Onward and Upward with NIM due 11/10/08

Problems 1 – 3 can be solved by "NIM-type thinking". By this I mean that some of the relationships you have been exploring turn up in these problems and can be used to solve them.
Solve each of the problems, writing up your reasoning carefully.

1) The game of Anti-Nim is very much like Nim. There are two players with a pile of beans. Turns alternate between the players. On your turn you must remove either one or two beans from the pile. But unlike Nim, in Anti-Nim you **do** want to take the last bean.

a) Suppose the pile starts with 9 beans. You, fortunately, are playing against a polite opponent who allows you to choose whether you wish to take the first turn or have him take the first turn. Which should you choose, and what is your strategy to guarantee that you win the game?

b) What should you do if the pile starts with 10 beans?

2)

The pumpkin and candy corn parade whose start you see above is being led by the candy corn with a flag. It goes on for quite a long way. On the basis of the part you can see, would you predict that the 55th member of the parade would be a pumpkin or a candy corn? _____
How about the 223rd? _____ Convince me you are not guessing.

3) If the first day of the year falls on a Tuesday, what day of the week will the 310^{th} day be?

(over)

Back to Multiplication:

Using conventional multiplication, we obtain the following products:

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  34
X 73
 102
238
2482
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  529
X  25
 2645
1058
13225
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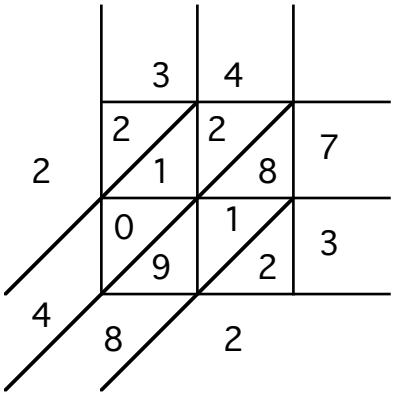
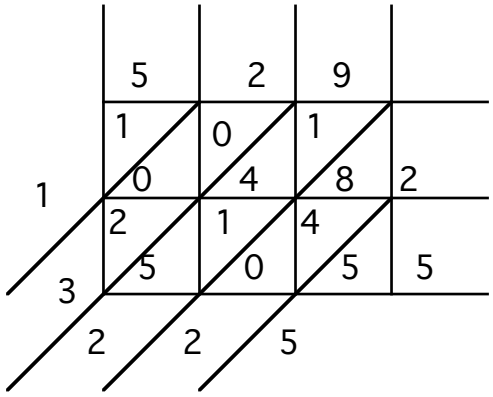
An alternative method of finding these two products is demonstrated below. You are to
A) Figure out how this method works;
B) Figure out why this method works;
C) Apply A) and B) to find the product of 573 and 469.





D) Now use a lattice to multiply 432_{five} by 134_{five}, staying in base five for all steps of the process.