

Name: _____

CST:8284: OOP (in Java): Midterm: Part 1: Solution

You have 1 hour 50 minutes for both parts of this midterm. After completing *Part 1*, you must submit it before receiving *Part 2*. You may take an unsupervised break between *Part 1* and *Part 2*.

Part 1: 24 marks Part 2: 29 marks

Multiple Choice Questions

Answer the following multiple choice questions on the attached sheet.

1. Immediately after this statement executes, what best describes the result:

```
Actor[] x = new Actor[1000];
```

- a) *x* is an array of 1000 *Actor* objects.
 - b) *x* is a reference variable that now stores the location information of an array of 1000 references to objects of type *Actor*. ◀
 - c) *x* is allocated on the *heap* and the resulting array is allocated on the *stack*.
 - d) *x* is an array of objects which could be of any subclass type (such as *Hobbit* or *Wizard*, etc.).
 - e) generates a syntax error because *Actor* is an *abstract* class.
2. Immediately after the last statement executes, what best describes the result:

```
Actor x = new Wizard( );  
// ... some additional code  
x = new Hobbit();
```

- a) *x* is garbage collected before the new *Hobbit()* object is created..
 - b) *Wizard* is a subclass of *x*.
 - c) *x* is a reference variable holding location information for a *Hobbit* object. ◀
 - d) The statement generates a warning about overwriting.
 - e) All of the above.
3. The term *signature* can be used when describing a method. In this context, a *signature* is:
- a) The number of arguments sent to the method.
 - b) The precise name of the method (including upper/lower case).
 - c) The data type of arguments sent to the method.
 - d) All of the above. ◀

4. Which of the following is an application of the principle of *inheritance*:

- a) An object of class *A* has a reference to a class *B* object.
- b) Several methods have the same name, but have different *signatures*.
- c) Fields are usually declared *private*.
- d) All classes are ultimately derived from the *super class* called *Object*. ◀
- e) Objects created with *new* are allocated on the *heap*.

5. Consider the following statement. The keyword **final** means:

```
private final int MAX = 1000;
```

- a) **MAX** is a constant. ◀
 - b) **MAX** will never be garbage collected.
 - c) A single instance of **MAX** will be shared by all objects created from the class where **MAX** is defined.
 - d) Capitalizing **MAX** is part of the Java language syntax specification.
 - e) All of the above.
6. A *virtual method* requires which of the following to be in effect:
- a) The method signatures must be identical in the *super class* and *subclass*. ◀
 - b) The *subclass* overrides all methods in the ultimate *super class* (called *Object*).
 - c) The keyword *virtual* is applied to the method name.
 - d) The *super class* must be declared to be *abstract*.
 - e) All of the above.
7. Which of the following is true about a *primitive* variable:
- a) It holds the raw machine-code address of a variable.
 - b) During program execution, accessing a primitive is slower than accessing a reference-based object.
 - c) Primitives are close to the machine-code level, thus have different byte sizes on different hardware platforms.
 - d) The value stored in the variable is an actual value (as opposed to a reference to something). ◀
 - e) None of the above.
8. Which of the following is true about a *reference* variable:
- a) It holds the raw machine-code address of a variable.
 - b) When created, it will always contain location information for some object.
 - c) It can hold location information for objects of the named class, or objects of any subclass. ◀
 - d) Once the location information in the *reference* variable is established, it cannot be changed.
 - e) None of the above.
9. Which of the following statements about *constructors* is correct:

- a) A *constructor* has the same name as the class name.
- b) A *constructor* is responsible for the initialization of an object's fields.
- c) *Constructor* methods have no return type.
- d) A class can have several *constructors*.
- e) All of the above. ◀

10. You know that memory is allocated when an object is created using a *new* operator. That memory is released when:
- a) The *delete* operator is called using the reference variable to define the location of the object.
 - b) Program execution enters a *catch* block.
 - c) The garbage collector discovers that there are no outstanding references to the object. ◀
 - d) The class loader detects an exception.
 - e) None of the above.

11. In the example code fragment shown below, the keyword *abstract*:

```
public abstract class Test // . . . more class code
```

- a) Implies that no object of type *Test* can ever be created. ◀
 - b) Makes class *Test* independent of all other classes, in particular, it is not a subclass of the class *Object*.
 - c) Is needed so that the class *Test* can implement virtual methods.
 - d) Ensures that only one object of type *Test* is ever created.
 - e) All of the above.
12. The following statements compare and contrast *array* and *ArrayList*. Which is true?
- a) Both *ArrayList* and *array* objects automatically keep track of their capacity and the number of elements actually in use.
 - b) *ArrayList* can expand its storage space as needed; an *array* cannot change the initial size of the array. ◀
 - c) The *array* type extends from *Object*. The *ArrayList* type extends from *array*.
 - d) The elements in an *ArrayList* can be primitives (*int*, *float*, *double* etc.) or reference-to values. An *array* can store only reference-to values.
 - e) All of the above.

The following declaration will be used in the next four questions:

```
class SuperClass {
    private int x;
    private int y;
    public SuperClass ( ) { x = 10; y = 20; }
    public SuperClass (int x, int y) { this.x = x; this.y = y; }
    public String toString ( )
        { return "Numbers are: " + x + " and " + y; }
    public int returnProduct ( ) { return (x*y); }
}
class SubClass extends SuperClass {
    private int z;
    public SubClass ( ) { super(); z = 30; }
    public int returnProduct ( ) { return (super.returnProduct() *
z); }
};
```

and the declarations:

```
SuperClass obj1 = new SuperClass(4, 5);
SuperClass obj2 = new SubClass();
```

13. What will the following statement display to the screen?

```
System.out.println (obj1);
```

- a) Nothing
- b) Numbers are: 10 and 20
- c) Numbers are: 10 and 20 and 30
- d) None of the above. Numbers are: 4 and 5 ◀

14. What will the following statement display to the screen?

```
System.out.println (obj2);
```

- a) Nothing
- b) Numbers are: 10 and 20 ◀
- c) Numbers are: 10 and 20 and 30
- d) None of the above

15. Given the following statement, what will display to the screen?

```
System.out.print("Product is:" + obj2.returnProduct());
```

- a) Product is: 20
- b) Product is: 200
- c) Product is: 6000 ◀
- d) Invalid statement – won't compile
- e) None of the above.

16. Which statement will create an array of 100 references to *SuperClass* objects:

- a) **SuperClass [100] numbers;**
- b) **SuperClass numbers [100];**
- c) **SuperClass numbers [99];**
- d) **SuperClass numbers [101];**
- e) None of the above. ◀

For the following 2 questions, assume that the following class specification is part of the program:

```
public class Actor {
    private String name;
    private int strength;
    private static int count;

    public Actor(String name, int strength) {
        this.name = name;
        this.strength = strength + ++count;
    }

    public String toString() {
        return "Name:"+name+" Strength:"+strength;
    }

    // many public methods
} // end class Actor
```

```
public class TestActor {
    public static void main(String[] args) {
        Actor a1 = new Actor("Bob", 33);
        Actor a2 = new Actor("Bill", 22);
        Actor a3 = new Actor("Boris", 11);
        System.out.println(a3);

        // more code
    }
}
```

17. What will be output by `System.out.println(a3);`
- a) *Name:BobBillBoris Strength:66*
 - b) *Name:Boris Strength:11*
 - c) *Name:Boris Strength:11.0*
 - d) **strength + ++count** is a syntax error. Won't execute.
 - e) None of the above. ◀ *Name:Boris Strength:14*
18. Assume that you do now have a correctly built array of 100 references to *Actor* objects managed through the variable *aaActors*. Identify the code needed to create a *Hobbit* object and capture it as the second element in the array.
- a) `aaActors[1] = new Hobbit();` ◀
 - b) `Actor[2] = new Hobbit();`
 - c) `new Actor[1] = Hobbit();`
 - d) `aaActors[2] = new Hobbit();`
 - e) None of the above.

Trace Program Execution (3 Marks)

Show the output that will result from the following code:

```
public class TestStuff {
    public static void main(String[] args) {
        Stuff s = new Stuff("testing", 0.5);
        System.out.println(s);
        double doubleValue = 2.5;
        s.doSomething(doubleValue);
        System.out.println(doubleValue);
        s = new Stuff("again", 1.5);
        String str = "word";
        System.out.println(s.changeSomething(str));
        System.out.println(s);
        System.out.println(str);
    }
}
```

```
public class Stuff {
    private static final int n = 2;
    private String string;
    private double d;

    public Stuff(String s, double d) {
        this.d = d;
        string = s;
    }

    public void doSomething(double d) {
        d = d * 2;
        System.out.println(this);
    }

    public double changeSomething(String s) {
        s = string;
        return n * d;
    }

    public String toString() {
        return string + " has " + d;
    }
}
```

Your Answer:

testing has 0.5
testing has 0.5
2.5
3.0
again has 1.5
word

Identify Syntax Errors (3 Marks)

There are 3 syntax and / or logic errors. Circle each error and suggest a correction.

```
public class Actor extends Hobbit {
    public static final double MAX_STEALTH = 100.0;
    private double stealth;

    public void Hobbit() {
        stealth = MAX_STEALTH / 2.0;
    }

    public void setStealth(double stealth) {
        stealth = stealth;
    }

    public void displayStatus() {
        super.displayStatus();
        System.out.printf(" Stealth: %d", stealth);
    }

    public toString() {
        return String.format("%s Stealth:%4.1f",
            toString(), stealth);
    }
} // end class Hobbit
```

Hobbit extends Actor

Use "this." to assign to the instance variable

Calls itself, need *super.toString()*