

Student Name: \_\_\_\_\_ Student ID # \_\_\_\_\_

**UOSA Statement of Academic Integrity**

*On my honor I affirm that I have neither given nor received inappropriate aid in the completion of this exercise.*

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Notes Regarding this Examination**

**Open Book(s)** You may consult any printed textbooks in your immediate possession during the course of this examination.

**Open Notes** You may consult any printed notes in your immediate possession during the course of this examination.

**No Electronic Devices Permitted** You may not use any electronic devices during the course of this examination, including but not limited to calculators, computers, and cellular phones. All electronic devices in the student's possession must be turned off and placed out of sight (for example, in the student's own pocket or backpack) for the duration of the examination.

**Violations** Copying another's work, or possession of electronic computing or communication devices in the testing area, is cheating and grounds for penalties in accordance with school policies.

**Question 1:** Object-Oriented Design (40 points)

A. Sara wants to write a program to help her keep track of and configure her electronic devices. In particular, the electronic devices she is concerned with are her computers and computer peripherals (such as printers). For each of these electronic devices, she wants to maintain information on its manufacturer and model. For some of these devices, she wants to maintain additional information.

Draw a simplified UML class diagram that shows appropriate classes and/or interfaces to handle the types of objects described above. In this simplified UML, you do not need to include methods or the types for variables. However, class, interface, and variable names should be included along with accessibility modifiers for the variables and indications of whether each class is concrete or abstract. Also be sure to indicate in the diagram where the listed information is stored and the relationships between the classes and/or interfaces.

B. Sara has two basic types of computers: laptops and desktops. For each computer, she wants to keep track of what processors (both CPUs and GPUs) it has, the amount and type of RAM it has, and the type and capacity of each internal non-volatile memory device (e.g., hard disk) it has built in. For each desktop computer she also wants to keep track of its monitor and keyboard.

Add to or modify the UML diagram to incorporate this additional detail into the design you created in part A.

C. For peripherals, Sara has printers, scanners, and external non-volatile memory devices. Most of these need to be directly connected to one computer or another but a few of them can be shared, either on her wired network, her wifi network, or via BlueTooth. Sharable peripherals will need to be able to respond to messages asking how they can be shared.

Add to or modify the UML diagram to incorporate this additional detail into the design you created previously.

D. If you used inheritance anywhere in your UML for any of the parts above, describe where you used it in your design and *explain why* using inheritance improves this design. If you did not use inheritance anywhere in your UML for this design, *explain* a situation in which using inheritance would improve OO design.

E. If you used composition anywhere in your UML for any of the parts above, describe where you used it in your design and *explain why* using composition improves this design. If you did not use composition anywhere in your UML for this design, *explain* a situation in which using composition would improve OO design.

F. If you used aggregation anywhere in your UML for any of the parts above, describe where you used it in your design and *explain why* using aggregation improves this design. If you did not use aggregation anywhere in your UML for this design, *explain* a situation in which using aggregation would improve OO design.

**Question 2:** Inheritance and the Java Collections Framework (10 points)

Does the following declaration make sense?

```
Public Class MyCustomClass extends ArrayList<Object>  
    implements Collection<Object>
```

*Explain* your answer.

**Question 3:** Inheritance and Polymorphism (20 points)

A. How does Java's capacity for subclass assignment make inheritance in Java more useful? *Explain* your answer.

B. How does Java's capacity to override a method make inheritance in Java more useful? *Explain* your answer.

C. How does Java's capacity to overload a method make inheritance in Java more useful? *Explain* your answer.

D. How does Java's capacity for late binding make inheritance in Java more useful? *Explain* your answer.

**Question 4:** Abstraction (15 points)

A. What does the term “information hiding” mean in the context of object-oriented programming?

B. Is information hiding in this context positive or negative? That is, should we try to use information hiding in object-oriented software development, or should we try to avoid it? *Explain your answer.*

C. Do accessor and mutator methods aid with information hiding or do they detract from it? *Explain your answer.*

**Question 5:** Java Collections Framework and Generics (10 points)

A. The `add()` method of the `Collection` interface takes a single parameter `e` of type `E`. What is type `E`?

B. The `remove()` method of the `Collection` interface takes a single parameter `o` of type `Object`. Why is this type different than the type for `add()`?



**Question 6:** Documentation (5 points)

Why is it important to follow coding conventions such as capitalization within a compound variable name (such as `employeeFromFile` rather than `employeefromfile`)?