Tutorial-3
CSL-471, Probability and Computing

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1. Give a zero knowledge proof for graph-3 coloring.

2. Consider a variant of the contention resolution problem.
   There are n processes $P_1, P_2, \ldots . P_n$ who wish to acquire some of the processor's time in each round. Let say each process asks for the processor's time with probability p in each round. Further suppose that the processor accepts requests in each round if the number of requests are less than or equal to 2 (i.e. 1 or 2). Let $E[i, t]$ represent the event: i^{th} process receives the processor's time in the tth round. Find the value of p for which the $E[i, t]$ is maximized.
   Explain its analysis.

3. We are aware with the coalescing process in Karger's algorithm for finding min cut. **Assume that the graph is having only one min cut**. You take one edge at a time uniformly at random and coalesce it. You keep doing it till the time only two vertices are left in the graph. What is the probability that you end up getting a min cut.

4. If we repeat the process described in question 3, λ times, and choose the min cut amongst all the solutions, what is the probability that we end up getting a min cut.

5. Explain a randomised algorithm for 2 SAT.

6. Assume you have a deck of cards, you flip all the cards and keep them on a table. Pick a card, guess its value and keep it separately. Pick another card, guess it, separate it. Assuming you have no memory power, that is, you can not remember what all cards you have seen till now, what is the expected number of cards guessed correctly?

7. In the above question, assuming that you can remember the cards that have already been separated, what is the expected number of correctly guessed cards?

8. Consider the stupidsort algorithm below. What is its time complexity ?

```
void stupidSort(int []array){
    while (!sorted(array)){
        shuffle(array)
}}
```

9. If we pick five numbers uniformly at random from the set {1,2,3...100} without repetitions. What is the probability that every number picked is strictly less than the previous number?