MIDTERM EXAM

CSE 1710 3.0 Programming for Digital Media
Section A, Fall 2011

Family Name: _____

Given Name(s): _____

Student Number: |___|___|___|___|___|___|___|___|___|

CS Account: c s e |___|___|___|___|___|

- Duration of test: 45 minutes.
- This is a closed book test. No written materials are permitted.
- No electronic aids or devices are permitted.
- Answer each question in the space provided and/or follow the instructions provided.
- Stay seated; no talking until all tests have been collected.

		Mark Earned
Q1 – Contracts	/10	
Q2 – Models of Delegation	/14	
Q3 – Contracts	/16	
Total	/40	

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Question Q1: Concepts about Types and Operators *<10 marks>*

Consider the following three expressions, which all make use of the / symbol.

```
1   10 / 2
2   10.0 / 2.0
3   10 / 2.0
```

Q1–1. [3 marks] Identify the operation that is being performed in each of these three expressions. Be specific.

(The answers provided here are given in a very concise form; answers from students are expected to be written out more fully).

integer quotient,
floating point division,
f.p. division

Q1–2. [1 mark] What is this term used to describe the situation where multiple operators share the same symbol?
overloaded

Q1–3. [2 marks] How does the compiler know which operator should be employed? In your answer, be sure to also explain the case represented by the third expression from the list above.
it looks at the types of the operands.
in the case of diff operands, it will attempt to auto-promote so that both are the same. elab to say what promotion is

Q1–4. [4 marks] Does the property of closure apply to data types or to operators? Explain what is meant by the *closure* property. Describe an example of something that satisfies the closure property (your choice; there are several possibilities).
closure applies to operators, not data types. [1 mark]
closure means that result of application of operator is the same type as the type of the operands [1 mark]
e.g., int multiplication - uses wrap around to ensure closure. fp multiplication - additional values included in data type to represent overflow and underflow, such as NaN and +Infy [2 marks]

Question Q2: Models of Delegation *<14 marks>*

This question refers to the classes `WordServices` and `EnglishWord`. The APIs for these classes can be found in a separate handout.

Q2–1. **[2 marks]** Is the class `WordServices` a utility class or a non-utility class? Explain your answer.

The class is a utility class [1 mark]
because it does not have a constructor and consists only of static methods. [1 mark]
static methods alone not sufficient reason, lack of constructor is key aspect

Q2–2. **[2 marks]** Should the method `removeVowels(String)` in `WordServices` provide additional information about how the method actually identifies and removes the vowels from the string? Explain why or why not.
FALSE - the API should say "what", not "how". key principle - separation of concerns, abstraction by delegation

Q2–3. **[2 marks]** What type of delegation is provided by `WordServices`?
it provides delegation to a method ("abstraction by delegation of task" is an ok answer too).

Q2–4. **[2 marks]** Is the class `EnglishWord` a utility class or a non-utility class? Does `EnglishWord` have private attributes? Explain your answer.

The class is a non-utility class because it can be constructed. It has static methods, but that is not the determining factor students will likely say it is utility because it has only one method and it is static, but this isn't the correct answer.

Q2–5. **[2 marks]** The class `EnglishWord` provides services that allow us to model multiple states at the same time, but class `WordServices` does not. Explain what this means. In your answer, be sure to describe what is meant by *state*.

We can create multiple instances of EnglishWord, but none of WordServices. State refers to, collectively, the set of values of the object's attributes. If a utility class has an attribute, then the value of the attribute is shared by all instances. If a non-utility class has an attribute, then all of the objects instantiated from that non-utility class will have that attribute, but the values of that attribute may vary among the objects.

Q2–6. **[2 marks]** What type of delegation is provided by `EnglishWord`?

it is a demonstration of *delegating computation and/or data representation to an object*. It may be pointed out that no object-specific computation is done and that the sole methods is static - if this rationale is given and if data representation is highlighted only, that is an ok answer too

Q2–7. **[2 marks]** As a client, the class `EnglishWord` is not very useful. Explain why.

it provides data representation services, but doesn't allow you to do anything with the objects. the single method is a static method.

Question Q3: Contracts *<16 marks>*

The APIs for the classes used in these examples as the same as in earlier questions. For all code examples in this test, you may assume they error-free compilation. You may assume that, at runtime, all necessary files are in place and are properly specified on the class path.

Q3–1. **[2 mark]** Consider the following application.

```
1   import mtPackage.WordServices;
2
3   public class MyApp1 {
4
5     public static void main(String[] args) {
6       String str1 = "yataghan";
7       WordServices.removeVowels(str1);
8     }
9
10  }
```

In the app above, identify who is the *client* of the method `removeVowels(String)` and who is the *implementer*. Be specific.

The client is the main method of MyApp1 (or "the class MyApp1" is also fine). The implementer is (the static method of) MyUtilityClass.

(You are not expected to fill all of this space — two sentences will suffice.)

Q3–2. [2 marks] Suppose the app crashes as a result of the method invocation in line number 7 above. Examine the contract for the method `removeVowels(String)`.
(a) Was the contract fulfilled? (yes or no answer)
(b) Did the client fulfill its part of the contract? (yes or no) Briefly explain.
(c) Did the implementer fulfill its part of the contract? (yes or no) Briefly explain.
(d) If the contract was not fulfilled, who is the party to whom blame should be assigned?

(a) NO
(b) YES - The client fulfilled its part by providing a string, thereby satisfying the precondition. There is no throws condition.
(c) NO - The implementer failed to fulfill its part because it had committed to printing something to System.out but did not do so. There is no throws condition. It crashed instead.
(d) The implementer

Q3–3. [2 marks] Suppose the app runs and the following is printed to `System.out` as a result of the method invocation in line number 7. (The printout is shown between the two horizontal lines).

`ytghn`

(a) Was the contract fulfilled? (yes or no answer)
(b) Did the client fulfill its part of the contract? (yes or no) Briefly explain.
(c) Did the implementer fulfill its part of the contract? (yes or no) Briefly explain.
(d) If the contract was not fulfilled, who is the party to whom blame should be assigned?

(a) NO - the output is incorrect.
(b) YES - The client fulfilled its part by providing a string, thereby satisfying the precondition. There is no throws condition.
(c) NO – The implementer failed to fulfill its part because the output is incorrect - y should have been removed.
(d) The implementer

Q3–4. [2 marks] Now consider `MyApp2`. This app compiles without error. Assume that all necessary files are available at run-time.

```
1   import java.io.PrintStream;
2   import mtPackage.WordServices;
3
4   public class MyApp2 {
5
6     public static void main(String[] args) {
7       PrintStream output = System.out;
8       String str1 = "yarnwindle234";
9       String str2 = WordServices.removeVowels(str1);
10      output.println(str2);
11
12    }
13
14  }
```

Suppose `MyApp2` runs and the following is printed to `System.out` (The printout is shown between the two horizontal lines).

```
windlewindlehahaha
windlewindlehahaha
```

Identify which lines are responsible for each line of output. Write the line number next to the output.

Examine the output from the method invocation in line number 9 and answer the following with with respect to this particular method invocation.

(a) Was the contract fulfilled? (yes or no answer)

(b) Did the client fulfill its part of the contract? (yes or no) Briefly explain.

(c) Did the implementer fulfill its part of the contract? (yes or no) Briefly explain.

(d) If the contract was not fulfilled, who is the party to whom blame should be assigned?

(Your answer can continue on the next page, if needed.)

first line is from line 9, second from line 10

(a) NO - output is not correct.

(b) NO - the client did not fulfill its part, the string it provided contained digits (contrary to the contract).

(c) NO - The implementer's responsibility was to provide correct output. But the precondition wasn't satisfied, so its responsibility is lifted.

(d) The client bears the responsibility; the client did not adhere to the contract. Even tho the implementer failed as well.

(answer con't from prev page)

Q3–5. [2 marks] Suppose the app `MyApp2` crashes as a result of line number 9 above.
(a) Was the contract fulfilled? (yes or no answer)
(b) Did the client fulfill its part of the contract? (yes or no) Briefly explain.
(c) Did the implementer fulfill its part of the contract? (yes or no) Briefly explain.
(d) If the contract was not fulfilled, who is the party to whom blame should be assigned?

(a) NO - not supposed to crash
(a) NO - the client did not fulfill its part, the string it provided contained digits.
(b) NO - The implementer's responsibility was to provide correct output. But the precondition wasn't satisfied, so its responsibility is lifted.
(c) The client bears the responsibility; the client did not adhere to the contract.

Q3–6. [2 marks] Now consider `MyApp3`. This app compiles without error. Assume that all necessary files are available at run-time.

```
1   import java.io.PrintStream;
2   import mtPackage.EnglishWord;
3
4   public class MyApp3 {
5
6     public static void main(String[] args) {
7       PrintStream output = System.out;
8       String str1 = "yarnwindle234";
9       EnglishWord word1 = new EnglishWord(str1);
10      String str2 = EnglishWord.removeConsonants(str1);
11      output.println(str2);
12    }
13
14  }
```

Suppose the app `MyApp3` runs without error. Consider the invocation of the constructor in line number 9. Answer the following with with respect to the invocation of this particular constructor.
(a) Was the contract fulfilled? (yes or no answer)
(b) Did the client fulfill its part of the contract? (yes or no) Briefly explain.
(c) Given the stated objective of the class `EnglishWord`, provide a critique of the contract for the constructor and propose a possible improvement.

(a) YES (an object was created).
(b) YES - no preconditions
(c) the contract does not address the possible situation in which the passed string has space characters. the contract should either make this a pre-cond or add a throws clause

Q3–7. **[2 marks]** Suppose the app runs and the following is printed to `System.out` as a result of the method invocation in line number 10. (The printout is shown between the two horizontal lines).

```
aie234
```

(a) Was the contract fulfilled? (yes or no answer)
(b) Did the client fulfill its part of the contract? (yes or no) Briefly explain.
(c) Did the implementer fulfill its part of the contract? (yes or no) Briefly explain.
(d) If the contract was not fulfilled, who is the party to whom blame should be assigned?

(a) NO - not correct, exception should have been thrown.
(b) YES - The client fulfilled its part by providing a string. The string that was not valid, thereby satisfying the condition in the throws clause.
(c) NO - The implementer did not fulfil its part; it had committed throwing an exception but it instead provided output.
(d) The implementer.

Q3–8. **[2 marks]** Suppose the app `MyApp3` runs and instead crashes as a result of line 10. (a) Was the contract fulfilled? (yes or no answer)
(b) Did the client fulfill its part of the contract? (yes or no) Briefly explain.
(c) Did the implementer fulfill its part of the contract? (yes or no) Briefly explain.
(d) If the contract was not fulfilled, who is the party to whom blame should be assigned?

(a) YES - the contract was fulfilled. The crash was an expected outcome and no one bears the responsibility.
(b) YES - The client fulfilled its part by providing a string. The string that was not valid, thereby satisfying the condition in the throws clause.
(c) YES - The implementer fulfilled its part; it had committed throwing an exception but it instead provided output.
(d) The crash was an expected outcome and no one bears the responsibility.

(additional page, if needed)