

Week 11 Q1

In the lecture for P vs NP, we discussed the SUBEXP class as a subset of the EXP class. Do you think there is any relation between EXP and SUBEXP? You may want to read up on Exponential Time Hypothesis.

The Exponential Time Hypothesis (ETH) states that 3-SAT is not solvable in subexponential time in the worst-case. In other words, any algorithm that solves the 3-SAT needs at least exponential time. Suppose the ETH is true, then it means that SUBEXP is a strict subset of EXP, that is, there is a decision problem (3-SAT) that is not solvable in subexponential time but is solvable in exponential time (Note that 3-SAT is solvable in exponential time by simply trying out all possible assignments to the variables). Another implication is that if the ETH is true, then P is not equal to NP. This is because the 3-SAT which belongs to NP and is complete for NP has no polynomial-time algorithm (if there is no subexponential time algorithm, it directly implies there is no polynomial-time algorithm).