Quant Quest

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1 Instructions

So these are the "interesting" questions

- Did you notice the dearth of 10/10 difficulty in the previous paper ? Here it comes
- If you have asked for this... uhh.... May the force be with you.

Good luck!

Name: _____

Entry Number: _____

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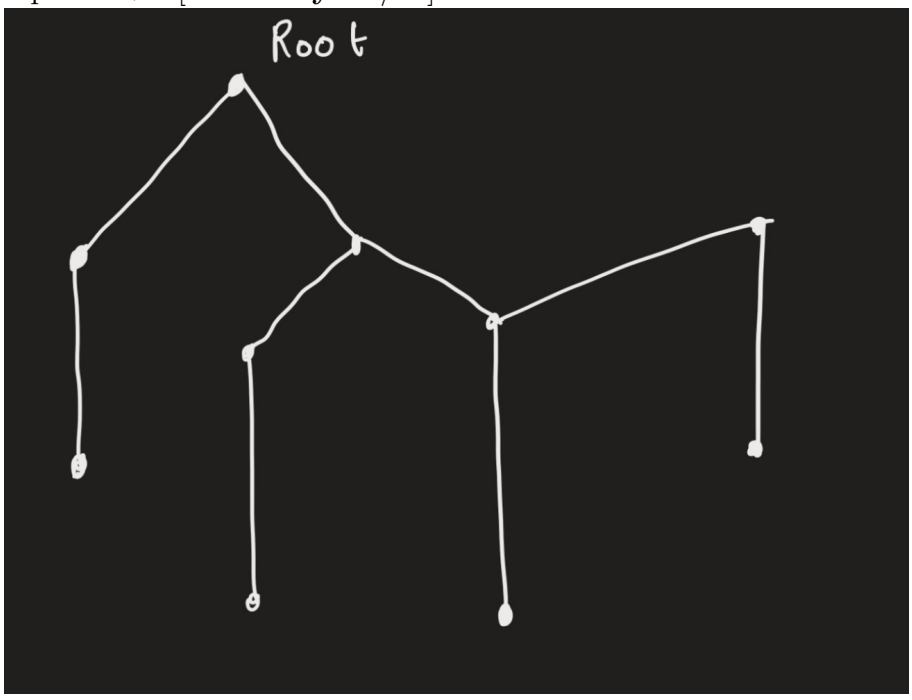
1. (10 points) Pravar decided to give the following problem to Tejas to help him with his interview preparation. If $X_1, X_2 \cdots X_n$ are Independently and identically distributed random variables such that X_i is $\mathcal{U}(0,1)$ for all i.
   Let Random Variable $N = \mathsf{min}\{n : X_1 + X_2 \cdots X_n > 2\}$, find $\mathsf{E}[N]$. If Tejas calculates it to be $ae^2 + be$, where a and b are integers, report $a^2 + b^2$. [**Difficulty** : 10/10]

2. (10 points) Bagchi is the CEO of a VC-firm named Silverwoman that wants to invest in a new emerging sector. That sector currently has 2 competing players namely Taskmasters and Gnadig. Silverwoman can only invest in one of the players due to conflict of interest concerns. Taskmasters are risk takers and fast movers while Gnadig's philosophy is of slow and steady movement. We do our analysis for a fixed but large time-period. Given a favourable market, investing in Taskmasters will result in profits worth 100M $ and investing in Gnadig will result in profits worth 20M $. On the flipside, given an unfavorable market investing in Taskmasters would lead to losses worth 150 M $ and investing in Gnadig would lead to losses worth 10M $. The chances of a favourable market are 50%. Bagchi can either take the decision of investing herself or hire Gain and Company and make a decision based on what they predict. Given a favourable market, Gain and Co. makes a correct prediction 90% of the times. However, they are bad at predicting an unfavourable market. Given an unfavourable market, Gain and Co. makes a correct prediction only 60% of the times. Because of this, Bagchi doesn't fully trust their predictions and goes against them with 10% probability. (Hint: Bagchi makes her decisions based on expected values) Should Bagchi hire Gain and Co. ? If yes, what is the maximum amount she is willing to pay them ? Should Bagchi increase her trust in

Gain and Co. ? If ans is x M \$, then report x. [**Difficulty** : 8/10]

3. (10 points) Pravar decided to draw a tree to play a game with Pratyush. Pratyush would uniformly at random select a node, and then remove the entire subtree rooted at that node, until he selects the root and the entire tree is removed. What is the expected number of times pratyush is going to remove a node. If the ans is a/b in the lowest form, report $a + b$ [**Difficulty** : 9/10]



End of exam.