

MATH 126

Review of Counting Problems

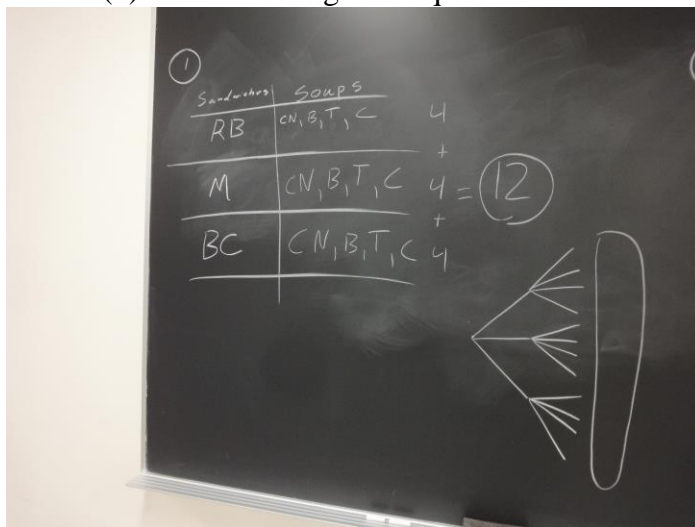
Note: For the quiz, be prepared to explain

- (a) the Fundamental Theorem of Counting.
- (b) the difference between a Permutation and a Combination.

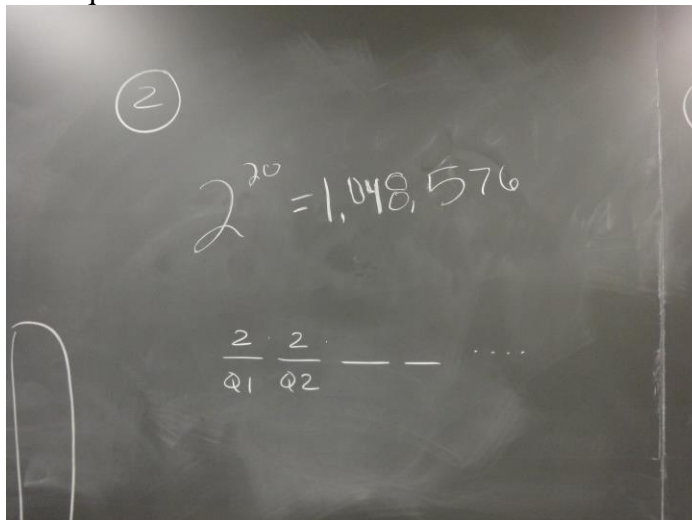
Here are some good review problems:

1. You want to order a sandwich and a soup. From the sandwiches, you can choose from roast beef, Mediterranean grilled veggie, or a turkey/bacon club. From the soups, you can choose from chicken noodle, broccoli cheese, tomato, or chili.

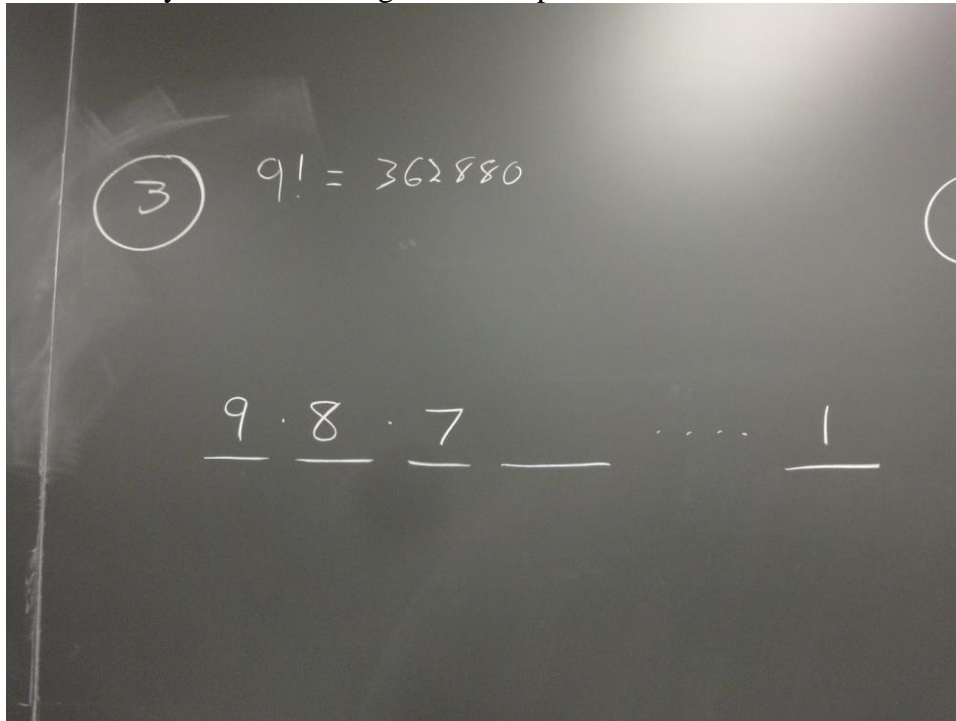
- (a) Draw a tree diagram showing all possibilities of a soup and sandwich.
- (b) Use a counting technique to find the number in (a).



2. In how many different ways can a person answer all the questions to a true/false test consisting of 20 questions?



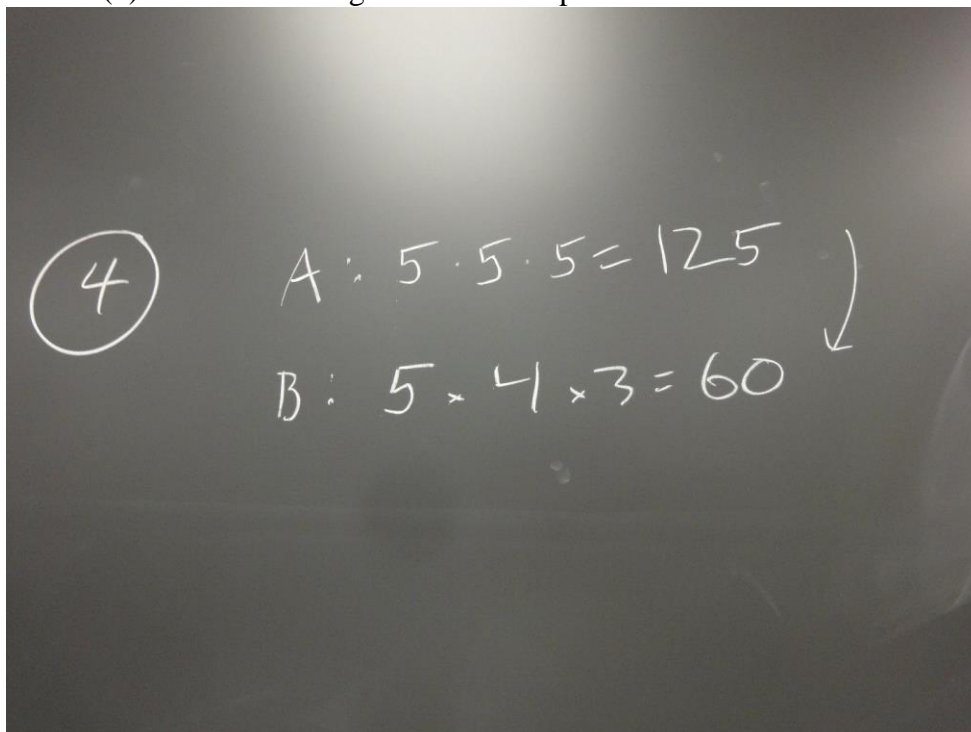
3. How many different batting orders are possible for a baseball team consisting of 9 players?



4. A storage facility lock is controlled by a keypad containing the digits 1 through 5.

(a) How many three-digit codes are possible?

(b) How about if digits cannot be repeated?



5. On an exam, a student must select 2 essay questions from 6 essay questions and 10 multiple choice questions from 20 multiple-choice questions to answer. How many different ways can the student select questions to answer?

Handwritten solution for problem 5 on a chalkboard. The text reads: "5) - 2 questions from 6", "- 10 questions from 20". Below this, the calculation is shown as $\frac{6C_2}{\text{essay}} \cdot \frac{20C_{10}}{\text{MC}} = 271340$. The number 271340 is circled. An arrow points from the result back to the multiplication sign.

$$\frac{6C_2}{\text{essay}} \cdot \frac{20C_{10}}{\text{MC}} = 271340$$

6. In how many different ways can the director of a research laboratory choose two chemists from among seven applicants and three physicists from among nine applicants? How does the problem change if the director just wants five scientists, regardless of their discipline?

Handwritten solution for problem 6 on a chalkboard. The text reads: "6) 7c2 9c3", "21 · 84". Below this, the calculation is shown as 1764 and $16c5 = 4368$. Both 1764 and 4368 are circled.

$$7c2 \quad 9c3$$
$$21 \cdot 84$$
$$1764$$
$$16c5 = 4368$$

7. From a twenty-person roster, we need to pick a captain, a co-captain, and a batboy. In how many different ways can this be done?

A chalkboard with a vertical line down the center. On the left side, the number 7 is circled. On the right side, the expression $20P_3$ is written with an arrow pointing to the 3. Below this, the number 6,840 is written and enclosed in a rectangular box.

$$\textcircled{7}$$
$$20P_3$$
$$\boxed{6,840}$$

8. To raise money for a charity event, a sorority will be selling six-month calendars with pictures of dogs and cats. They need to select six pictures from a pool of nine cats and six dogs. How many possible choices are there if they want to feature at least four cats?

A chalkboard with the number 8 circled. Below it, the text '9 cats, 6 dogs' is written, followed by '(At least 4 cats)' in parentheses. Below this, three lines of calculations are shown, each with a plus sign to the right. The first line is '4 cats: 9 C_4 · 6 C_2 = 1890'. The second line is '5 cats: 9 C_5 · 6 C_1 = 756'. The third line is '6 cats: 9 C_6 · 6 C_0 = 84'. A horizontal line is drawn under the 84, and the number 2730 is written in a box to the right. Below the first two lines, the word 'CAT' is written with an arrow pointing up to the 9 in the first line, and the word 'DOG' is written with an arrow pointing up to the 6 in the second line.

$$\textcircled{8}$$

9 cats, 6 dogs
(At least 4 cats)

$$\begin{array}{l} 4 \text{ cats: } 9 C_4 \cdot 6 C_2 = 1890 \\ 5 \text{ cats: } 9 C_5 \cdot 6 C_1 = 756 \\ 6 \text{ cats: } 9 C_6 \cdot 6 C_0 = 84 \end{array} \quad \begin{array}{l} + \\ \hline \end{array}$$
$$\boxed{2730}$$

↑ ↑
CAT DOG