

## Repeat Exam: MTH 103 : Introduction to Computing

June 04, 2014

### Please take note of the following.

1. Answer all the questions.
2. Each question is worth 20 points. The distribution of points among subparts are mentioned after each question.
3. You can use functions from python packages, but nothing more while writing algorithms.
4. For the computational problems, show the steps clearly.
5. The numbers in parenthesis after each problem is the weightage for that problem.

The problems below which are computational in nature have been mentioned to be computational. Ones in which you have to write an algorithm has been marked as (Algorithm).

- 1) (Computational) Consider the following python functions and answer the questions below them. Explain the answers you get. You can reuse computations once you have done them.

1a) 

```
def f(m) :  
    if m > 0 :  
        if m == 1 :  
            r = 1  
        elif m == 2 :  
            r = 1  
        else :  
            r = f(m-1) + f(m-2)  
    else :  
        r = None  
    return r
```

Compute  $f(10)$ . (12)

1b) 

```
def g(n) :  
    l = range(n)  
    m = []  
    for i in l :  
        m.append(2*i + 1)  
    s = 0  
    for i in m :  
        s += i  
    return s
```

Compute  $g(8)$ . (8)

- 2) (Algorithm) Write an algorithm/code to solve the following. Given a set of 10 scores (in the form of a list), find the sum of the 5 highest scores. (20)

- 3) (Computation)

3a) Using Lagrange interpolation formula find a polynomial passing through  $(0, -2)$ ,  $(1, 1)$  and  $(2, 6)$ . Please explain the computation. (10)

3b) Consider the list of random numbers :  
 0.57365, 0.62582, 0.61227, 0.60616, 0.55168, 0.15853, 0.31215, 0.05039,  
 0.60588, 0.86638, 0.22980, 0.24089, 0.13923, 0.38415, 0.92611, 0.31185,  
 0.34468, 0.26702, 0.96824, 0.90265  
 between 0 and 1.  
 Using a Monte Carlo technique find the length of the interval  $[0.25, 0.75]$   
 using the above set of random numbers. (5)

3c) What does the following python code print?  

```

lop = [('Peter', 18), ('Sam', 15), ('Henry', 19)]
a = lop[0][1]
n = lop[0][0]
for pair in lop :
    if pair[1] > a :
        n = pair[0]
        a = pair[1]
print n

```

(5)

4) (Computation)

4a) Do the single step of trapezoidal rule to integrate

$$\int_0^2 x^2 dx$$

in which the interval  $[0, 2]$  is divided into 4 equal parts. Write the computation clearly (10)

4b) Find a root of the quadratic equation  $x^2 - 5 = 0$  by the Newton Raphson method using the starting point as  $x_0 = 4$ . Just do two iterations, computing  $x_1$  and  $x_2$ . (3 + 7 = 10)

5) (Algorithm)

5a) Write a code which given a positive integer, find the sum of its digits. (10)

5b) Write a code which emulates a very basic calculator in the following sense. It takes a string as input. The string should be of the form "number operation number". Examples are "4.5 \* 3.4", "23 + 3". Assume that the only operations allowed are +, -, \* and /. Write a code which will take such a string as input, and return the value of the expression. *You cannot use the python function eval in this problem.* (10)