

CS5120: Assignment Two

Deadline: 06/04/2023

1. In the k -SAT problem, the input is a set of m clauses over n variables, with each clause having exactly k literals (with no variable repeated in a clause). Describe a deterministic algorithm that given a k -SAT instance, finds an assignment that satisfies at least αm clauses, for a suitable value of α .
2. In class, we say an algorithm for finding the length of a stream using $O(\log \log N)$ bits of memory, where N is the (unknown) length of the stream. We had a counter initialized to zero and that was incremented with probability $\frac{1}{2^C}$, when C is the current value of the counter. Let $C[n]$ denote the value of the counter after seeing n items. In class, we proved by induction that $E[2^{C(n)}] = n + 1$. Prove that $\text{Var}[2^{C(n)}] \leq n^2$.

[This bound is useful for arguing about the approximation guarantee when taking the average of many counters. See notes.]