Institute: **Indian Institute Of Science, Bangalore** Date: **17th-18th May,2021**

CSA Department

Duration : 20 minutes (Over Google Meet)

Panel : Prof. Sidhharth Barman, Prof. Gagan Thope, Prof Sushila Devi.
Prof Gagan Thope first introduce myself by going through information from my application.

1. **Probability :** (By Prof. Barman)
   (a) Asked me about my masters thesis and work I am doing at IIT-kgp currently.
   (b) Given n iid random variables $X_1, X_2, ...X_n$ which draw values from $Uniform[0,1]$ distribution. Find $Exp[max_i X_i]$
2. **Linear Algebra :** (Prof Sushila Devi) :
   He first asked me what I have prepared and I replied basic random variables and distributions.
   (a) What is column space?
   (b) what is eigen values and eigen vectors?
   (c) Find the eigen values of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$
   (d) Prove that if λ is eigen value of A, then prove λ^k is eigen value of A^k
   (e) Prove $(ABC)^{-1}$ is $C^{-1}B^{-1}A^{-1}$
   (f) Following System of Linear Equation:
   U+V+2W=2
   2U+3V-W=5
   3U+4U+W=c
   Find the value of c for which system is consistent. Also find the solutions.

EE Department

Duration : 30 minutes(Over Microsoft Teams)

Panel : Prof. Ramakrishnan A G, Prof. Prasanta Kumar Ghosh, Prof Soma Biswas and other cant remember the name.
Prof Ramakrishnan A G first introduce myself by going through information from my application.He also asked me about my current work at iitkgp in brief.

1. **Linear Algebra :** (By that other prof)

(a) Eigen Vector, Eigen Values

(b) Characteristics equation. Why $det(A - \lambda I) = 0$?

(c) Can eigen values be complex number? Find out the eigen values for rotational matrix.

(d) Prove that eigen values of symmetric matrix is real.

2. **Probability :** (By Prasanta Kumar Ghosh) :
He first asked me what I have prepared and I replied basic random variables and distributions.

   (a) What is Random Variable, What is probability density function?

   (b) Tell me one such distribution (I replied Uniform). Write the pdf of uniform distribution.

   (c) Suppose $X : U[0, 1]$ is a random variable, which we want to transform to $Y : U[-1, 1]$, what transformation operator we should use?

   (d) Suppose $X : U[0, 1]$ is a random variable, which we want to transform to $Y : exp(\lambda)$, what transformation operator we should use? Ask to say the general method.

3. **Machine Learning :** (By Ramakrishnan A G) :
He asked me to write the multivariate Gaussian distribution. I wrote it, Then he asked whats the exponential term called, which is used as a distance in Machine Learning. I was confused. He helped me saying its related to the state I belong and I replied "Mahalanobis Distance".

ECE Department

Duration : 30 minutes(Over Google Meet)

Panel : Prof. Neelesh B.Mehta, Prof. P. Vijay Kumar
Prof Neelesh B.Mehta first introduce myself by going through information from my application.

1. **Linear Algebra :** (By P. Vijay Kumar)
He first asked me what I am comfortable with in Linear Algebra. I replied eigen vectors, vector space.

   (a) Eigen value and Eigen Vector

   (b) Prove If a matrix has unique eigen values, it's eigen vectors are linearly independent.

   (c) Prove that eigen values of symmetric matrix is real.

   (d) Basis of vector space. Dimension.

   (e) How to form a basis of a vector space of dimension is 3 when you are given 5 vectors which spans the space.

   (f) How to form a basis of a vector space of dimension is 3 when you are given 2 vectors, which are independent.

2. **Probability :** (By Neelesh B.Mehta) :

(a) Exponential Distribution. Prove its memory-less property. Prove its the unique continuous distribution which has this property.

(b) Write the pdf of Gaussian Random Distribution.

(c) Given $X : N[\mu, \sigma]$ and $Y = exp^X$,find the pdf of Y.

(d) Suppose you are given a fair dice and it is thrown until a '4' appears. What is the expected number of throws of the dice? Prove why the expectation of geometric R.V is $\frac{1}{p}$, where p is the probability of success.