

1. A family wishes to have 3 children. Assume throughout the problem that boys and girls are equally likely.

- a. Write down the sample space for the three children in the family.

BBB,BBG,BGB,GBB,GGB,GBG,GGB,GGG

- b. What is the probability that the family will have at least one girl?

There are 7 outcomes with at least one girl so the probability is $7/8$

- c. What is the expected number of girls the family will have?

$$0(1/8) + 1(3/8) + 2(3/8) + 3(1/8) = 12/8 = 1.5 \text{ girls}$$

- d. Suppose now that the family decides to have 8 children. What is the probability that they will have no girls? (don't try to write down the sample space)

There are $2^8 = 256$ possibilities in the sample space. Only 1 (the all boy) outcome has no girls so the probability is $1/256$.

- e. What is the probability that they will have at least one girl (Hint: at least one girl means not zero girls).

All of the outcomes except the all boy have at least one girl so $255/256$.

2. At one point in the 2008 US Presidential Campaign there were 7 candidates from the Republican or Democrat party still in the running:

Democrat Party Candidates: Clinton, Obama, Gravel

Republican Party Candidates: McCain, Romney, Huckabee, Paul

- a. How many different ways can the candidates be lined up?

$$7! = 5040$$

- b. How many different ways can the candidates be lined up so that no one is standing next to someone else of the same party (no Republicans next to each other and no Democrats next to each other)?

It must look like RDRDRDR (i.e. Republicans on each end since there are only 3 Democrats). The number of ways to do this is:

$$4*3*3*2*2*1*1 = 144$$

- c. Selecting only from the list of Republican candidates, how many ways are there to choose a President and a Vice President?

$${}_4P_2 = 4*3 = 12$$

- d. Suppose three candidates are selected at random from the seven above. Find the probability that exactly two of them are from the same party.

There are two cases: 2 dems and 1 repub., or 1 dem and 2 repubs:

$$\frac{{}_4C_2 * {}_3C_1 + {}_4C_1 * {}_3C_2}{{}_7C_3} = \frac{6*3 + 4*3}{35} = \frac{30}{35} = \frac{6}{7}$$

- e. The seven candidates are being chosen randomly for a game of dodgeball. What is the probability that the 3rd person chosen is a Republican?

There are several ways this can happen (note we don't care what happens after the 3rd person is chosen so I'll just list the first 3 chosen):

DDR, DRR, RDR, RRR

So the probability is: $\frac{3*2*4+3*4*3+4*3*3+4*3*2}{7*6*5} = \frac{120}{210}$

- f. Again the seven candidates are being chosen randomly for a game of dodgeball. What is the probability that the 4th person chosen is a Democrat if you know that the second and third chosen were Republicans?

I shouldn't have asked you this problem – you need conditional probability which we didn't cover.