

# Revision Exercises Part 3

## Algorithms

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10th August 2015

### 1 Thursday 18 September

### 2 Friday 19 September

**Exercise 2.1** Write down the ten first Fibonacci numbers, using the rule

$$f(n) = f(n-1) + f(n-2), \quad (1)$$

$$f(1) = f(2) = 1 \quad (2)$$

### 3 Tuesday 23 September

**Exercise 3.1** Prove that the output array of selection sort (as given in previous videos) is sorted in increasing order.

**Exercise 3.2** Prove that the merge operation used by Merge Sort is correct.

**Exercise 3.3** We can define the non-negative, integer powers of  $a$  using the rules

$$a^0 = 1, \quad (3)$$

$$a^n = a \cdot a^{n-1}. \quad (4)$$

Answer the following questions,

- Explain how the above rule defines  $a^n$  for any natural number  $n$ .
- Use the rule to prove that  $a^n a^m = a^{n+m}$

### 4 Thursday 25 September

**Exercise 4.1** Consider the solution to the Tower of Hanoi. What is the complexity, in terms of the number of disks  $n$ ? Use Big-O notation.

## 5 Friday 26 September

**Exercise 5.1** *Use induction to prove that the number of subsets of an  $n$ -set is  $2^n$ .*

**Exercise 5.2 (Stein et al Exercise 4.1-5)** *For what values of  $n$  do we get  $2^n > n^2$ ? Prove that your answer is correct using mathematical induction.*

**Exercise 5.3** *Do Problem 1, page 210–211 in Stein et al.*