### 18.440 PROBLEM SET SIX, DUE APRIL 1

## A. FROM TEXTBOOK CHAPTER FIVE:

1. Problems: $14,17,33$
2. Theoretical Exercises: 9, 12, 15, 19, 29, 30
B. At time zero, a single bacterium in a dish divides into two bacteria. This species of bacteria has the following property: after a bacterium $B$ divides into two new bacteria $B_{1}$ and $B_{2}$, the subsequent length of time until each $B_{i}$ divides is an exponential random variable of rate $\lambda=1$, independently of everything else happening in the dish.
3. Compute the expectation of the time $T_{n}$ at which the number of bacteria reaches $n$.
4. Compute the variance of $T_{n}$.
5. Are both of the answers above unbounded, as functions of $n$ ? Give a rough numerical estimate of the values when $n=10^{50}$.
