CS328 – Autumn 2019 — Assignment 1

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Collaborator: None

4.

5. Let X be the random variable denoting the run time of the algorithm.
Then we have, $E[X] = O(n^2)$. i.e., $E[X] <= an^2$, for $a > 0$.
Now, consider $b > a$, then by Markov's inequality, $Pr[X \geq bn^2] \leq \frac{E[X]}{bn^2}$.
$\implies Pr[X \geq bn^2] \leq \frac{an^2}{bn^2} = \frac{a}{b}$
Since, $b > a$, let b=ka ($k > 1$).
Thus we get, $Pr[X \geq bn^2] \leq \frac{1}{k}$, i.e., $Pr[X \leq bn^2] \geq 1 - \frac{1}{k}$
For sufficiently large k we get $Pr[X \leq bn^2] \approx 1$. Thus, Markov's inequality tells us that the probability that the run time of the algorithm is less than bn^2 is almost 100%. Thus, the run time is always less than bn^2.Thus, **the worst case run time is** $O(n^2)$.$(Ans.)$

6. The two topics that I feel I could not understand were: Singular Value Decomposition and Expectation Maximization (EM) algorithm.