MIT HSSP Spring Syllabus: Generating Functions Course

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1 Week 1

1. Review of Combinatorics
2. Review of Calculus
3. Identifying Recursive Problems
4. Determining the Recursion
5. Solving Recursions By Hand: Dynamic Programming

2 Week 2

1. Introduction to Formal Power Series
2. Elementary Operations on Power Series
3. Recognizing Convolutions in Recursive Problems
4. Converting Recursive Formulas to Generating Function Equations

3 Week 3

1. Differentiation and Integration of Power Series
2. Generalizations of Operations from Calculus Using the Gamma Function
3. Precursor to the Snake Oil Method
4. Deriving Commonly Used Generating Functions

4 Week 4

1. Review of Everything so Far (without which the snake oil technique will be useless)
2. The Hammer: The Snake Oil Method
3. Lots of Examples!

5 Week 5

1. More examples of Using the Snake Oil Method
2. Use of Generating Functions in Applied Math and the Sciences
3. Exponential Generating Functions and Dirichlet Series