Chapter 11 Problems

1. Jack and Jill are independently struggling to pass their last (one) class required for graduation. Jack needs to pass Calculus III, but he only has probability .30 of passing. Jill needs to pass Advanced Pharmaceuticals, but she only has probability .46 of passing. They work independently.

Let $X = 0$ if neither of them graduates, or $X = 1$ if exactly one of them graduate, or $X = 2$ if both of them graduate. Find the expected value of $X$. 
2. Four students order noodles at a certain local restaurant. Their orders are placed independently. Each student is known to prefer Japanese pan noodles 40% of the time (it is a very popular and tasty dish!). How many of them do we expect to order Japanese noodles?

Please justify your answer using the methods we have learned so far in class, i.e., briefly consider the 16 possible outcomes and then compute the expected value. (Don’t just write (.4)(4) = 1.6, even though we will see on Monday that 1.6 is actually the correct answer! Please follow the intermediate steps carefully.)
3. Bob’s music player, in “shuffle” mode, will play songs without any repetitions, until every song has been played exactly once. The number of songs of each genre is the following: 330 blues songs; 537 jazz songs; and 1 folk song. So there are 868 songs altogether. (All possible “shuffles”—i.e., all possible orderings of the 868 songs—are equally likely.) How many songs does Bob expect to listen to, until the folk song finally appears?

Please justify using the methods from class. Hint: Use the method in Example 11.8.
4. The Super Breakfast Challenge (SBC) consists of bacon, eggs, oatmeal, orange juice, milk, and several other foods, and it costs $12.99 per person to order at a local restaurant. It is known to be very difficult to consume the entire SBC. Only 10% of people are able to eat all of the SBC. The other 90% of people will be unable to eat the whole SBC (it is too much food!).

A probability student hears about the SBC and goes to the local restaurant. He observes the number of customers, $X$, that attempt to eat the SBC, until the first success. So if there are 4 failures and then 1 success (i.e., the outcome is $(F, F, F, F, T)$), then $X = 5$.

Find the expected value of $X$, i.e., the number of customers expected to try the SBC until the first success. Justify your answer completely—please do not only write the answer. (Hint: Your answer should follow along the same lines as Examples 11.9, 11.10, or 11.11.)
5. Create your own scenario with a discrete random variable $X$ that has a *finite number of possible values*. Compute the expected value of $X$. 


6. Create another scenario of your own, with a discrete random variable $X$ that has \textit{infinitely many possible values} (similar to the SBC example, or to Example 11.9, 11.10, or 11.11, for instance). Compute $E[X]$. 