Section 1: Problem Solving

Thoroughly review the problems we solved in class making sure you understand the wording and ways of solving it. Knowing more than one way of solving the problem will deepen your understanding of the problem although on the exam, you can solve it using the method of your choice. Problems on the exam might slightly vary from the problems on the study guide but if you are comfortable with all problems here, the exam problems will not surprise you. Please also keep in mind that there is a difference between *understanding* something and *being able to do* it. Make sure you solve as many the problems on this guide as you need to feel comfortable; Don't skip them just because you "understand" how we solved it in class. One last consideration: Giving the answer is not enough. It must be clear from your write-up how you solved the problem.

1. The Brick problem.

If a brick weighs 1 kilogram and half a brick, how many kilograms does the brick weigh?

How the solution changes if:

A. Brick weighs 2 kg and half a brick .
B. Brick weighs 4 kg and a third of a brick. .
C. Brick weighs 12 kg and a fifth of a brick.
D. Come up with your own combination and solve it.
E. Bonus challenge: Brick weighs ☐ kg and a quarter of a brick. Replace the blank with a number so that the answer is a nice whole number (not a fraction or decimal).

2. The Bacteria problem.

A biologist notices that a certain bacterium splits into 2 separate bacteria once every minute. In 24 hours bacteria filled up the whole test tube. When was the test tube half full?

How the solution changes if:

A. The question asks *When was a test tube ¼ full?*
B. Bacteria in the test tube triple every minute. When was the test tube 1/9 full?
C. Bacteria in the test tube triple every minute. When was the test tube 1/3 full?
D. Bacteria in the test tube multiply by 10 every minute. When there was a one thousandth of the test tube full?
E. If the bacteria still multiply by 10 every minute, what should be the question so that answer is 23hrs and 59min?

3. The Bottle and cap problem.

A bottle with cap costs one dollar and ten cents. The bottle costs one dollar more than the cap. How much does the cap cost?

How the solution changes if:

A. Bottle and the cap cost $3.30. Bottle is $3 more than the cap.

B. Bottle and the cap cost $5. Bottle is $1 more than the cap.

C. Bottle and the cap cost $1.70. Bottle is 50c more than the cap.

4. The Emily problem.

Emily spent two thirds of her money. Then she lost two thirds of the money that was left. Four dollars remained. How much money did Emily have to begin with?

How the solution changes if:

A. What if 10 dollars remained?

B. What if she spent and lost 3/4 of her money?

C. What if she spent 3/4 and then lost 2/3 of her money?

D. What if she spent 2/3 and lost 1/3 of their money?

5. The Sarah problem.

Sarah went to a store, spent half of her money, and then spent $10 more. She went to a second store, spent half of her remaining money, and then spent $10 more. Then she had no money left. How much money did she have in the beginning when she went to the first store?

A. What if she has $10 left leaving the second store? .

B. What if she spends 2/3 each time and no money is left?

Answer key:

1	1A	1B	1C	1E	2	2A	2B	2C
2kg	4kg	6kg	15kg	any multiple of 3	*23:59*	23:58	23:58	23:59
2D	2E	3	3A	3B	3C	4	4A	4B
23:57	When was it 1/10 full	*5c*	15c	$2	60c	*$36*	$90	$64
4C	4D	5	5A	5B				
$48	$18	*$60*	$100	$120				

Section 2: The Mathematics of Voting

Review the methods of counting votes: The Plurality Method (p.10), The Borda Count Method (p.12), The Plurality-with-Elimination method (p. 14) and the Pairwise Comparison method (p.19). Answer the following questions from the book. As the book has quite a number of problems, solve as many problems in each part as you need to feel comfortable with a given kind of questions. Answers are in the back of the book.

- Ballots and different presentations of voting, pages 29-30, Problem #3 through 8.
- Plurality Method, pages 3-31, Problems #11 through 16
- Borda Count Method, pages 31-32, Problems #21 through 24
- Plurality-with-Elimination Method, pages 32-33, Problems #31 through 37
- Pairwise comparison, pages 33-34, Problems #41-44