Please fill in your Student Number and Name.

Student Number : _____

Name:

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Student Number:

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University of Cape Town ~ Department of Computer Science

Computer Science 1015F ~ 2012

Test 3

** *SOLUTIONS* **

Question	Max	Mark	Marker
1	8		
2	7		
3	8		
3	7		
TOTAL	**30**		

Marks : 30

Time : 40 minutes

Instructions:

a) Answer all questions.

b) Write your answers in PEN in the spaces provided.

c) Show all calculations where applicable.

Question 1 [8]

Examine the following function:

```
def mystery (alist):
    newlist = []
    for a in alist:
        newlist.insert (0, a)
    return newlist
```

(a) Explain in simple English what this function does. [2]

returns a reversed [1] copy [1] of a list

(b) What is the value returned by `mystery([1,2,3])`? [2]

[3,2,1]

(c) Can different types of data be stored in a single list? Is yes, provide an example of such a list. [2]

yes [1]. [1, 2, 'hello'][1]

(d) How does the Python interpreter react to `A[5]=0` when A has 4 elements? [2]

it throws an exception [1] that the index value is out of range [1]

Question 2 [7]

(a) Write a program to read the first 2 lines of the file **data.txt** into variables x and y. Do not include exception handling. [3]

f = open ("data.txt", "r") [1]

x = f.readline() [1]

y = f.readline()

f.close () [1]

(b) Explain the meaning of the 3 file opening modes: "r", "w" and "a". [3]

r=read; w=overwrite; a=append

(c) Why are exception handlers necessary when using files? [1]

to gracefully deal with errors without the program crashing

Question 3 [8]

Examine the following program:

```
def mystery (x):
    if x=="":
        return ""
    else:
        return mystery (x[1:])+x[0]
```

(a) What is the output of `mystery ("hello")`? [2]

olleh

(b) Explain in simple English what this recursive function computes. [2]

reverses a string

(c) Write a recursive function to calculate the factorial of an integer. [4]

```
def fact (x): [1]
  if x==0: [1]
    return 1 [1]
  else:
    return x * fact(x-1) [1]
```

Question 4 [7]

Suppose that we have a program that uses binary search to search through this list of student marks:

```
8, 12, 13, 15, 17, 21, 27
```

(a) When searching for 27, state the elements, in order, that are compared to 27. [2]

15 [1], 21 [1], 27

(b) What is the time complexity of binary search in the worst case? [1]

O(log n)

(c) Why is binary search better than linear search? [1]

it is faster

(d) What restrictions are there on binary search – is it always applicable or are there conditions? [1]

the list must be sorted

(e) Describe an algorithm that incorporates binary search to find all matching elements in a list. [2]

first find one element using binary search [0.5]; then scan linearly to left and right of position to find starting and ending of list of items [1.5]