## 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 Bdivides 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.

- 1. Compute the expectation of the time  $T_n$  at which the number of bacteria reaches n.
- 2. Compute the variance of  $T_n$ .
- 3. Are both of the answers above unbounded, as functions of n? Give a rough numerical estimate of the values when  $n = 10^{50}$ .