Discrete Structures/Math information from Rika (bold faced are available as [Math Tutors](link) (link))

1) Most job interview questions are from CS311 and Discrete Math. They are related to analysis of algorithms and solving some real-life Math problems.
2) **Abstraction** is very important since CS is all about creating a general solution using variables.
3) Being able to map real-life situations to math equations is very important for CS majors.
4) Predicate Logic is used in CS to express our thoughts. E.g. database queries, knowledge representation in AI. It is important to know how to translate English sentences into predicate logic and know the limitations of predicate logic.
5) To analyze algorithms, you have to be able to first represent the number of operations as an equation or a recurrence relation.

   e.g. **Sum of** k as k varies from 1 to N-1 for the number of comparisons done by a sorting algorithm that corrects one pair at a time.

   e.g. $W(N) = 2W(N/2) + N$ for the number of comparisons done by a recursive sorting algorithm.

   e.g. N! for all the possible paths through N cities you need to examine.

   e.g. **X^N** for all the ways of choosing one of the X's for N items.

4) In the theory class, you will have to prove that

   The grammar G is for the language L using induction on the lengths of strings.

   The language L is not regular using proof by contradiction

   The language L is not context free using proof by contradiction

6) **Trees** are good ways to show how **logs** and recurrence relations can be used to show the properties of trees. Trees are used to analyze algorithms.

   Statistics:
   Conditional probabilities and Bayes Theorem are used in Natural Language Processing and informatics
   e.g. what is the probability that you will find Y after seeing S in a word?

   Linear Algebra:
   Linear Algebra is essential in graphics and game programming.

   Calculus:
   Calculus is very important in machine learning, especially in classification problems.

In general, math is fascinating.
Without Geometry, we cannot implement GPS.
Without number properties, we cannot do Hashing; we cannot do Encryption.
Math is the foundation of computer science!