Fall 2017 Programming Languages Qualifying Exam

CODE______________________________

This is a closed book test.

Correct, clear and precise answers receive full marks

Please start a new page for each question.

There are five (5) questions, each 20 points

1. ***C****onsider the following JAVA code and the compiler error. Explain why this error occurs. Give two ways to remedy this error. Explain what happens with each of your proposed solutions.*

```
class foo {

  public static void bar()
  {
      int z;
      z=foo1();
      System.out.println("Hello" + z );
  }

 public  int foo1() {
      return (1);
  }
}
```

```
foo.java:7: error: non-static method foo1() cannot be referenced from a static context
```

Solution:

The problem stems from static vs dynamic environments. Since "bar()" is static, it is a class method. The class method is restricted to access class data (including class methods). The method foo1() is an instance method. It is to access an object instance data.

To solve this problem you can either remove the "static" from bar() or add "static" to the method foo1(). Removing static would mean that the "bar()" method would no longer be a class method (making it an instance method). Adding static to foo1() would mean that foo1() is now a class method.

2. *Regular expressions*

Write a regular expression which will accept typical US phone numbers with the following patterns. Note that where there is a digit (except the leading '1') , it can be any of the ten digits.

```
800 555 1212
800-555-1212
800.555.1212
(800) 555-1212
1-800-555-1212
800-555-1212-1234
800-555-1212x1234
800-555-1212 ext. 1234
```

Solution:

```
(\d\d\d \d\d\d \d\d\d\d)|
(\d\d\d\-\d\d\d\-\d\d\d\d)|
(\d\d\d\.\d\d\d\.\d\d\d\d)|
(\(\d\d\d\) \d\d\d\-\d\d\d\d)|
(1\-\d\d\d\-\d\d\d\-\d\d\d\d)|
(\d\d\d\-\d\d\d\-\d\d\d\d((x\d\d\d\d)|( ext. \d\d\d\d))
```

3. *In Java the type "int" and the type "Integer" are quite different.*

a) Give an example of a context in which you can use one but not the other.

Answer: You can write "Integer I = new Integer(10);" but not "int I = new int(10)". Another context where you can use Integer but not int is in the argument to generics

b) Explain the difference in their implementation.

Answer: An int is a simple value, a single word containing an integer bit string. If it is a local variable, it is allocated on the stack. An Integer is an object. It is always allocated on the heap. In addition to the value, the record for an Integer contains other fields for the use of the run tine system; at minimum, a pointer to the class Integer.

4. *Consider the following Javascript code and output*

```
// Find the successor of a number
suc = function(x) {
   var m = x + 1
   return m;
}

a = "1";
writeln(a);
writeln(suc(a));
```

```
OUTPUT
1
11
```

The expected second value is 2, not 11. Explain why? Provide two different solutions to make this problem work correctly

Solution:

The problem is that the input is a string and not a number. The plus operator is overloaded and hence is performing string concatenation instead of math addition. To fix this problem either 1) remove the quotes from the assignment of "a", or 2) force "x" to be a number. In Javascript, the statement is Number(x).

5. *Python*

Provide the output and explain in detail how this statement works in Python

```
print map((lambda a:lambda v:a(a,v))(lambda s,x:1 if x==0 else x*s(s,x-1)),[1,5])
```

Solution:

There are three portions of the statement
1) print – this is a standard method that is used to create output from the object created from the argument

2) map() – applies the provided function to a list of arguments creating a list of results from the application of the function to each element of the list.

3) (lambda…) .. This is a complex lamba function which, in part takes a function as an argument (seen as the "s" variable) and recursively applies that function to the input. The program effectively creates the factorial of an input element which comes into the system as the variable "a" and then internally the variable "x".

4) Output [1, 120]