week1lecture1

- Heap of beans ($\sim$ 15 minutes)
  - Directions
    - There are 16 beans in a pile. Two people playing against each other take turns removing either 1, 2, or 3 beans from the pile on each turn. The person who removes the last bean(s) wins the game. Describe a winning strategy for this game!
  - Solution
    - Be the second player and make it such that the other player always has a multiple of four beans before they take their turn.
  - Leave space for students to write possible solutions on board
- Two bean heaps
  - Directions
    - There are two heaps of 10 beans each on the table. You and a partner alternate moves until all the beans are gone. The player to take the last bean(s) wins. A move consists of removing one bean from one of the piles, or of removing a bean from each pile. What is a winning strategy?
  - Solution
    - Make sure the number of beans in each pile is even. One way to do this is to go second and make the exact moves as your opponent.
- Assignment: Write a letter to a friend or family member explaining the rules and object of the game, and how to win.
  - Refer to page 96 of the text for a checklist in writing this and future assignments.
- PSSSP
  - If you have noticed, the title of the book is PProblem SSSolving. The reasoning for this title is that the authors created a nifty acronym for a guideline strategy for problem solving. The acronym is PSSSP . Before I go on, you'll need to understand that this guideline is not a step by step method for problem solving. You will need to practice solving problems and using this guideline to know which strategies to use and when. So what does each letter stand for?
  - Be Proactive
    Just do it! When you are given a problem, you have to attack it and keep attacking it. You will need to do your best to not give up 5 minutes after starting. We saw that it took more than 5 minutes to solve the heap problem. As you may guess, this strategy should always be used first.
  - See it!
    Use visuals! You have all problem been given a problem and told DRAW A PICTURE as if it will magically solve the problem for you. Sadly, it's not this easy; however, it is often the case that when a proper visual is used, the solution method to the problem will come to you. How was this strategy used for the heap of beans problem?
  - Simplify it!
    Problems can be difficult. Sometimes the given problem is too complicated to even start on. This is why many decent problem solvers simplify the given problem. For some problems you will find that the problem may be simplified in at least one of two different ways. Firstly, if the problem has a lot of parts, try breaking the problem into small more manageable problems. For example, say you have to find the floor area of an apartment. It is often easier to break the problem into finding the area of each individual room and then summing up these areas. Secondly, say the problem is just one big complicated problem. Try doing a simplier version

of the problem.
Does anyone have any idea how one could have simplified the heap of beans problem?
For example, in the heap problem, one can view the problem as four heap of bean problems with only four beans in the heap.

- Stir it up!
  Are you stuck? Stir it up! Take a stab at a guess! Did it work? What have you learned from that guess? Try another guess! Try a similar problem! Did that give you any inspiration?
- Pause and reflect
  This is another strategy is used almost immediately. Sometimes you will be given a problem, and if you're lucky, the solution will come immediately to you. Other times, you will get stuck, either in the beginning or some time in the middle when different methods are failing. When this happens, it's a good time to pause and reflect what is going on. You should ask yourself questions like
  Do I know the definitions of all the words in the problem?
  Do I know what the solution should look like? E.g., the size of a room shouldn't be 1,000,000sf.
  Have I solved similar problems and do their solutions help with this problem?
  How would this strategy have been used for the heap of beans?
- We will spend some more time going over each of these strategies over the semester.

Problem: What is the unit digit of 2^{2012}
Problem: Fish match sticks