**Exercises for lesson 1: Big-Oh, lists, stacks and queues**

**Exercise 1.1**

Order the following by their O(⋅) ranking:

1. 7
2. 2
3. 5
4. 8
5. 4
6. 9
7. 1
8. 3
9. 10
10. 6

**Exercise 1.2**

Which of the following are true?

1. T
2. T
3. F
4. F
5. T
6. T

**Exercise 1.3**

What is the complexity of the following algorithm?

algorithm(*m*, *n*):  
 *r* = 1 // 1  
 for *i* from 1 to *n*: // 1 assignment, n increment, n+1 checks = 2n+2  
 *r* = *r \* m* // n multiplication, n assignment = 2n  
 return *r* // 1 return

Sum: 1 + 2n + 2 + 2n + 1 = 4n + 3 = O(n)

What does the algorithm compute?

Raises *m* to the power of *n*.

**Exercise 1.4**  
Write pseudocode for an algorithm to determine if a number is a prime. What is the time complexity of your algorithm?

isPrime(n):

if n <= 2: // 1

return n == 2 // 2

if n % 2 == 0 // 2

return false // 1

for i from 3 to root(n); i += 2 // 1 assignment, (root(n) – 3) / 2 increment, same – 1 checks

if n % i == 0 // 2 \* (root(n)-3)/2 = root(n) - 3

return false // 1

return true // 1

Complexity = 6 + root(n) – 3 + root(n) – 3 + 1 = 2 \* root(n) + 1 = O(root(n))

isPrime(n):

for i from 2 to n-1: // 1 assign, n-2 increment, n-1 checks = 2n-2

if n % i == 0: // 2 \* (n-2)

return false // 1

return true // 1

Complexity = 2n – 2 + 2\*(n-2) + 1 = 4n-5 = O(n)

**Exercise 1.5**

Finish the implementation of ADSLinkedList.

Determine the running time for each method.

Test your program

**Exercise 1.6**

Implement a Stack.

Use your list implementation, or use Java's ArrayList

**Exercise 1.7**

To check if a String of parenthesis, curly brackets and square brackets matches, you can use the following algorithm:

For each character in the String, if it is an opening character - ( [ { - push it onto the stack.

If it is a closing character, pop the element from the stack, and see if it fits with the opening character.

If it doesn't, the String doesn't match. Otherwise, keep going.

When there are no more characters ar left, the stack must be empty.

If it is, the String matches, otherwise, it doesn't.