-two-arrays/

https://leetcode.com/problems/intersection-of-two-arrays-ii/

3) Random variable definition E(x) formula PDF etc

Verdict: (Did not get selected but may be because I got the MS by Research in CSE Dept which was having higher preference than this and any IIT offers only one offer of one Dept at a time (even if I get selected in multiple depts of same IIT) and that too of highest preference only)

IIT Bombay MS by Research CSE Dept Written Test + Interview

Written Test (Cleared)

Date May 2, 2022, 9 am to 12 pm

3 hours subjective test each que 10 marks 120 marks paper

3 streams we have to chose one stream beforehand.

1) Intelligent systems (3 panels)

2)Computing systems (3panels) (My preference)

3) Theory (2 panels)

Total 12 questions to be solved from only one selected stream. Each panel of each stream min 8 questions.

1) Token1 a token2 a(b+cd)*b token3 a(b+cd)*cd

Find minimum DFA with tokens as their final states?

. abbadbacdabbcdbb is this string can be parsed/detected by scanner or not? why?

2) question on paging do address translation page table given page size given

```
Int z;
Int recur(int x)
{
    Int y=1;
    If(x<=30)
    {
        x=x+z;
        y=recur(x-y);
        z=x*5;
    }
    Return z;
}
```

```
Main()


{
        W=1,z=15;
        z=recur(z-w);
        print(z);
}
```

Find output explain global/local variables, parameters passings, activation records and temporary results too.

4) Programming language scope resolution questions

5) you will given h,w return h*w matrix with following patterns given in example

Let h=4,w=6

```
* * * * * *
* + * + * +
* * * * * *
* + * + * +
```

6)

```
int gcd(int x,int y)
{
        Int init;
        If(x<y)
                ----------
        Else
                Init=y;
        Int g;
        For(g=init; ----------;g--)
        {
                If(---------- and ----------)
                        ----------;
```

```
        }
        Return ----------
        }
```

Fill the blanks.

6) page size page table give VA convert to phys address

7) how much RTT for window size to reach 1MB from 1KB?

8)sender window size in stop-n-wait protocol numerical?

9)25 host required, address given, find no.of subnets formed ?

Hamming distance id can detect d-1 erros can correct (d-1)/2 numerical?

10)Blockchain question

11) CN throughput efficiency numerical?

12) two Binary search tree given, insert elements one by one, find leftmost of tree1 and rightmost of tree2? Heapsort time complexity? Average comparison for searching in linked list of k elemments?

13) partition algo given and an array is given find the output of code on array after execution?

14) find output for n=8;

```
Int rec(int n)
{
        If(n!=0)
                Return n-rec(n-1);
        Return n;
}
```

15) logic question quantifiers true false, combinatorics question

Result Declared on 5th May Morning

Result: Cleared Test Selected for Interview

Interview

Interview scheduled on 7th May 9:40 am to 10:20 am (Approx 40 minutes)

Questions:

1) which subjects you are comfortable with?

(I said OS and Data Structure)

2) what are some scheduling algorithms you have worked on?

FCFS, SJF, Round Robin

3) in SJF how do you know the execution time of processes beforehand? (You predict with aging algo or based on type of process)

4) Explain round robin? Which one is used in current operating systems? How do I decide what time quantum to take? When the processes get preempted in round robin explain with queue operations?

5) what is ternary tree? If given number of nodes what s height? (I generalized and explained for k arry tree too)

6) draw a tree. M is No. of nodes having two children and n is No. of node having 1 child. Find no. of leaves on tree.

7) can groups be finite and infinite? (Yes) give example of infinite and then of finite? is multiplication modulo 5 over set {0,1,2,3,4} is group or not?

8) what is virtual memory, demand paging?

How does paging works, address translation works, virtual add to phy address, page table etc

9) in demand paging how do search pages in secondary memory?

10) also how do you bring pages from secondary memory into main memory?

11) page table is stored in MM, how do you access it for paging?

(These 8-11 Operating system question were very brutal, he never looked like convinced or happy, always interrupting me in between and misunderstood that I was a something Instrumentation branch or so student and not a CSE student)

12) Product of an array is product of all its elements ex arr= {1,2,3}, product =6.

An empty array of n element is given, and a number k is given. Find max possible product of array by distributing k to n elements?

Like this statement:

We are given two numbers, n and k. We must find n numbers such that

x1+x2+⋯+xn=kx1+x2+⋯+xn=k

x1∗x2∗.....∗xn=maximumx1∗x2∗.....∗xn=maximum

What are the values of x1,x2,...xnx1,x2,...xn if these numbers can be any real number ?

What are the values of x1,x2...xnx1,x2...xn if these numbers have to be non-negative numbers ?

(I didn't actually answer this question cause while I was thinking they dropped it due to time constraint plus I assumed k as integer which they didn't tell initially, their mistake I guess, so I only try telling base cases assuming k integer.

13) You graduated in 2021, what were you doing since then?

(I said I had placement offers from two service-based companies, but I rejected them as I wanted to go for higher education and that too from IITs hance I dedicatedly prepared for GATE exam only and nothing else)

13) do you have any questions? (I asked what qualities you were looking from a candidate)

14) you applied to CMInDS and CTARA too. If you get CMInDS/CATARA and CSE which, do you prefer and why?

Result Selected for final offer in round 3 of COAP 3rd June 2022

Result Day:

Since they were declaring offers from COAP round 1 itself and didn't get this in round 1 and 2, Lost all hopes and was not expecting this in 3rd round. Day before round 3 I was hoping to get some new IIT like mandi or jodhpur.

3rd June morning I checked COAP I was surprised and so happy but doubtful too. I had 4 offers Mandi, Goa, Patna and Bombay. I checked twice thrice, checked from another browser, checked if it is my login only or not etc.

Then I went to my mother and said, "Guess which college I got in 3rd round today?" she said IIT Powai (she knows it by Powai name and was very optimistic from the beginning).

So, I told her I got Mandi, Goa, Patna only. And she said, "you will get Powai in 4th round then, but you will definitely get it".

Then I gathered everyone in kitchen, my father, and brother, and then announced I got IIT Bombay, that too in CSE Dept. everyone was very happy. We waited for mail from IITB for provisional offer letter till 11 am. After that we told our relatives and put it on the WhatsApp story.

This one is the happiest day in my life.

Also, after 5 days I got offer from IIT Delhi MSR CSE too. Cherry on cake.

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.

---

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))

---

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)

---

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

---

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?

---

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)

IIT Delhi MS by Research ScAI Dept Written Test and interview

Date May 14, 2022, Time 2 pm to 5pm 3 hours test

41 questions MCQ MSQ NAT each of 1.5 or 3 marks

3 que programming 10 marks

Syllabus:

Calculus Differentiation, Integration, Partial derivatives, Nested integration, Polar coordinates, etc.

Linear algebra Vectors, Linear equations, Vector spaces and subspaces, Orthogonality, Determinants, Eigenvalues and eigenvectors.

Probability Basic probability, Random variables, Sampling, Parameter estimation, Regression.

Algorithms Asymptotic notation, Divide and conquer, Sorting, Searching.

Questions

1) which is stable sort algo?

2) 4-5 aptitude questions --- circular sitting, row wise sitting, 1 Profit loss, 1 time work, DELHI typed as CEDFKMGIHJ then BOMBAY == ?, angle between hour and minute hand at 6:15 pm, venn diagram etc

3) how many edges in transitive closure of Directed graph of n edges?

4) correct probability distribution of Bayesian network drawn below.

5) some 6-7 que on Machine learning neural nets etc. (I didn't know any of this)

6)f(z)=(1/(1+ e^(-z))) what is f(-z), f(1-z), f'(z) etc

7) array given, basic stack operations given and find final state of stack .

8) matrix given find maximum eigen value?3-4 time complexity ques. (2n)^n and n^(2n) etc

9) recursive code given on tree find final answer called fun(root,3) full bin tree of 7 nodes given

```
Fun(root,sum)
{
        If(!root)
                Return sum;
```

```
        Else
        {
                Sum=sum+fun(root->left,sum);
                Sum=sum+fun(root->right,sum);
                Return sum;
        }
}
```

10) rank of matrix que

11) probability density fn given find E(Y) where Y=3x^2 – 2x^3

12) one eigen value fiven of its corresponding two eigen vectors given find |A| determinant

13) 10 circles c1,c2,c3….c10 , radius of Ci=2*i find area of all of them.

14)3x^2 – 4x+1 in defined in [-1,1] for x= what maxima and minima occurs

15) total no of squares formed in 8*8 chessboard

Programming ques: 10 mark each

1) m*n matrix given, find total no. of possible ways from 0,0 to m,n going through p,q

Where 0 < p < m-1 and 0 < q < n-1.

Similar to this

https://www.geeksforgeeks.org/count-possible-paths-top-left-bottom-right-nxm-matrix/

2) Directed graph given a matrix mat[i][j] => edge time from i to j.

Return all the nodes who have their difference of (outgoing – incoming) maximum amond all nodes difference

E.g. Answer returned is node 0,2 as max =2

nodes	0	1	2
0	0	2	4
1	1	0	2
2	3	5	0

Nodes	Out	In	diff
0	6	4	2
1	3	7	-4
2	8	6	2

3) hash map related question easy one

Result declared on 26th May 4pm **(Selected for Interview)**

Interview

Interview Date 2 June 2022 (Did not appeared as already got MS by Research in CSE IIT Bombay)