Math 46, Spring 2009, Take-home exam Name: _____

Read the following instructions before you begin, and again before you turn in your exam to see if you have followed directions!!

(a) Due at the start of class, 3:45 PM, on Thursday, June 4, 2009
(b) You are encouraged to work together; however if your work is identical to that of someone else in the class, neither will be counted.
(c) Except for problem 3, for which you may turn in a group answer, only work appearing on these official pages will receive credit - do not use extra sheets. Make your answers fit in the space provided, one problem per page (you may use the back if absolutely necessary!)
(d) If asked to explain why your result is correct, do not merely state an answer, give a full explanation in complete sentences.
(e) **For each problem**, list who you worked with and give details as to who did what. For example: "Jane found many examples and spotted the pattern, I solved the problem in general, then we both figured out how to write down an accurate proof." No credit without this information.
(f) You may discuss these problems with others in this class, but not those not in the class.
(g) Do not hand in this cover sheet!

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(1) Explain (in complete sentences) how and with whom you worked on this problem, giving credit to anyone who contributed to your solution:

How many different ways are there to replace the stars in the expression

* 1 * 2 * 3 * 4 * 5 * 6 * 7 * 8 * 9 * 10

with either a plus sign or a minus sign so that the resulting sum equals 35?

(a) (2 pts.) Number of ways: ____

List of ways:

(b) (5 pts.) Explanation that you have found them all:

(c) (3 pts.) What other non-negative sums, other than 35, are possible by some choice of plus or minus signs? Explain how you know you found them all.

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(2) Explain (in complete sentences) how and with whom you worked on this problem, giving credit to anyone who contributed to your solution:

In this problem you will each be given a set of numbers, A, at the class site, with which to play a game like the take-away game we played in class. In the game, two players start with a pile of counters, and take turns choosing a number from set A (repeats are allowed) to remove from the pile. The first person to leave 0 counters wins. For example, if A =- {1,2,3,4}, we saw that when starting with a number that is not divisible by 5, assuming best play by both players, the second player can force a win by always bringing the running total to a multiple of 5.

Hint: suppose the numbers in your set were A={1,3}. Then work "backwards" from the lowest numbers to see what are the winning and losing positions. For example, in this case, 1 would be a winning number, since that player could remove 1 counter. 2 is a losing number, since the player with that number can only remove 1, leaving a winning number for her opponent. 3 is a winning number, since that player can remove 3. And 4 is a losing number, since that player can remove 1 or 3, leaving a winning number for her opponent. If you continue with this example, you will begin to see that odd numbers are losing numbers, and even numbers are winning numbers. Your problem will most likely have a more complicated analysis than this though!

List the four numbers in your set A:_____

(a) Find who has the winning strategy for each number 1 through 35. If a player has a winning strategy when left with a given number of counters, place W by that number; if the opposing player has the winning strategy, place L by the number. For example, the first two have been done for you:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
L	W																		

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

(b) Find and explain the general winning strategy, assuming best play by both opponents:

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(3) Explain (in complete sentences) how and with whom you worked on this problem, giving credit to anyone who contributed to your solution:

During Spring 2009 the De Anza College main quad is the site of a unique sculpture by Kathleen Crocetti. Entitled "Counting Lives Lost," the sculpture consists of thousands of small clay figures representing Americans and Iraqis killed during the occupation of Iraq. You may work with a group of up to 4 students on this problem. Your group must come up with 3 problems, and their solutions, which deal with the mathematics of this course in relation to the sculpture. Each problem must be an "extended" problem involving at least three questions about the sculpture or issues it raises. Your problems may be in these areas:
(1) Multiplication (2) Estimation (3) Ratio (4) Linear growth, or any area related to the mathematics of the course.

You should think of your problem sets as a "mathematical module" for teaching using the sculpture, and may include information about the Iraq War in your module. For example, see http://nebula2.deanza.edu:16080/~karl/Public/MathandtheIraqWar.4.5.08.pdf for an example of teaching modules which also integrate and address larger issues about the war.
Your effort will be graded on originality and completeness: do not simply list a series of math calculations! Your problems cannot be identical to those of other groups!

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(4) Explain (in complete sentences) how and with whom you worked on this problem, giving credit to anyone who contributed to your solution:

At the class web site you will be assigned 3 fractions, labeled set B. In the expression x * y * z replace the first * by either • or ÷, and replace the second * by either + or –. You may insert parentheses wherever you like. You must use each of your 3 fractions exactly once (in any order). For example, if your fractions were $\frac{1}{5}, \frac{2}{5}, \text{ and } \frac{3}{5}$, you might answer question (a) by writing $\frac{1}{5}(\frac{3}{5} - \frac{2}{5}) = \frac{1}{25}$.

List your three fractions: _____

(a) Find the smallest positive result: _____

(b) Find the largest positive result: _____

(c) Find the result closest to 1: _____

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For the purposes of questions 6-8, let $a_1, a_2, a_3, \ldots, a_8$ be the digits of your student ID number. **If any digits are 0, replace them with the digit 6.**
Write your ID number, with replacements for zeros, here: _____
(Note that this is NOT your social security number!! Ask the instructor immediately if you do not have yours!!)

(5) Explain (in complete sentences) how and with whom you worked on this problem, giving credit to anyone who contributed to your solution:

(a) Let m be the four digit number given by $a_4 a_3 a_2 a_1$, and let n be the three digit number given by $a_8 a_7 a_6 a_5$. Show how to use the Euclidean algorithm to find GCD(m,n)
GCD = _____

(b) Suppose $a_1 a_2 a_3 \ldots a_8 a_8$ are the first nine digits of the ISBN number of a book. (Note that the last digit is repeated.) Show how to find the check digit:
Check digit = _____

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(6) Explain (in complete sentences) how and with whom you worked on this problem, giving credit to anyone who contributed to your solution:

(a) Convert m in problem 5 to base 2: _____

(b) Convert n in problem 5 to base 5: _____

(c) (4) Show how to use "Russian Peasant Multiplication" to multiply $a_8a_7a_6a_5$ by $a_4a_3a_2a_1$

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(7) Explain (in complete sentences) how and with whom you worked on this problem, giving credit to anyone who contributed to your solution:

A palindrome is a number that reads the same forwards as backwards. Give the next three palindrome numbers after $a_8a_7a_6a_5$ that are also divisible by 3, and explain your method for finding them. (For example, the *next* palindrome number after 119 is 121, and the next after that is 131, etc. Do not count leading 0's as part of a number.)

Next three: _____

Explain how you found them: