Extra Credit 8

Two women met after not seeing each other for ages.  
One asks another: How many kids do you have? 2.  
At least one of them is a boy? Yes.  
What is the probability that the other is a boy?

So, let's assume:

* There is a 50/50 chance of being a boy or a girl for both kids
* The genders of both kids are mutually independent (mathematically speaking, this means that the outcome of one random event does not affect the outcome of another event; in this case, the gender of one kid does not affect the gender of another.)

Let's find the Probability that K2 is a boy given that K1 is a boy.  
But how do we do that?

First, Let's list out all of the possible permutations of gender for two kids:

1. <Boy, Boy>
2. <Girl, Girl>
3. <Boy, Girl>
4. <Girl, Boy>

This is called the universal set for this scenario, basically it's all of the possible outcomes of genders for two kids:

Since we know that one of the kids is a boy, we can narrow our choices down a bit:

1. <Boy, Boy>
2. <Boy, Girl>
3. <Girl, Boy>

This is called the sample space, it's all of the possible outcomes given the constraints applied in our specific inquiry. That is, that at least one of the kids is a boy.

Of these three outcomes, we can see that there is only one that satisfies the condition that both kids are boys:

1. **<Boy, Boy>**
2. <Boy, Girl>
3. <Girl, Boy>

**Thus, our answer is 1/3**

***We can also use conditioning to solve this:***

P(Both boys | At least one boy) = P(both boys) / P(At least one boy)

P(Both boys) = .5 \* .5 = .25  
P(At least one boy) = 1 - P(No boys)  
P(No boys) = P(Both girls) = .5 \* .5 = .25  
P(AT least one boy) = 1 - .25 = .75

**Thus, P(Both Boys | At least one boy) = .25 / .75 = 1/3**