

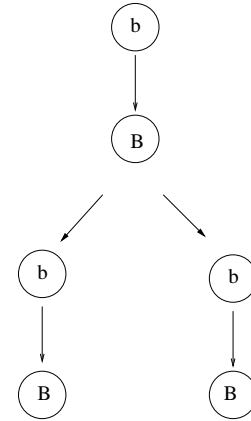
MAT115 Exam 2 (Fall 2011)

Name:

Directions: Show your work! Answers without justification will likely result in few points. Your written work also allows me the option of giving you partial credit in the event of an incorrect final answer (but good reasoning). Indicate clearly your answer to each problem (e.g., put a box around it).

FYI: 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597 **Good luck!**

Problem 1: (15 pts) Let's change our rabbit population problem, so that each matched pair of baby rabbits matures in the second month, then produces two matched pairs of young in the next generation (and then dies). This is illustrated in the following figure:



- (5 pts) Continue the graph through eight months.
- (6 pts) How many pairs would you have in each month

through the 8th month?

<i>Month</i>	<i>Pairs</i>
1	1
2	1
3	
4	
5	
6	
7	
8	

- (4 pts) Describe a rule for the number of pairs at month n .

Problem 2: (15 pts) You and I are playing a game of Fibonacci Nim with coins. In each of the three cases below, we start with the number of coins specified, and you are to

- a. explain whether you would prefer to go first or second (and why), and then
- b. describe your **first** move assuming that you're in your preferred position. You may have to first say what I would do, assuming that I always use the strategies described in class (including the slow-down defensive strategy).

Warning: Do not play out an entire game! Don't waste your time!

• 89

a.

b.

• 39

a.

b.

• 267

a.

b.

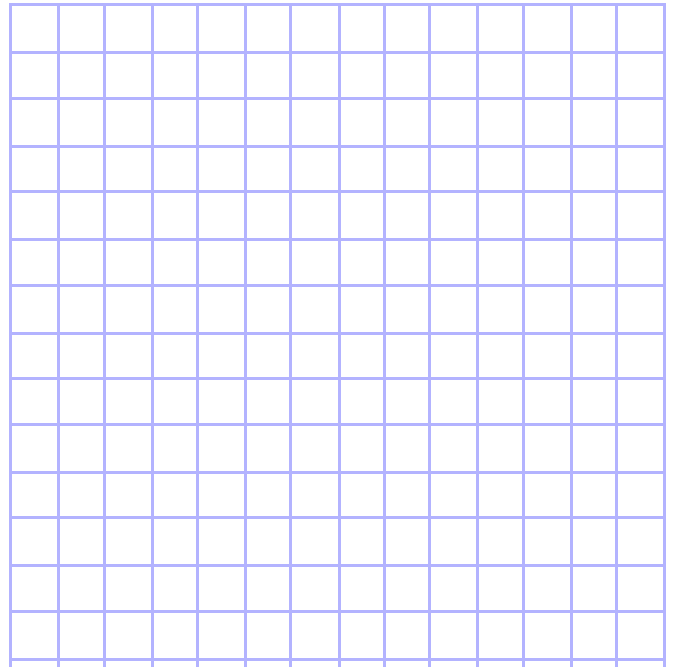
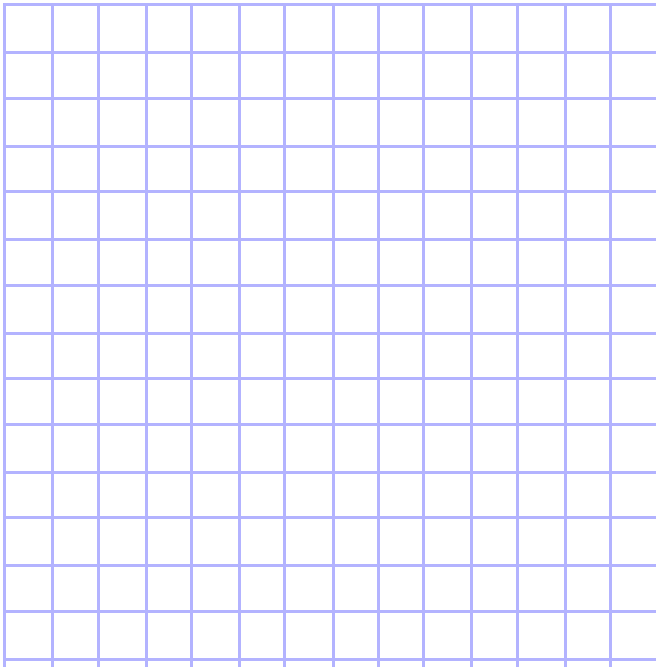
Problem 3: (10 pts)

a. (4 pts) What is the value of the golden ratio (its **true** value)?

b. (6 pts) Give the definition of the rectangle golden, using an appropriate figure to illustrate its golden property.

Problem 4: (20 pts)

- a. (10 pts) In the grids provided, it is possible to create a Fibonacci spiral of maximum size 13x8. Do so (and don't forget to actually trace the spiral at the end). I provide two copies of the grid: you may practice on the grid at the left (if you wish), **but do your finished spiral at the right.**



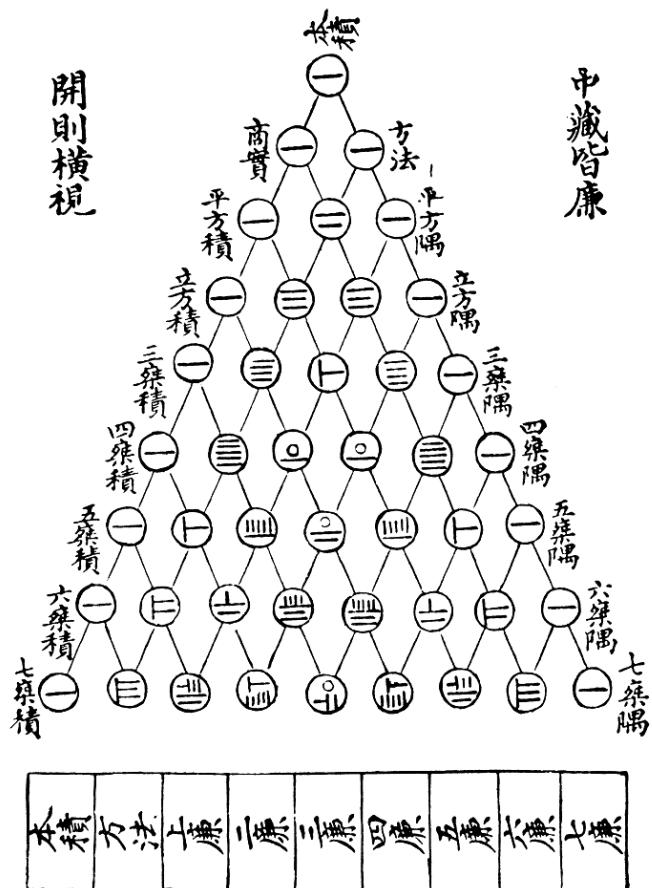
- b. (6 pts) Compute the ratio of side lengths for every one of the rectangles used in creating the Fibonacci

spiral above.	Rectangle	Ratio of side lengths
	1	
	2	
	3	
	4	
	5	
6		

- c. (4 pts) What precise value are the ratios of side lengths approaching?

Problem 5: (20 pts) Here is Pascal's triangle, using Chinese Bamboo Counting Rods:

古法七乘方圖



- (10 pts) At right of the Chinese figure, draw the corresponding Pascal's triangle in our numbers (arabic numbers).
- (5 pts) Using either drawing above (or in the space below), show how the Fibonacci numbers are obtained from this triangle.
- (5 pts) Make an informed guess about how the Chinese would write 11 and 40 using Bamboo Counting Rods.

Problem 6: (20 pts) Bases:

a. Write the number 421_{10} in

i. (4 pts) base 2

ii. (4 pts) base 16

b. (4 pts) Write the number 100110101_2 in base 10.

c. (4 pts) Do the following calculation: $452_8 + 637_8$, giving your answer in base 8.

d. (4 pts) What base did the Mayans use? What other facts or numbers were interesting about the Mayans?