

FIT1008 – Intro to Computer Science

Tutorial 11

Semester 1, 2017

Objectives of this tutorial

- To understand Recursion and Iteration.
- To understand Hash Tables.

Exercise 1

Consider a *Node* class which defines a node for a linked data structure, and which is defined as follows:

```
1 class Node:
2     def __init__(self, item = None, link = None):
3         self.item = item
4         self.next = link
```

Suppose you have a *List* class that implements a Linked List using the *Node* class above, and has the following method.

```
1 def mystery(self):
2     mystery_aux(head)
3
4 def mystery_aux(current):
5     if current == None:
6         return 0
7     else:
8         current.item += mystery_aux(current.next)
9     return current.item
```

- (a) What does the method do? Explain in terms of its effect on the value of `a_list`, that consists of the following items in order 1,2,3,4,5.
- (b) What is the best and worst complexity in Big O notation of our `mystery()` method in terms of the length of the list (N)?
- (c) How would you define the method iteratively?

Exercise 2

Using the following hash function:

```
1 def hash(input_string):
2     return ord(input_string[0]) % 11
```

and linear probing, calculate the hash value of the following names and insert them into a Hash Table of size 11.

```
1 Eva, Amy, Tim, Ron, Jan, Kim, Dot, Ann, Jim, Jon
```

Note that the ascii value for E is 69, for A 65, for T 84, for R 82, for J 74, for K 75, and for D 68.

Exercise 3

Assume you have completed *Exercise 2*. Illustrate what happens, when you search for the names Jim, Jon and Joe.

Exercise 4

Repeat *Exercises 2 and 3* using Quadratic probing instead of linear probing.

Exercise 5

Using the following function:

```
1 def hash2(input_string):
2     return ord(input_string[0]) % 10 + 1
```

as the second hash function, repeat *Exercise 2* using double hashing instead of linear probing.

Is the second hash function a good choice of function? Discuss in terms of the values provided for keys that are mapped to the same value by the first hash function.

Exercise 6

Discuss the idea behind universal and a perfect hash functions.

Exercise 7

What are advantages and disadvantages of separate chaining over open addressing?