Homework 2 Solutions:

1. Well, there are N ways to choose the president. Once you have chosen the president, for each of these choices, there are $N-1$ ways to choose the vice president. So the total number of possible choices of president and vice president is $N \cdot (N-1)$. This is by the Multiplication Principle. It can also be seen geometrically by imagining a grid with the N possible choices of president written across the top and below each president the $N-1$ possible choices of vice president. This makes a rectangle containing N by $N-1$ boxes or $N \cdot (N-1)$ possible choices.

2. Again, there are 10 ways to choose the first person and for each choice, 9 ways to choose the second. So (as in the first problme) $10 \cdot 9$ ways to choose the first 2 people. For each of these choices of 2 people, there are 8 ways to pick the third person, so $(10 \cdot 9) \cdot 8$ ways to pick the next person. Each time we add a new person have one fewer to choose from, but each choice of the first group and each choice of the next person give a different ordering. So, in total there are

$$10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$$

   ways. (This is called "10 factorial" and is sometimes denoted 10!.)

3. Here we are making a slightly different type of choice. For each of the 5 fruits, we are making a yes of no decision about putting it in the salad. So for the first fruit (apples) there are 2 possible choices, yes or no. For each choice about applies there are two possilbe choices, yes or no, about the second fruit (pears). So for just apples and pears there are $2 \cdot 2 = 2^2 = 4$ choices. Having decided about apples and pears, we decide yes of no to cherrys. For each of the 4 choices about apples and pears we get a different salad depending on what we decide for pears, so $2^2 \cdot 2 = 2^3 = 8$ choices. Same for cantalope and blackberries. So if we only decide yes or no on all 5 fruits there are $2^5 = 32$ choices. But, we can not choose "no" for all 5 and still have a salad. So that means one of the 32 choices above is not allowed.

   So the number of possible choices is $2^5 - 1 = 31$,

4. You need to make a graph of the $\log_2$ of the data...that is

$$1800 \qquad \log_2(0.589) = -0.764$$

$$1810 \qquad \log_2(1.373) = 0.457$$

   and so on (Google Log base 2 calculator if you don't have a calculator that can compute logs base 2).

   The resulting graph with year across the horizontal and $\log_2$ of the data in the vertical direction makes a curve...If this curve looks like a line to you then "Yes, the log of the

data gives (almost) a line, so this is exponential growth". If the graph does not look like (almost) a line, then "No this data does not grow exponentially because the graph of the log of the data is not a line."–does it grow faster of slower than a line (so is the original data growing faster or slower than exponential).

The decision if the data "looks enough like a line" is up to you and either answer is accepted as long as you interpret correctly (there are entire courses in the department about approximating data with lines and measuring how well the data fits...real data won't fit exactly.)