MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

MAIN CAMPUS

SCS 404/CCS 417: PRINCIPLES OF FUNCTIONAL PROGRAMMING

Date: 10th December, 2016 Time: 12.00 - 3.00pm

INSTRUCTIONS:

- Answer Question ONE and any other TWO
  If writing program code is required, use the JavaScript programming language

Question #1 Compulsory (30 Marks)

a) What is a *higher order function* (HoF)? [6 Marks]

b) For each of the HoFs *map*, *filter* and *fold*, state how each is similar to the other two and how each is differs from the other two. [18 Marks]

c) Using examples, explain the two expression evaluation strategies, *eager evaluation* and *lazy evaluation*. For each, outline/highlight why it is called so and state, if any, the other terms that can be used to refer to it. [6 Marks]

Question #2

a) What is the output of the following code [10 Marks]

```
var counter = 10;
function countdown(value) {
   if (value > 0) {
      console.log(value);
      return countdown(value - 1);
   }
   else {
      return value;
   }
};
countdown(10);
console.log(counter);
```

b) What is the output of the following code [10 Marks]

```
var counter = 10;
   while(counter > 0) {
      console.log(counter--);
   }
console.log(counter);
```

Question #3

a) A *curried function* is a *higher order function* but the reverse is not true. Explain [4 Marks]

Use the following code to answer the questions that follow [4 Marks]

```
var setVisitor;
function hujambo(greeting) {
   var name = 'makali';
   setVisitor = function (newVisitor) { name = newVisitor; }
   return function () { console.log(greeting + ' ' + name); }
}
var greetVisitor = hujambo('good morning');
greetVisitor();
setVisitor('makamba');
greetVisitor();
greetVisistor = hujambo('good night');
greetVisitor();
```

b) In the code, how many *functions* are there? Identify them [4 Marks]

c) Are any function in b) *curried functions*? If so, which ones? Justify your choice. [4 Marks]

d) How many *function calls* are there in the code? Identify them? [4 Marks]

e) Are any of the calls in d) a *curried function call*? If so identify and justify your choice. [4 Marks]

Question #4

a) A function definition can be applied. Explain this with a sample code. [5 Marks]

Use the following code to answer the questions that follow

```
var setVisitor;
function hujambo(greeting) {
   var name = 'makali';
   setVisitor = function (newVisitor) { name = newVisitor; }
   return function () { console.log(greeting + ' ' + name); }
}
var greetVisitor = hujambo('good morning');
greetVisitor();
setVisitor('makamba');
greetVisitor();
greetVisistor = hujambo('good night');
greetVisitor();
```

b) In the code, **greetVisitor** and **setVisitor** are *closures*. Explain this. [5 Marks]

c) What is the output of the code? [5 Marks]

d) What is an *anonymous function*? Does the code contain any? If so, identify them. [5 Marks]

Question #5

Recursion is primarily used to define *infinites sets* or extremely large sets. You use recursion to generate new members or prove that an item is a member. An example of an infinite set is the set of odd numbers. A number is odd if it is not evenly divisible by 2.

REQUIRED:

a) Write at least two relations (equations) that define the set of odd numbers. [8 Marks]

b) Write a recursive function that determines if a number is odd. [6 Marks]

c) Write a function that lists all the odd numbers between its two non-zero positive integer parameters. [6 Marks]