Student ID: ____

Full Names: ____

Modern Programming Practices
(CS401)

(August 2017)

Instructor: Obinna A. Kalu

Final Examination

1. The exam duration is 2 hours.
2. The exam is a computer-based exam.
3. You are expected to use a CS lab computer to answer both the Java coding questions and the theory/non-coding/knowledge-based questions. However you must not use the Internet, your phone, books, the lecture slides, the lab assignments or any written notes.
4. Make sure to switch-off your cell-phones or simply turn the ringer off.
5. You may use blank sheet(s) of paper for your scratch work, if needed. But you will need to turn it in.
6. Exams are copyrighted materials and may not be copied or reproduced.
7. All answers to the theory/non-coding/knowledge-based questions should be typed-in, on this document, following the questions.
8. All answers to the Java coding questions should be typed-in as source code files, using Eclipse or some other Java language IDE.

(CS401 - MPP)
(August 2017)
Midterm Examination

Part I – Science of Consciousness (SCI): (3 points)

From Maharishi's teachings, we learnt about the principles of the Science of Consciousness which are the fundamental laws of nature that uphold all progress and growth in life. In the last 3 weeks, you have learnt about several concepts and principles in Modern Programming Practices (MPP). In the table below, three (3) modern programming concepts/principles are given, on the first column. For each of these, write-down in the 2nd column, a related principle from the Science of Consciousness which you are familiar with, and in the 3rd column, write 1 or 2 sentences to show how the two principles are connected.

Note: To get the full credit, make sure your sentence(s) provide(s) a reasonable, clear connection between your stated SCI principle and the given MPP concept/principle. You may use a relevant analogy from Maharishi's teachings, to help illustrate your point.

Concept or Principle from Modern Programming Practices	SCI principle	Connection sentence(s)
Functional Programming		
Lambda Expressions		
Generic Programming		

Part II – Theory (Short answers, True/False, Multiple-choice questions):

(37 points)

1. (7 points) Answer the following questions with True or False. For each answer, give a rationale (i.e. If True state how, if False state why. No rationale, earns you just half of the points if your True/False answer is correct, and zero point if your True/False answer is incorrect).

I. (3 points) In Java Generics, for a collection that uses the super wildcard, (e.g. *List<? super Double>*), any object of type, *java.lang.Object*, can be read legally, without causing a compiler error.

II. (2 points) Based on the retention policy specified, the annotation defined below will be retained by the JVM and used by the Java runtime environment during execution of the compiled code.

```
@Retention(value=RetentionPolicy.SOURCE)
public @interface Generated {
     String comment;
     String date;
}
```

III. (2 points) In executing a stream pipeline of operations, using a parallel stream always gives a better performance than using sequential stream.

2. (23 points) Give short answers to the following question~~s~~s.

I. (4 points) In working with the *java.util.Optional<T>* container object, what is the difference between the *orElse(…)* and *orElseGet(…)* methods?

II. (4 points) Using the Java 8 *"try-with-resources"* language construct, means including a "*finally*" block is no longer necessary. Why is that?

III. (3 points) Using the Stream API, write one line of code that creates an infinite stream of even numbers.

IV. (4 points) In 2 or 3 sentences, explain what you understand by the statement, Functions are first-class citizens, as it applies to Functional Programming in Java (You may give an example to illustrate your answer).

V. (4 points) In 2 or 3 sentences explain what it means to say, Functions have referential transparency? (You may give an example to illustrate your answer).

VI. (4 points) Consider the Account class defined below. And the 2 Account objects, a1 and a2, created.

```java
class Account {
   private String accountNumber;
   Account(String accountNumber) {
      this.accountNumber = accountNumber;
   }
}

// Creating 2 Account objects
Account a1 = new Account("10023");
Account a2 = new Account("10023");
```

What will be the output when the following statement is executed? And state why.

System.out.println("a1.equals(a2)? " + a1.equals(a2));

3. (7 points) The following questions involve multiple choices; choose the correct option by putting a green highlight over, either Option A or Option B.

I. (2 points) To create a Stream from an array containing the integer values, [41,47,49,50].

Option A.

```
Stream<int[]> streamInts = Stream.of(new int[] {41, 47, 49, 50});
```

Option B.

```
Stream<Integer> streamInts = Stream.of(new Integer[] {41, 47, 49, 50});
```

II. (3 points) Which is the correct @FunctionalInterface for a lambda expression given as, *(w,x,y,z)* -> *w+x+y+z*, which sums any four input values:

Option A.

```
@FunctionalInterface
public interface QuadriFunction<S,T,U,V,R> {
   R apply(S s, T t, U u, V v);
}
```

Option B.

```
@FunctionalInterface
public interface TriFunction<S,T,U,R> {
   R apply(S s, T t, U u);
}
```

III. (2 points) To spawn a new Thread of Execution in a Java application, which of these is an incorrect interface to implement?

Option A.
java.lang.Runnable

Option B.
java.util.concurrent.Invokable

Option C.
java.util.concurrent.Callable

Part III – Skill (Java coding etc.): (60 points)

1. (40 points) Load the Starter Java source code found inside the package named, `edu.mum.cs.mpp.finalexam.part3q1,` in the src folder. And answer the 5 questions given as comments in the source file named, Main.java, by implementing all the necessary code needed inside the class files in packages named, "model" and "streampipelineops".

2. (20 points) Answer the following questionss:

a. (10 points) Implement a method -

```
public static void printCubes(int num)
```

which creates an `IntStream` using the `iterate` method. The method prints to the console the first `num` cubes. For instance, if `num` = 3, then your method would output 1, 8, 27.

Note: Devise a function to be used in the second argument of the `iterate` method. Use the starter code in the source file named, `MyCubesPrinterApp, which is` found in the package named, `edu.mum.cs.mpp.finalexam.part3q2a.`

b. (10 points) By applying the try-with-resources construct, re-implement the code given in the class file named, MyClass inside the package - `edu.mum.cs.mpp.finalexam.part3q2b.`

Use the starter code in the source file named, `MyClassUsingTryWithRes, which is` found in the package named, `edu.mum.cs.mpp.finalexam.part3q2b.`

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