

CS 1331 Final Exam Version A

Fall 2016

ANSWER KEY

- Signing signifies you are aware of and in accordance with the **Academic Honor Code of Georgia Tech**.
- Calculators and cell phones are NOT allowed.
- This is an object-oriented programming test. Java is the required language. Java is case-sensitive. DO NOT WRITE IN ALL CAPS. A Java program in all caps will not compile. Good variable names and style are required. Comments are not required.

Completely fill in the box corresponding to your answer choice for each question.

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Number missed: _____ Final Score: _____

```

public class Kitten {

    private String name = "";

    public Kitten(String name) {
        name = name;
    }

    public String toString() {
        return "Kitten: " + name;
    }

    public boolean equals(Object other) {
        if (this == other) return true;
        if (null == other) return false;
        if (!(other instanceof Kitten)) return false;
        Kitten that = (Kitten) other;
        return this.name.equals(that.name);
    }
}

```

Assume the following statements have been executed:

```

Object maggie = new Kitten("Maggie");
Object fiona = new Kitten("Fiona");
Object fiona2 = new Kitten("Fiona");

```

- [3] 1. What is the value of `maggie`?
- A. the address of a Kitten object**
 - B. null
 - C. automatically set to 0
 - D. undefined
- [3] 2. What is printed on the console after the following statement is executed?
- ```
System.out.println(maggie.toString());
```
- A. Kitten:**
  - B. Kitten: null
  - C. Kitten: Maggie
- [3] 3. What is the value of the expression `fiona.equals(fiona2)`?
- A. true**
  - B. false
- [3] 4. What is the value of the expression `fiona.equals(maggie)`?
- A. true**
  - B. false
- [3] 5. After executing `Kitten[] kittens = new Kitten[5];`, what is the value of `kittens[0]` ?
- A. null**
  - B. the address of a Kitten object
  - C. automatically set to 0
  - D. undefined

```
public class Doberman {
 private static int dobieCount = 0;
 private String name;

 public Doberman(String name) {
 this.name = name;
 dobieCount++;
 }
 public String reportDobieCount() {
 return name + " says there are " + dobieCount + " dobies.";
 }
 public boolean equals(Doberman other) {
 return this.name.equals(other.name);
 }
}
```

- [3] 6. If no `Doberman` instances have been created, what is true about the following line from another class?

```
System.out.println("dobieCount: " + Doberman.dobieCount);
```

- A. It will not compile.**
- B. It will compile but will cause a `ClassCastException` at run-time.
- C. It will print "dobieCount: 0"

- [3] 7. What would be printed to the console after executing the following statements?

```
Doberman fido = new Doberman("Fido");
Doberman chloe = new Doberman("Chloe");
System.out.println(chloe.reportDobieCount());
Doberman prince = new Doberman("Prince");
```

- A. Chloe says there are 1 dobies.
- B. Chloe says there are 2 dobies.**
- C. Chloe says there are 3 dobies.

- [3] 8. What would be printed to the console after executing the following statements?

```
ArrayList daringDobermans = new ArrayList();
daringDobermans.add(new Doberman("Chloe"));
System.out.println(daringDobermans.contains(new Doberman("Chloe")));
```

- A. true
- B. false**

- [3] 9. What would be printed to the console after executing the following statements?

```
ArrayList daringDobermans = new ArrayList();
Doberman chloe = new Doberman("Chloe");
daringDobermans.add(chloe);
System.out.println(daringDobermans.contains(chloe));
```

- A. true**
- B. false

- [3] 10. Given `Doberman chloe = new Doberman("Chloe")`, what would `chloe.toString()` return?

- A. Something like "Doberman@deadbeef"**
- B. "Chloe"
- C. null

```
public class Super {
 protected int x = 1;
}
```

```
public class Duper extends Super {
 protected int y = 2;

 public Duper(int n) { x += y + n; }

 public String toString() { return new Integer(x).toString(); }
}
```

```
1 public class Andes {
2 static int a = 0;
3 static boolean incrementA() { return ++a > 0; }
4
5 public static void main(String[] args) {
6 boolean b = Boolean.parseBoolean(args[0]);
7 System.out.println(b && incrementA() ? new Duper(a) : new Duper(a + 1));
8 }
9 }
```

[3] 11. What is printed when `java Andes true` is executed on the command line?

- A. 3
- B. 4**
- C. 5

[3] 12. What is printed when `java Andes false` is executed on the command line?

- A. 3
- B. 4**
- C. 5

For the next two questions, change line 3 in `Andes.java` to

```
static boolean incrementA() { return a++ > 0; }
```

[3] 13. What is printed when `java Andes true` is executed on the command line?

- A. 3
- B. 4
- C. 5**

[3] 14. What is printed when `java Andes false` is executed on the command line?

- A. 3
- B. 4**
- C. 5

[3] 15. Will the expression `new Duper()` compile?

- A. Yes
- B. No**

Assume Trooper is defined as follows:

```
public class Trooper {
 private String name;
 private boolean mustached;
 public Trooper(String name, boolean hasMustache) {
 this.name = name; this.mustached = hasMustache;
 }
 public String getName() { return name; }
 public boolean hasMustache() { return mustached; }

 public boolean equals(Trooper other) {
 if (this == other) return true;
 if (null == other || !(other instanceof Trooper)) return false;
 Trooper that = (Trooper) other;
 return this.name.equals(that.name) && this.mustached == that.mustached;
 }
 public int hashCode() { return 1; }
}
```

And the following has been executed in the same scope as the code in the questions below:

```
ArrayList<Trooper> troopers = new ArrayList<>();
troopers.add(new Trooper("Farva", true));
troopers.add(new Trooper("Farva", true));
troopers.add(new Trooper("Rabbit", false));
troopers.add(new Trooper("Mac", true));
```

- [3] 16. What would be the result of the statement `Collections.sort(troopers)`?
- A. The code will not compile.
  - B. `troopers` will be sorted in order by name.
  - C. `troopers` will be sorted in order by mustache, then name.
  - D. `troopers` will not have any duplicate elements.
- [3] 17. After executing the statement `Set<Trooper> trooperSet = new HashSet<>(troopers)`, what would be the value of `trooperSet.contains(new Trooper("Mac", true))`?
- A. The code will not compile.
  - B. `true`
  - C. `false`
  - D. `void`
- [3] 18. Given the definitions of `troopers` and `trooperSet` above, what would `trooperSet.size()` return?
- A. 3
  - B. 4
- [3] 19. After the statement `Set<String> stringSet = new HashSet<>(Arrays.asList("meow", "meow"))` executes, what would be the value of `stringSet.size()`?
- A. 1
  - B. 2
- [3] 20. What would `new Trooper("Ursula", false).equals(new Trooper("Ursula", false))` return?
- A. `true`
  - B. `false`

Given the following class definitions:

```
public abstract class Animal {
 public abstract void speak();
 public int legs() { return 4; }
}
```

```
public class Mammal extends Animal {
 public void speak() { System.out.println("Hello!"); }
}
```

```
public class Canine extends Mammal {
 public void speak() { System.out.println("Grr!"); }
}
```

```
public class Dog extends Canine {
 public void speak(String to) { System.out.println("Woof, " + to); }
}
```

```
public class Cat extends Mammal {
 public void speak() { System.out.println("Meow!"); }
}
```

- [3] 21. Say we write a subclass of `Mammal` named `Kangaroo` in which we want to override the `legs` method. Which of the following methods overrides `legs`?
- A. `public void legs() { System.out.println(2); }`
  - B. `public Object legs() { return new Integer(2); }`
  - C. `public double legs() { return 2; }`
  - D. **None of the above.**
- [3] 22. Which of the following is an invocation of the method `public void pet(Canine c)`?
- A. `pet(new Dog())`
  - B. `pet(new Cat())`
  - C. `pet(new Mammal())`
  - D. `pet(new Animal())`
- [3] 23. Assuming `Mammal fido = new Dog();` has been executed, what does `fido.speak()` print?
- A. Hello!
  - B. Woof! Woof!
  - C. Meow!
  - D. **None of the above.**
- [3] 24. Assuming `Mammal fido = new Dog();` has been executed, what does `((Mammal) fido).speak()` print?
- A. **Grr!**
  - B. Hello!
  - C. Woof! Woof!
  - D. Meow!
- [3] 25. Assuming the statement `Mammal sparky = new Mammal();` has been executed, which of the following statements will compile but cause a `ClassCastException` at run-time?
- A. **`Dog fido = (Dog) sparky;`**
  - B. `Mammal fido = new Dog();`
  - C. `Dog fido2 = (Dog) new Dog();`
  - D. `Cat c = new Dog();`

Given the following classes, which have no-arg constructors:

```
public class A extends Throwable { ... }
public class B extends A { ... }
public class C extends RuntimeException { ... }
```

[3] 26. Which of the following will **not** compile?

A.

```
A foo(B b) throws C {
 if (true) throw new C();
 return new B();
}
```

B.

```
A baz(B b) throws B {
 if (true) throw new A();
 return new B();
}
```

[3] 27. Which of the following will **not** compile?

A.

```
A foo(B b) throws C {
 if (true) throw new B();
 return new B();
}
```

B.

```
A bar(B b) throws C {
 if (true) throw new RuntimeException("c");
 return new B("c");
}
```

C.

```
A baz(B b) throws A {
 if (true) throw new A("a");
 return new B("c");
}
```

[3] 28. Given the method signature `A bar(B q) throws C`, will this code compile?

```
A m() throws C {
 return bar(new B());
}
```

A. Yes

B. No

[3] 29. Given the method signature `A bar(B q) throws B`, which of the following will **not** compile?

A.

```
A m() throws C {
 return bar(new B());
}
```

B.

```
A m() throws Throwable {
 return bar(new B());
}
```

C. All of the above will compile.

[3] 30. What is the highest superclass of all exceptions?

A. `java.lang.Object`

B. `java.lang.Throwable`

C. `java.lang.Exception`

Given the following definitions:

```
public interface Predicate<T> {
 boolean test(T t);
}
```

```
static <E> E find(List<E> es, Predicate<E> p) {
 for (E e: es) if (p.test(e)) return e;
 return null;
}
```

```
public interface Function<T, R> {
 R apply(T t);
}
```

```
static <E, R> List<R> map(List<E> es, Function<E, R> f) {
 List<R> result = new ArrayList<>();
 for (E e: es) result.add(f.apply(e));
 return result;
}
```

and the list:

```
List<String> words = Arrays.asList("Welcome", "To", "Java", "8");
```

- [3] 31. Which of the following expressions would return the first word in `words` that starts with an upper case character?
- A. `find(words, s -> Character.isUpperCase(s.charAt(0)))`
  - B. `find(map(words, String::split), a -> a[0].isUpperCase())`
  - C. `find(words, s -> s.toUpperCase())`
  - D. All of the above.
- [3] 32. Which of the following expressions would return a list of the lengths of the words in `words`?
- A. `map(words, (String s) -> s.length())`
  - B. `map(words, String::length)`
  - C. `map(map(words, s -> s.split("")), a -> a.length)`
  - D. All of the above.
- [3] 33. Is `Comparable<T>` a functional interface?
- A. Yes
  - B. No



[3] 34. What is true about this code?

```
public static int fac(int n) {
 if (n >= 1) return 1;
 else return n * fac(n + 1);
}
// ...
int fac5 = fac(5);
```

**A. Compiles and runs without errors or exceptions.**

B. Compiles but program terminates with an error or exception.

```
public static int f(int n) {
 if (n < 0) throw new IllegalArgumentException("n < 0");
 if (n <= 1) {
 return n;
 } else {
 return f(n - 1) + f(n - 2);
 }
}
```

[3] 35. Given the method `f` above, what is `f(5)`?

A. 0

B. 4

**C. 5**

D. 120

```
public class ArrayListQueue<E> {
 private ArrayList<E> elems = new ArrayList<>();
 public void enqueue(E item) {
 ???
 }
 public E dequeue() {
 ???
 }
 public boolean isEmpty() {
 return elems.isEmpty();
 }
}
```

[3] 36. Given the partial `ArrayListQueue` implementation above, which of the following statements for line 4 would implement `enqueue` in  $O(1)$  time? Do not consider any particular implementation for `dequeue`.

**A. `elems.add(item);`**

B. `elems.add(0, item);`

C. `return elems.remove(elems.size() - 1);`

[3] 37. Given the partial `ArrayListQueue` implementation above, which of the following statements for line 4 would implement `enqueue` in  $O(n)$  time? Do not consider any particular implementation for `dequeue`.

A. `elems.add(item);`

**B. `elems.add(0, item);`**

C. `return elems.remove(elems.size() - 1);`