

## WEEK 3 (SEP 26-OCT 2)

Below is a screenshot of the calendar from the syllabus. I am throwing this in case you have missed the calendar in the syllabus. Note that the schedule is tentative. So far we have been keeping to schedule, and we will do so the coming week too.

### Calendar

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This is a tentative schedule for the term.

Week	Textbook Section	Evaluation	Note
Sep 12–Sep 18	2		
Sep 19–Sep 25	2		
Sep 26–Oct 2	3	PS 1 due on Oct 2	
Oct 3–Oct 9	4.1, 5		
Oct 10–Oct 16	5	PS 2 due on Oct 16	No lecture on Oct 10
Oct 17–Oct 23	5		
Oct 24–Oct 30	7	Midterm project due on Oct 24	
Oct 31–Nov 6	8	PS 3 due on Nov 6	
Nov 7–Nov 13			Reading week
Nov 14–Nov 20	9	PS 4 due on Nov 20	
Nov 21–Nov 27	9		
Nov 28–Dec 4	10	PS 5 due on Dec 4	
Dec 5–Dec 9	10		Make up class on Thursday

**Week 3.** The plan is cover [Recursion \(§ 3.5\)](#) and [Induction \(§ 3.6\)](#). We will not be following the book in a strict way for these topics. The examples we will do in class may well be different from what is in the text. But they will be related. Moreover the exercises at the end of Chapter 3 of the text are good sources for problems.

This is what you need to know for the next week.

1. You should be comfortable with permutations and combinations.
2. You should know lattice paths, including diagonal lattice paths, for which a file was uploaded in the module for week 2. Go through that note on diagonal paths.
3. It won't hurt to get ahead of the game and look up mathematical induction. I suggest looking up problems like the [Tower of Hanoi](#). See if you can show (without looking up the solution) that the answer for a stack of  $n$  discs is  $2^n - 1$ .

**Problems worth thinking about.** You may not be able to solve the following problems, but if you think about them, you will be in a better position to understand the solutions when they are done in class or in a tutorial (in the event there is no time in class). My suggestion is: Don't worry about induction, and try to solve these problems in a naive way. Start with  $n = 1$  and similar simple cases. And

see if you can see a pattern. It is possible that you might discover the basics of induction by yourself in a natural way if you follow this path.

1. Find an upper bound to the sequence  $\sqrt{2}$ ,  $\sqrt{2 + \sqrt{2}}$ ,  $\sqrt{2 + \sqrt{2 + \sqrt{2}}}$ ,  $\dots$
2. You are given  $3^n$  coins, all identical except for one which is heavier. Using a balance, prove that you can find the heavy coin in  $n$  weighings.
3. Let  $n$  be a positive integer. Show that any  $2^n \times 2^n$  chessboard with one square removed can be tiled using  $L$ -shaped pieces, where these pieces cover three squares at a time.
4. Into how many regions is the plane cut by  $n$  lines, assuming no two lines are parallel and no three intersect at a point?