MA 162 - Recitation Worksheet Solutions - Feb. 13, 2014

Multiplication Principle

1. A vendor sells ice cream from a cart on a sidewalk. He offers 4 different flavors (vanilla, chocolate,...) served on 2 different cones. How many different single-scoop ice-cream cones can you buy from this vendor? *4 choices for ice-cream, 2 choices for cone, so* $4 \cdot 2 = 8$ *choices total.*

2. A boy owns 2 pairs of pants, 6 shirts, 3 pairs of shoes and 2 pairs of boots. How many different outfits can the boy wear to school if he must wear a shirt, pants, and he must wear either shoes or boots. *2 choices of pants, 6 choices of shirt, and 5 choices for footwear, so* $2 \cdot 6 \cdot 5 = 60$ *choices.*

3. A particular brand of shirt comes in 13 colors, has a male version and a female version, and comes in 2 sizes for each sex. How many different types of this shirt are made? *13 choices of color, 2 choices for sex, and 2 choices for size, so total of* $13 \cdot 2 \cdot 2 = 52$.

4. A coin is tossed 13 times. How many outcomes are possible? (Hint: first answer the question if the coin is tossed twice, then thrice, etc, and try to pick up on a pattern.) *2 possibilities for the first flip, 2 for the second flip, 2 for the third, etc. Total number is therefore* $2 \cdot 2 \cdot \cdots \cdot 2 = 2^{13} = 8,192$

5. A true-false test contains 15 questions. In how many different ways can the 15-question test be answered? *2 possibilities for the first question, 2 for the second question, 2 for the third, etc. Total number is therefore* $2 \cdot 2 \cdot \cdots \cdot 2 = 2^{15} = 32,768$

6. A multiple choice test contains 15 questions. For each question, there are 5 choices, A, B, C, D, E. In how many different ways can this 15 question test be answered? *5 possibilities for the first question, 5 for the second question, 5 for the third, etc. Total number is therefore* $5 \cdot 5 \cdot \cdots \cdot 5 = 5^{15}$

7. A company has 3210 employees. Each employee is to be given an ID number that consists of one letter followed by one digit. How many different ID numbers are possible? Is it possible to give each employee a different ID number using this scheme? *26 possibilities for the letter, 10 possibilities for the digit, so* $26 \cdot 10 = 260$ *total possibilities. Is it possible to give each employee a unique ID number? NO. Not even close. It would be possible if the ID consisted of two letters followed by a digit. In that case, there would be* $26 \cdot 26 \cdot 10 = 6,760$.

Inclusion-Exclusion Principle

1. 20 high school students went camping in the woods. 8 of them stepped in poison ivy, 12 of them had their lunch eaten by bears, and 3 students stepped in poison ivy and had their lunch eaten by bears.

   (a) How many students had their lunch eaten by bears, but didn't step in poison ivy? **12 of them had their lunch eaten by bears, and 3 students stepped in poison ivy and had their lunch eaten by bears, so that means that 9 students had their lunch eaten by bears, but didn't step in poison ivy.**

   (b) How many students didn't step in poison ivy or have their lunch eaten by bears? **12 of them had their lunch eaten by bears, and 3 students stepped in poison ivy and had their lunch eaten by bears, so that means that 9 students only had their lunch eaten by bears. 8 of them stepped in poison ivy, and 3 students stepped in poison ivy and had their lunch eaten by bears, so 5 students only stepped in poison ivy. This means that the number of student who had their lunch eaten by bears or stepped in poison ivy is $9+8+3=17$. We have to also add the 3 who both stepped in poison ivy and had their lunch eaten by bears. Since 20 students went on the trip, this means that 3 students did not step in poison ivy or have their lunch eaten by bears.**

2. A sports magazine took a survey of $1,000$ sports fans in New York City and asked them which teams they root for. The results were as follows.

   650 root for the Yankees
   540 root for the Giants
   480 root for the Knicks
   330 root for the Yankees and the Giants
   290 root for the Yankees and the Knicks
   240 root for the Giants and the Knicks
   100 root for all three teams

   How many fans root for any of the three teams?

   240 people root for the Giants and the Knicks, and 100 people root for all three teams, so 140 people root for only the Giants and the Knicks. 290 people root for the Yankees and the Knicks, and 100 people root for all three teams, so 190 people root for only the Yankees and the Knicks. 330 people root for the Giants and the Yankees, and 100 people root for all three teams, so 230 people root for only the Giants and the Yankees. This means that the number of people who only root for the Giants is $540-140-230-100=70$, the number of people who root only for the Yankees is $650-190-230-100=130$, and the number of people who only root for the Knicks is $480-140-190-100=50$. So the total number of people who root for at least 1 team is $70+130+50+140+190+230+100=910$.