

## Homework 9 (Sections 5.2, 5.4, 6.1, 6.2)

Problems from *Discrete Mathematics and Its Applications*, 7th edition, Rosen.  
Due on Wed, Nov 14.

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### Main HW Problems (80% of HW points)

5.2: 6ac

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For P1 please provide a printout of your Mathematica code and output. Also upload your Mathematica nb file to Canvas for HW 9.

P1: Consider the function

$$f(n) = \begin{cases} n/2 & n \text{ is even} \\ 1 + 3n & n \text{ is odd.} \end{cases}$$

Write a function `oddEven[n_]` that takes a positive integer  $n$  and returns the value of  $f(n)$ . For example, `oddEven[5]` should return 16 and `oddEven[64]` should return 32.

Suppose we begin with a positive integer  $n$  and apply the function  $f(n)$  repeatedly. An unproven conjecture states that eventually the number 1 will be reached. For example, starting with  $n = 5$ , we get  $5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$ .

Write a recursive function `oddEvenSeq[start_]` that takes a positive integer `start` and returns the list of terms generated by  $f$ , beginning with `start` and ending at 1. For example `oddEvenSeq[5]` should return `{5, 16, 8, 4, 2, 1}`. How many terms are in `oddEvenSeq[83]`?

P2: In the Care of Magical Creatures class, 100 flobberworms are randomly distributed among 15 students. Each student receives some number of flobberworms or none. Show that there are two students who have the same number of flobberworms.

P3: Five points are placed inside a unit equilateral triangle. Show that there must be two points no more than  $1/2$  unit apart.

P4: In the following problem, numbers do not begin with zero. (ex: 123456 is a 6-digit number but 012345 is not.) You may leave your answers unsimplified.

- (a) How many 6-digit numbers are there?
  - (b) How many 6-digit even numbers are there?
  - (c) How many 6-digit numbers have all odd digits?
  - (d) How many 6-digit numbers have all even digits?
  - (e) How many 6-digit numbers have all distinct digits?
  - (f) The numbers 3514153 and 8068608 are called *palindromic* because they read the same forwards and backwards.
    - i. How many 7-digit palindromic numbers are there?
    - ii. How many 7-digit even palindromic numbers are there?
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MORE PROBLEMS ON THE BACK ↪

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**Additional HW Problems (20% of HW points)**

5.2: 25, 29

5.4: 9

6.2: 3