Discrete Mathematics
Logic
SAT Problem - Part 2
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Now an important note specially for computer science students you can look up this concept called SAT problem. It's called the satisfiability problem. It's a very important problem in computer science and it is not known to be - it's known to be not so easy to solve this. Okay. What is the problem? Assume you are given several see we have only being seeing P, Q and so on. Let's assume we have several columns here, A,B, C, D, E, F, G, H, and I. So that makes it 1, 2, 3, 4, 5, 6, 7, 8, 9 let's include J also 10 columns and I have a complicated Boolean expression which involves all these ten variables, A,B, C, D, E, F, G, H, I and J. Now the question is tell me if there is assignment to A,B, C, D, E, F, G, H, I, J which makes the Boolean expression becomes 1? So what do I mean by this? These are all inputs to my Boolean circuit you see. Is there a input that gives the answer as 1? How do I even solve this question? What I should do is I should try all possibilities. Put A equal 01. Put B equal 01. C equal 01. D equal 01. you see it's a ten digit binary number. For every possibility I should check whether it will return 1 or not. Correct? So there are 2 to 10 possibilities because there are 2 to the 10 possible binary numbers that are ten digit long. For each of these assignments of 0s or 1s to A,B, C, D, E, F, G, H, I, J, I must check whether my output is 0 or 1.

Some one assignment might give me 1. Correct? So I repeat the question is given a long Boolean expression with ten variables like this and you are asked to find an assignment that makes it 1 you must try all possible 0s and 1 assignment to these Boolean variables and then see which one gives 1. 2 to the 10 is a very big number. 1024 correct. If you think this is not so big assume you had 100 Boolean variables. 100 Boolean variables in your Boolean expression. Then you should try 2 to the 100 possibilities. Now that is actually an astronomical number. 2 to the 100 is very huge. Correct? So that is a reason why the SAT problem is tough. It's not so easy to solve this even with super computers you will not be able to do much when you have many Boolean variables. Of course I am not getting into the details of this. This is not actually part of our discrete math syallubus but it's a very motivational introduction to what is called complexity theory which computer science students will be studying later. It's a good idea to open a thread here so that they can relate to it when they encounter it in the other subjects.