Student Name: _____ Student ID # _____

OU Academic Integrity Pledge
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.

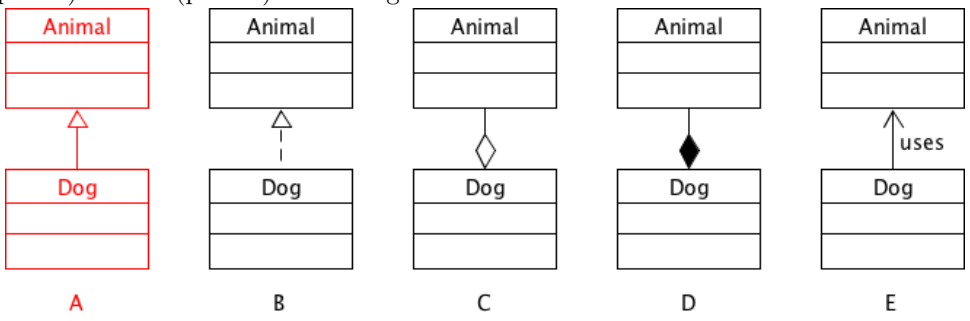
Open Notes You may consult any printed notes in your immediate possession during the course of this examination.

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.

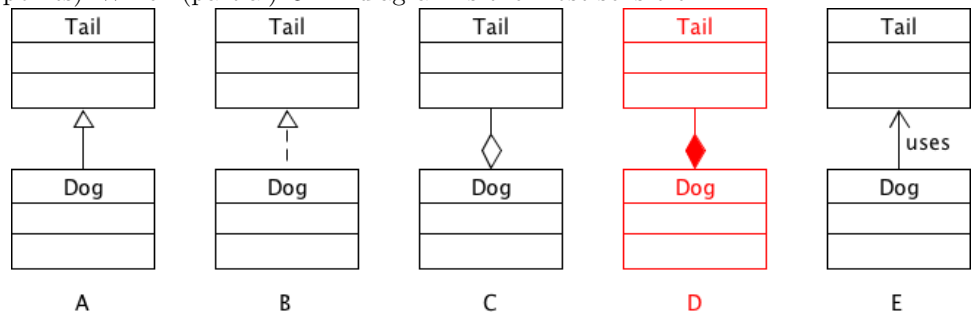
Violations Copying another's work, or possession of electronic computing or communication devices in the testing area, is cheating and grounds for penalties in accordance with school policies.

Part I. Understanding Object-Oriented Design Components & UML

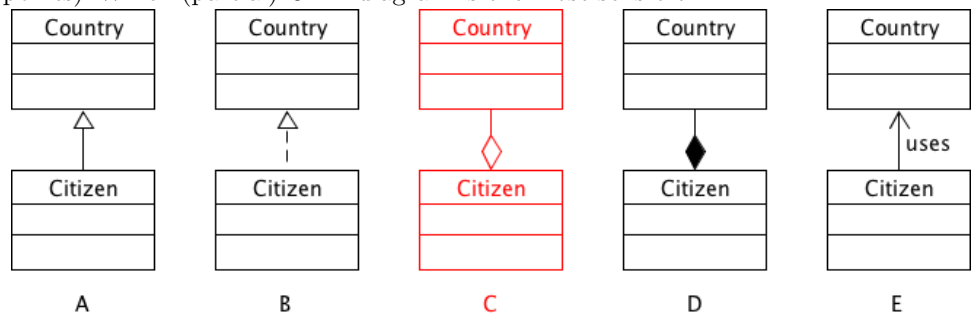
1. (2 points) Which (partial) UML diagram is the most sensible?



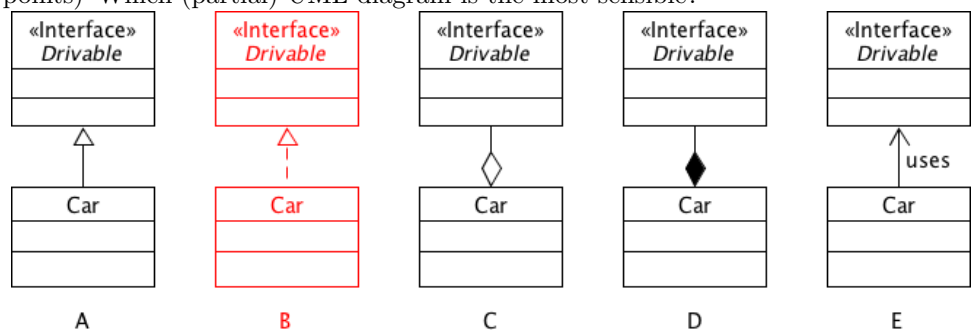
2. (2 points) Which (partial) UML diagram is the most sensible?



3. (2 points) Which (partial) UML diagram is the most sensible?



4. (2 points) Which (partial) UML diagram is the most sensible?



Part II. Recognizing Object-Oriented Design Components in Code

Refer to the code listings on Pages 13 and 14 when answering the questions in this part.

5. (2 points) Which line shows an example of declaring an instance variable?
   A. Listing 1, Line 1
   B. Listing 1, Line 2
   C. Listing 1, Line 4
   D. Listing 1, Line 5
   E. Listing 1, Line 8

6. (2 points) Which line shows an example of assigning a value to a variable?
   A. Listing 1, Line 1
   B. Listing 1, Line 2
   C. Listing 1, Line 4
   D. Listing 1, Line 5
   E. Listing 1, Line 8

7. (2 points) Which line shows an example of instantiating an object?
   A. Listing 1, Line 1
   B. Listing 1, Line 2
   C. Listing 1, Line 4
   D. Listing 1, Line 5
   E. Listing 1, Line 8

8. (2 points) Which line shows an example of defining a Class?
   A. Listing 1, Line 1
   B. Listing 1, Line 2
   C. Listing 1, Line 4
   D. Listing 1, Line 5
   E. Listing 1, Line 8

9. (2 points) Which line shows an example of a parameter?
   A. Listing 1, Line 1
   B. Listing 1, Line 2
   C. Listing 1, Line 4
   D. Listing 1, Line 5
   E. Listing 1, Line 8

10. (2 points) Which lines show an example of overloading?
    A. Listing 1, Lines 4 and 8
    B. Listing 1, Lines 14 and 18
    C. Listing 2, Line 5 and Listing 3, Line 11
    D. Listing 2, Lines 5 and 10
    E. Listing 3, Line 4 and Listing 3, Line 7

11. (2 points) Which lines show an example of overriding?
    A. Listing 1, Lines 4 and 8
    B. Listing 1, Lines 14 and 18
    C. Listing 2, Line 5 and Listing 3, Line 11
    D. Listing 2, Lines 5 and 10
    E. Listing 3, Line 4 and Listing 3, Line 7

12. (2 points) Which line shows an example of inheritance?
    A. Listing 1, Line 2
    B. Listing 2, Line 5
    C. Listing 2, Line 15
    D. Listing 3, Line 2
    E. Listing 3, Line 4

13. (2 points) Which line shows an example of an accessor?
    A. Listing 1, Line 4
    B. Listing 1, Line 14
    C. Listing 1, Line 18
    D. Listing 2, Line 15
    E. Listing 3, Line 5

14. (2 points) Which line shows an example of a mutator?
    A. Listing 1, Line 4
    B. Listing 1, Line 14
    C. Listing 1, Line 18
    D. Listing 2, Line 5
    E. Listing 2, Line 10

15. (2 points) Which line shows an example of a constructor?
    A. Listing 1, Line 4
    B. Listing 1, Line 14
    C. Listing 1, Line 18
    D. Listing 2, Line 5
    E. Listing 2, Line 10

16. (2 points) Which line shows an example of constructor chaining?
    A. Listing 1, Line 22
    B. Listing 2, Line 1
    C. Listing 2, Line 15
    D. Listing 3, Line 5
    E. Listing 3, Line 12

17. (2 points) Which line shows an example of a base Class?

A. Listing 1, Line 1
B. Listing 1, Line 22
C. Listing 2, Line 1
D. Listing 3, Line 2
E. Listing 3, Line 24

18. (2 points) Which line shows an example of a derived Class?

A. Listing 1, Line 1
B. Listing 1, Line 22
C. Listing 2, Line 1
D. Listing 3, Line 2
E. Listing 3, Line 24

19. (2 points) Which line shows an example of Generics?

A. Listing 1, Line 15
B. Listing 2, Line 10
C. Listing 3, Line 2
D. Listing 3, Line 4
E. Listing 3, Line 24

20. (2 points) Which line shows an example of the Java Collections Framework?

A. Listing 1, Line 15
B. Listing 2, Line 10
C. Listing 3, Line 2
D. Listing 3, Line 4
E. Listing 3, Line 24

21. (2 points) Which of the following would show an example of subclass assignment?

A. `double area = shape.getArea();`
B. `Point point = new Point();`
C. `double length = Calculator.distance (point1, point2);`
D. `Point point = (Point) center;`
E. `Shape shape = new Square(corners);`

22. (2 points) Which of the following would show an example of dynamic binding?

A. `double area = shape.getArea();`
B. `Point point = new Point();`
C. `double length = Calculator.distance (point1, point2);`
D. `Point point = (Point) center;`
E. `Shape shape = new Square(corners);`

Part III. Recognizing Object-Oriented Concepts

Refer to the following description when answering the questions in this part.

Nolan, a fantasy novelist and software developer, created the `FanDate` Class to represent the days, months, seasons, and years of his make-believe world. He made the fields that hold this data private but made numerous public constructor, mutator, and accessor methods with which to interact with objects of Class `FanDate`, including methods to set and get the months and seasons both by number (taking or returning an `int`) and by name (taking or returning a `String`). For example, `public int getMonth()` would return an `int` whereas `public String getMonth()` would return a `String`.

Later, Nolan created several subclasses of `FanDate` to represent the way different groups of people within his fantasy world talk about the same dates using different numbering and naming systems for the days, months, seasons, and years. For these Classes, he created mutator and accessor methods with the same names as those in `FanDate` but with different behavior. For example, in his `FanDate` Class, `public String getMonth()` would return "Long Sun" for the eighth month of the year, whereas in his `ElfDate` subclass, `public String getMonth()` would return "Hei-viar" instead.

In addition, for his new subclasses he added constructors, mutators, and accessors that take or return `FanDate` objects, so that he can convert from dates in one subclass to those in another subclass by converting to and from `FanDate` objects. For example, his `ElfDate` subclass would have a method `public FanDate getDate()` that would return a `FanDate` object that is equivalent to the `ElfDate` object being queried.

23. (2 points) Having the methods `public int getMonth()` and `public String getMonth()` defined in `FanDate` is an example of which?

    A. encapsulation
    B. overloading
    C. overriding
    D. inheritance
    E. constructor chaining

24. (2 points) Having the methods `public void setMonth(int month)` and `public void setMonth (String month)` defined in `FanDate` is an example of which?

    A. encapsulation
    B. overloading
    C. overriding
    D. inheritance
    E. constructor chaining

25. (2 points) Having the method `public String getMonth()` defined in `FanDate` and the method `public String getMonth()` defined in `ElfDate` is an example of which?

    A. encapsulation
    B. overloading
    C. overriding
    D. inheritance
    E. constructor chaining

26. (2 points) Having the Classes `FanDate` and `ElfDate` is an example of which?

A. encapsulation
B. overloading
C. overriding
D. inheritance
E. constructor chaining

27. (2 points) The choice of access modifiers for `FanDate` is an example of which?

A. encapsulation
B. overloading
C. overriding
D. inheritance
E. constructor chaining

Part IV. Understanding Object-Oriented Design

Refer to the following description when answering the questions in this part.

Lubna wants to design a software system to keep track of information about her smartphone software apps. Each app has a name, a size (in MB), a version number, a release date, and an icon; was created by a software developer; and can run on one or more smartphone operating systems. Types of apps include games, social apps, productivity apps, utility apps, lifestyle apps, and entertainment apps. Software developers may be individuals or groups, may or may not be businesses, and have names. Operating systems are software with names, version numbers, and release dates.

Data for this system will be stored to and retrieved from files in two formats – a human-readable text format and a machine-readable binary format.

28. (2 points) Which of the following is not an appropriate Class for this software?

A. `App`
B. `Comparable`
C. `AppNameComparator`
D. `OperatingSystem`
E. `Driver`

29. (2 points) Which Interface should be implemented to allow for objects to be sorted?

A. `Serializable`
B. `Cloneable`
C. `Comparable`
D. `Collections.sort`
E. `Collections.binarySearch`

30. (2 points) Which relationship should be included in this design?

A. `Developer` "is a" `Person`
B. `App` ***"is a"*** `Software`
C. `Software` "is a" `OperatingSystem`
D. `App` "is a" `Game`
E. `App` "is a" `Utility`

31. (2 points) Which relationship should not be included in this design?

A. `App` "has a" `Name`
B. `Developer` "has a" `App`
C. `App` "has a" `OperatingSystem`
D. `OperatingSystem` "has a" `Name`
E. `Developer` ***"has a"*** `VersionNumber`

32. (2 points) Which method should not be included in this design?
    A. `compareTo`
    B. `App`
    C. `getVersionNumber`
    D. `setName`
    E. `hasNext`

33. (2 points) Which field should not be included in `App`?
    A. `productivity`
    B. `releaseDate`
    C. `developer`
    D. `versionNumber`
    E. `name`

34. (2 points) For this software, `App` should be which of the following?
    A. An Interface
    B. A Class
    C. An `ArrayList`
    D. A method
    E. A field

Part V. Understanding Object-Oriented Design and Java

35. (2 points) Which of the following is a benefit of encapsulation?
    A. Fields are private
    B. Accessors and mutators are public
    C. Data are shielded from accidental modifications
    D. Code size is reduced
    E. Faster execution time

36. (2 points) Which is a key concept behind OO design and programming?
    A. Equations can be represented in code
    B. Software can represent the world
    C. Programs do things
    D. Logical reasoning can prove code correctness
    E. Java is an OO language

37. (2 points) UML Class diagrams show which of the following?
    A. Static relationships between Classes
    B. The flow of execution through OO programs
    C. Objects, Classes, and Interfaces
    D. Class fields and Class method implementations
    E. Class cast exceptions

38. (2 points) Which is a good reason for creating an Interface in Java?
    A. To instantiate objects of the Interface type
    B. To specify a contract that Classes may agree to
    C. To provide encapsulation of data
    D. To reduce code redundancy
    E. All of the above

39. (2 points) Which is a good reason for creating an Abstract Class in Java?
    A. To instantiate objects of the Abstract Class type
    B. To specify a contract that Classes may agree to
    C. To provide encapsulation of data
    D. To reduce code redundancy
    E. All of the above

40. (2 points) Which is a good reason for creating a (concrete) Class in Java?
    A. To instantiate objects of the (concrete) Class type
    B. To specify a contract that Classes may agree to
    C. To provide encapsulation of data
    D. To reduce code redundancy
    E. All of the above

41. (2 points) Which is a good reason for using Generics in Java?
    A. To move errors from run time to compile time
    B. To reduce the amount of casting needed
    C. To cut back on type checking using conditional statements
    D. To allow the same methods to operate on data of different types
    E. All of the above

42. (2 points) Which is an advantage of `ArrayList` over `LinkedList`?
    A. `ArrayList` requires contiguous memory locations for the array
    B. `LinkedList` can use non-contiguous memory locations
    C. `ArrayList` allows for binary search
    D. `ArrayList` doubles in size when it becomes full
    E. `ArrayList` is a subclass of `List`

43. (2 points) Which is an advantage of `Linked List` over `ArrayList`?
    A. `ArrayList` requires contiguous memory locations for the array
    B. `LinkedList` can use non-contiguous memory locations the list nodes
    C. `ArrayList` allows for binary search
    D. `ArrayList` doubles in size when it becomes full
    E. `ArrayList` is a subclass of `List`

44. (2 points) Which is a characteristic of `HashSet`?
    A. `HashSet` requires contiguous memory locations for the hash table
    B. `HashSet` has faster lookups for large sets than `TreeSet`
    C. `HashSet` cannot contain duplicates
    D. All of the above
    E. None of the above

45. (2 points) Which distinguishes subclasses of `Map` from subclasses of `Collection`?
    A. `Map` subclasses are not indexed; `Collection` subclasses are
    B. `Map` subclasses cannot be sorted; `Collection` subclasses can
    C. `Map` subclasses use keys to locate values; `Collection` subclasses use `Compare`/`CompareTo`
    D. All of the above
    E. None of the above

46. (2 points) Which is a characteristic of `Map`?
    A. `Map` requires contiguous memory for the key/value map
    B. `Map` has faster lookups for many elements than `List`
    C. `Map` cannot contain duplicate keys
    D. All of the above
    E. None of the above

47. (2 points) Which is an advantage of `Vector` over `Array List`?
    A. `Vector` is found in legacy code
    B. `Vector` can use non-contiguous memory locations for the list nodes
    C. `Vector` allows for binary search
    D. `Vector` doubles in size when it becomes full
    E. `Vector` is synchronized for thread safety

48. (2 points) Which is the purpose of `serialVersionUID`?
    A. To identify the version of Java running the code
    B. To identify the version of the object to be read/written
    C. To identify the user requesting service
    D. All of the above
    E. None of the above

49. (2 points) Which is an advantage of `FileInputStream` over `FileReader`?
    A. `FileInputStream` is more efficient for non-character data
    B. `FileInputStream` is more efficient for character data
    C. `FileInputStream` reads one line at a time
    D. `FileReader` needs to use `BufferedReader`
    E. `FileInputStream` needs to use `BufferedInputStream`

50. (2 points) Which is an advantage of wrapping a `FileReader` with a `BufferedReader`?
    A. `FileReader` is intended for reading characters from a file; `BufferedReader` can read from streams as well
    B. `FileReader` can only read one character at a time; `BufferedReader` can read multiple characters with one read
    C. `BufferedReader` can read an entire object with one call to `readObject`; `FileReader` cannot
    D. `BufferedReader` can improve efficiency by loading more data than currently requested
    E. Trick question – there is no advantage

Use these listings to answer the questions in Part II. (Feel free to tear off this page for easy reference.)

Listing 1.

```
1  public abstract class Shape {
2      private Point center;
3
4      public Shape() {
5          this.center = new Point();
6      }
7
8      public Shape(Point center) {
9          this.center = new Point(center);
10     }
11
12     ...
13
14     public Point getCenter() {
15         return new Point(this.center);
16     }
17
18     public void setCenter(Point center) {
19         this.center = new Point(center);
20     }
21
22     public abstract double getArea();
23 }
```

Listing 2.

```
1  public interface Regular {
2      /**
3       * @return True if all sides match; False otherwise.
4       */
5      public abstract boolean sidesMatch();
6
7      /**
8       * @return True if all angles match; False otherwise.
9       */
10     public abstract boolean anglesMatch();
11
12     /**
13      * @param length  The new length for the sides.
14      */
15     public abstract void resize(double length);
16 }
```

Listing 3.

```
1  import java.util.ArrayList;
2  public class Square extends Rectangle implements Regular {
3
4      public Square(ArrayList<Point> corners) throws IllegalArgumentException{
5          super(corners);
6          if (!sidesMatch(corners)) {
7              throw new IllegalArgumentException();
8          }
9      }
10
11     public boolean sidesMatch() {
12         double sideLength = Calculator.distance(getCorner(3), getCorner(0));
13         for (int i = 0; i < 3; i++) {
14             if (sideLength !=
15                 Calculator.distance(getCorner(i), getCorner(i + 1))) {
16                     return false;
17             }
18         }
19         return true;
20     }
21
22     ...
23
24     public double getArea() {
25         double sideLength = Calculator.distance(getCorner(0), getCorner(1));
26         return sideLength * sideLength;
27     }
28 }
```