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1. Consider the following two classes.

```
public class A
{
  public void show()
  {
    System.out.print("A");
  }
}


public class B extends A
{
  public void show()
  {
    System.out.print("B");
  }
}
```

What is printed as a result of executing the following code segment?

```
A obj = new B();
obj.show();
```

(A) A

(B) B

(C) AB

(D) BA

(E) The code results in a runtime error.

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2. Consider the following class definitions.

```
public class Robot
{
     private int servoCount;
     public int getServoCount()
     {
         return servoCount;
     }
     public void setServoCount(int in)
     {
         servoCount = in;
     }
}
public class Android extends Robot
{
     private int servoCount;
     public Android(int initVal)
     {
         setServoCount(initVal);
     }
     public int getServoCount()
     {
         return super.getServoCount();
     }
     public int getLocal()
     {
         return servoCount;
     }
     public void setServoCount(int in)
     {
         super.setServoCount(in);
     }
     public void setLocal(int in)
     {
         servoCount = in;
     }
}
```

The following code segment appears in a method in another class.

```
int x = 10;
int y = 20;
/* missing code */
```

Which of the following code segments can be used to replace `/* missing code */` so that the value `20` will be printed?

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(A)
```
Android a = new Android(x);
a.setServoCount(y);
System.out.println(a.getServoCount());
```

(B)
```
Android a = new Android(x);
a.setServoCount(y);
System.out.println(a.getLocal());
```

(C)
```
Android a = new Android(x);
a.setLocal(y);
System.out.println(a.getServoCount());
```

(D)
```
Android a = new Android(y);
a.setServoCount(x);
System.out.println(a.getLocal());
```

(E)
```
Android a = new Android(y);
a.setLocal(x);
System.out.println(a.getLocal());
```

3. Consider the following class definitions.

```
public class Artifact
{
     private String title;
     private int year;
     public Artifact(String t, int y)
     {
         title = t;
         year = y;
     }
     public void printInfo()
     {
         System.out.print(title + " (" + year + ")");
     }
}
public class Artwork extends Artifact
{
     private String artist;
     public Artwork(String t, int y, String a)
     {
         super(t, y);
         artist = a;
     }
     public void printInfo()
     {
         /* missing implementation */
     }
}
```

The following code segment appears in a method in another class.

```
Artwork starry = new Artwork("The Starry Night", 1889, "Van Gogh");
starry.printInfo();
```

The code segment is intended to produce the following output.

```
The Starry Night (1889) by Van Gogh
```

Which of the following can be used to replace `/* missing implementation */` in the `printInfo` method in the `Artwork` class so that the code segment produces the intended output?

(A)
```
System.out.print(title + " (" + year + ") by " + artist);
```

(B)
```
super.printInfo(artist);
```

(C)
```
System.out.print(super.printInfo() + " by " + artist);
```

(D)
```
super();
System.out.print(" by " + artist);
```

(E)
```
super.printInfo();
System.out.print(" by " + artist);
```

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4. Consider the following class definition.

```
public class Backyard
{
     private int length;
     private int width;

     public Backyard(int l, int w)
     {
         length = l;
         width = w;
     }

     public int getLength()
     {
         return length;
     }

     public int getWidth()
     {
         return width;
     }

     public boolean equals(Object other)
     {
         if (other == null)
         {
            return false;
         }

         Backyard b = (Backyard) other;
         return (length == b.getLength() & width == b.getWidth());
     }
}
```

The following code segment appears in a class other than `Backyard`. It is intended to print `true` if `b1` and `b2` have the same lengths and widths, and to print `false` otherwise. Assume that `x`, `y`, `j`, and `k` are properly declared and initialized variables of type `int`.

```
Backyard b1 = new Backyard(x, y);
Backyard b2 = new Backyard(j, k);
System.out.println( /* missing code */ );
```

Which of the following can be used as a replacement for `/* missing code */` so the code segment works as intended?

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(A) `b1 == b2`
(B) `b1.equals(b2)`
(C) `equals(b1, b2)`
(D) `b1.equals(b2.getLength(), b2.getWidth())`
(E) `b1.length == b2.length && b1.width == b2.width`

5. Consider the following class declarations.

```
public class Base
{
  private int myVal;

  public Base()
  { myVal = 0; }

  public Base(int x)
  { myVal = x; }
}

public class Sub extends Base
{
  public Sub()
  { super(0); }
}
```

Which of the following statements will NOT compile?

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(A) Base b1 = new Base();
(B) Base b2 = new Base(5);
(C) Base s1 = new Sub();
(D) Sub s2 = new Sub();
(E) Sub s3 = new Sub(5);

6. Consider the following class definition.

```
public class Beverage
{
     private int temperature;
     public Beverage(int t)
     {
         temperature = t;
     }
     public int getTemperature()
     {
         return temperature;
     }
     public boolean equals(Object other)
     {
         if (other == null)
         {
            return false;
         }
         Beverage b = (Beverage) other;
         return (b.getTemperature() == temperature);
     }
}
```

The following code segment appears in a class other than `Beverage`. Assume that `x` and `y` are properly declared and initialized `int` variables.

```
Beverage hotChocolate = new Beverage(x);
Beverage coffee = new Beverage(y);
boolean same = /* missing code */;
```

Which of the following can be used as a replacement for `/* missing code */` so that the `boolean` variable `same` is set to `true` if and only if the `hotChocolate` and `coffee` objects have the same temperature values?

(A) `(hotChocolate = coffee)`
(B) `(hotChocolate == coffee)`
(C) `hotChocolate.equals(coffee)`
(D) `hotChocolate.equals(coffee.getTemperature())`
(E) `hotChocolate.getTemperature().equals(coffee.getTemperature())`

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7. Consider the following Book and AudioBook classes.

```
public class Book
{
  private int numPages;
  private String bookTitle;

  public Book(int pages, String title)
  {
    numPages = pages;
    bookTitle = title;
  }

  public String toString()
  {
    return bookTitle + " " + numPages;
  }

  public int length()
  {
    return numPages;
  }
}


public class AudioBook extends Book
{
  private int numMinutes;

  public AudioBook(int minutes, int pages, String title)
  {
    super(pages, title);
    numMinutes = minutes;
  }

  public int length()
  {
    return numMinutes;
  }

  public double pagesPerMinute()
  {
    return ((double) super.length()) / numMinutes;
  }
}
```

Consider the following code segment that appears in a class other than Book or AudioBook.

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```
Line 1:  Book[] books = new Book[2];
Line 2:  books[0] = new AudioBook(100, 300, "The Jungle");
Line 3:  books[1] = new Book(400, "Captains Courageous");
Line 4:  System.out.println(books[0].pagesPerMinute());
Line 5:  System.out.println(books[0].toString());
Line 6:  System.out.println(books[0].length());
Line 7:  System.out.println(books[1].toString());
```

Which of the following best explains why the code segment will not compile?

(A) Line 2 will not compile because variables of type Book may not refer to variables of type AudioBook.

(B) Line 4 will not compile because variables of type Book may only call methods in the Book class.

(C) Line 5 will not compile because the AudioBook class does not have a method named toString declared or implemented.

(D) Line 6 will not compile because the statement is ambiguous. The compiler cannot determine which length method should be called.

(E) Line 7 will not compile because the element at index 1 in the array named books may not have been initialized.

8. Consider the following class definition.

```
public class Document
{
     private int pageCount;
     private int chapterCount;
     public Document(int p, int c)
     {
         pageCount = p;
         chapterCount = c;
     }
     public String toString()
     {
         return pageCount + " " + chapterCount;
     }
}
```

The following code segment, which is intended to print the page and chapter counts of a `Document` object, appears in a class other than `Document`.

```
Document d = new Document(245, 16);
System.out.println( /* missing code */ );
```

Which of the following can be used as a replacement for `/* missing code */` so the code segment works as intended?

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(A) `d.toString()`

(B) `toString(d)`

(C) `d.pageCount + " " + d.chapterCount`

(D) `d.getPageCount() + " " + d.getChapterCount()`

(E) `Document.pageCount + " " + Document.chapterCount`

9. Consider the following three class declarations.

```
public class ClassOne
{
     public void methodA()
     { /* implementation not shown */ }

     public void methodB()
     { /* implementation not shown */ }
}

public class ClassTwo
{
     public void methodA()
     { /* implementation not shown */ }
}

public class ClassThree extends ClassOne
{
     public void methodB()
     { /* implementation not shown */ }
}
```

The following declarations occur in a method in another class.

```
ClassOne one = new ClassOne();
ClassTwo two = new ClassTwo();
ClassThree three = new ClassThree();
/* missing method call */
```

Which of the following replacements for `/* missing method call */` will cause a compile-time error?

(A) `one.methodA();`

(B) `two.methodA();`

(C) `two.methodB();`

(D) `three.methodA();`

(E) `three.methodB();`

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10. Consider the following class definitions.

```
public class A
{
   private int aI;
   public void methodA()
   {
     methodB();     // Statement  I
   }
}
public class B extends A
{
   public void methodB()
   {
            methodA();        // Statement II
            aI = 0;             // Statement III
        }
}
```

Which of the labeled statements in the methods shown above will cause a compile-time error?

(A) I only
(B) III only
(C) I and II
(D) I and III
(E) II and III

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11. Assume that class Vehicle contains the following method.

```
public void setPrice(double price)

{ /* implementation not shown */ }
```

Also assume that class Car extends Vehicle and contains the following method.

```
public void setPrice(double price)

{ /* implementation not shown */ }
```

Assume Vehicle v is initialized as follows.

```
Vehicle v = new Car();

v.setPrice(1000.0);
```

Which of the following is true?

(A) The code above will cause a compile-time error, because a subclass cannot have a method with the same name and the same signature as its superclass.

(B) The code above will cause a run-time error, because a subclass cannot have a method with the same name and the same signature as its superclass.

(C) The code above will cause a compile-time error because of type mismatch.

(D) The code v.setPrice(1000.0); will cause the setPrice method of the Car class to be called.

(E) The code v.setPrice(1000.0); will cause the setPrice method of the Vehicle class to be called.

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12. Consider the following class declarations.

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```
public class A
{
private int x;
public A()
{ x = 0; }
public A(int y)
{ x = y; }
// There may be instance variables, constructors, and methods that are not shown.
}

public class B extends A
{
private int y;
public B()
{
/* missing code */
}
// There may be instance variables, constructors, and methods that are not shown.
}
```

Which of the following can be used to replace /* *missing code* */ so that the statement

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B temp = new B();

will construct an object of type B and initialize both x and y with 0 ?

I. y = 0

II. super (0);

y = 0;

III. x = 0;

y = 0;

(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

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13. Consider the following classes.

```
public class Base

{

public Base()

{

System.out.print("Base" + " ");

}

}

public class Derived extends Base

{

public Derived()

{

System.out.print("Derived" + " ");

}

}
```

Assume that the following statement appears in another class.

```
Derived d1 = new Derived();
```

What is printed as a result of executing the statement?

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(A) Nothing is printed because the statement is a variable declaration.
(B) Base
(C) Derived
(D) Base Derived
(E) Derived Base

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14. Consider the following declaration for a class that will be used to represent points in the *xy*-coordinate plane.

```
public class Point
{
  private int x;      // x-coordinate of the point
  private int y;      // y-coordinate of the point

  public Point()
  {
    x = 0;
    y = 0;
  }

  public Point(int a, int b)
  {
    x = a;
    y = b;
  }

  // Other methods not shown
}
```

The following incomplete class declaration is intended to extend the above class so that points can be named.

```
public class NamedPoint extends Point
{
  private String name; // name of point

  // Constructors go here

  // Other methods not shown
}
```

Consider the following proposed constructors for this class.

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I.
```
public NamedPoint()
{
  name = "";
}
```

II.
```
public NamedPoint(int d1, int d2, String pointName)
{
  x = d1;
  y = d2;
  name = pointName;
}
```

III.
```
public NamedPoint(int d1, int d2, String pointName)
{
  super(d1, d2);
  name = pointName;
}
```

Which of these constructors would be legal for the NamedPoint class?

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) II and III only

15. Consider the following interface and class declarations.

```
public interface Student
{  /* implementation not shown */  }

public class Athlete
{  /* implementation not shown */  }

public class TennisPlayer extends Athlete implements Student
{  /* implementation not shown */  }
```

Assume that each class has a zero-parameter constructor. Which of the following is NOT a valid declaration?

(A) Student a = new TennisPlayer();
(B) TennisPlayer b = new TennisPlayer();
(C) Athlete c = new TennisPlayer();
(D) Student d = new Athlete();
(E) Athlete e = new Athlete();

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16. Consider the following two classes.

```
public class Dog
{
  public void act()
  {
    System.out.print("run ");
    eat();
  }
  public void eat()
  {
    System.out.print("eat ");
  }
}
public class UnderDog extends Dog
{
  public void act()
  {
    super.act();
    System.out.print("sleep ");
  }
  public void eat()
  {
    super.eat();
    System.out.print("bark ");
  }
 }
```

Assume that the following declaration appears in a class other than Dog.

Dog fido = new UnderDog ( ) ;

What is printed as a result of the call fido.act() ?

(A) run eat
(B) run eat sleep
(C) run eat sleep bark
(D) run eat bark sleep
(E) Nothing is printed due to infinite recursion.

17. Consider the following class definitions.

```
public class Book
{
     private String bookTitle;
     public Book()
     {
         bookTitle = "";
     }
     public Book(String title)
     {
         bookTitle = title;
     }
}

public class TextBook extends Book
{
     private String subject;
     public TextBook(String theSubject)
     {
         subject = theSubject;
     }
}
```

The following code segment appears in a method in a class other than `Book` or `TextBook`.

```
Book b = new TextBook("Psychology");
```

Which of the following best describes the effect of executing the code segment?

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(A) The `TextBook` constructor initializes the instance variable `subject` with the value of the parameter `theSubject`, and then invokes the zero-parameter `Book` constructor, which initializes the instance variable `bookTitle` to `""`.

(B) The `TextBook` constructor initializes the instance variable `subject` with the value of the parameter `theSubject`, and then invokes the one-parameter `Book` constructor with `theSubject` as the parameter, which initializes the instance variable `bookTitle` to the value of the parameter `theSubject`.

(C) There is an implicit call to the zero-parameter `Book` constructor. The instance variable `bookTitle` is then initialized to `""`. Then, the instance variable `subject` is initialized with the value of the parameter `theSubject`.

(D) The code segment will not execute because the `TextBook` constructor does not contain an explicit call to one of the `Book` constructors.

(E) The code segment will not execute because the `TextBook` constructor does not have a parameter for the title of the book.

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18. Consider the following class definitions.

```
public class Data
{
  private int x;
  public void setX(int n)
  {
    x = n;
  }
  // ... other methods not shown
}
public class EnhancedData extends Data
{
  private int y;
  public void setY(int n)
  {
    y = n:
  }
  // ... other methods not shown
}
```

Assume that the following declaration appears in a client program.

```
EnhancedData item = new EnhancedData();
```

Which of the following statements would be valid?

I. item.y = 16;

II. item.setY(16);

III. item.setX(25);

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(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

19. Consider the following class declarations. Assume that each class has a no-argument constructor.

```
public class Food
{ /* implementation not shown */ }

public class Snack extends Food
{ /* implementation not shown */ }

public class Pizza extends Snack
{ /* implementation not shown */ }
```

Which of the following declarations will compile without error?

(A) `Food tacos = new Snack();`
(B) `Pizza cheesePizza = new Snack();`
(C) `Pizza sausagePizza = new Food();`
(D) `Snack pretzel = new Food();`
(E) `String Snack = new Pizza();`

20. When designing a class hierarchy, which of the following should be true of a superclass?

(A) A superclass should contain the data and functionality that are common to all subclasses that inherit from the superclass.
(B) A superclass should be the largest, most complex class from which all other subclasses are derived.
(C) A superclass should contain the data and functionality that are only required for the most complex class.
(D) A superclass should have public data in order to provide access for the entire class hierarchy.
(E) A superclass should contain the most specific details of the class hierarchy.

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21. Consider the following classes.

```
public class Ticket
{
     private double price;

     public Ticket(double p)
     {
         price = p;
     }

     public double getPrice()
     {
         return price;
     }

     public String toString()
     {
         return "Price is " + getPrice();
     }
}

public class DiscountTicket extends Ticket
{
     public DiscountTicket(double p)
     {
         super(p);
     }

     public double getPrice()
     {
         return super.getPrice() / 2.0;
     }
}
```

The following code segment appears in a class other than `Ticket` or `DiscountTicket`.

```
Ticket t = new DiscountTicket(10.0);
System.out.println(t);
```

What output, if any, is produced when the code segment is executed?

(A) `5.0`

(B) `10.0`

(C) `Price is 5.0`

(D) `Price is 10.0`

(E) There is no output because the code does not compile.

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22. Consider the following class definitions.

```
public class Bike
{
     private int numWheels = 2;
     // No constructor defined
}
public class EBike extends Bike
{
     private int numBatteries;
     public EBike(int batteries)
     {
         numBatteries = batteries;
     }
}
```

The following code segment appears in a method in a class other than `Bike` or `EBike`.

```
EBike eB = new EBike(4);
```

Which of the following best describes the effect of executing the code segment?

(A) An implicit call to the zero-parameter `Bike` constructor initializes the instance variable `numWheels`. The instance variable `numBatteries` is initialized using the value of the parameter `batteries`.

(B) An implicit call to the one-parameter `Bike` constructor with the parameter passed to the `EBike` constructor initializes the instance variable `numWheels`. The instance variable `numBatteries` is initialized using the value of the parameter `batteries`.

(C) Because `super` is not explicitly called from the `EBike` constructor, the instance variable `numWheels` is not initialized. The instance variable `numBatteries` is initialized using the value of the parameter `batteries`.

(D) The code segment will not execute because the `Bike` class is a superclass and must have a constructor.

(E) The code segment will not execute because the constructor of the `EBike` class is missing a second parameter to use to initialize the `numWheels` instance variable.

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23. Consider the following class definitions.

```
public class Computer
{
     private String memory;
     public Computer()
     {
         memory = "RAM";
     }
     public Computer(String m)
     {
         memory = m;
     }
     public String getMemory()
     {
         return memory;
     }
}
public class Smartphone extends Computer
{
     private double screenWidth, screenHeight;
     public SmartPhone(double w, double h)
     {
         super("flash");
         screenWidth = w;
         screenHeight = h;
     }
     public double getScreenWidth()
     {
         return screenWidth;
     }
     public double getScreenHeight()
     {
         return screenHeight;
     }
}
```

The following code segment appears in a class other than `Computer` or `Smartphone`.

```
Computer myPhone = new SmartPhone(2.55, 4.53);
System.out.println("Device has memory: " + myPhone.getMemory() +
     ", screen area: " + myPhone.getScreenWidth() *
     myPhone.getScreenHeight() + " square inches.");
```

The code segment is intended to produce the following output.

```
Device has memory: flash, screen area: 11.5515 square inches.
```

Which of the following best explains why the code segment does not work as intended?

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(A) An error occurs during compilation because a `Smartphone` object cannot be assigned to the `Computer` reference variable `myPhone`.

(B) An error occurs during compilation because the `Smartphone` class has no `getMemory` method.

(C) An error occurs during compilation because the `getScreenWidth` and `getScreenHeight` methods are not defined for the `Computer` object `myPhone`.

(D) An error occurs at runtime because the `Smartphone` class has no `getMemory` method.

(E) An error occurs at runtime because the `getScreenWidth` and `getScreenHeight` methods are not defined for the `Computer` object `myPhone`.

24. Consider the following class definitions.

```
public class C1
{
     public C1()
     { /* implementation not shown */ }
     public void m1()
     { System.out.print("A"); }
     public void m2()
     { System.out.print("B"); }
}
public class C2 extends C1
{
     public C2()
     { /* implementation not shown */ }
     public void m2()
     { System.out.print("C"); }
}
```

The following code segment appears in a class other than `C1` or `C2`.

```
C1 obj1 = new C2();
obj1.m1();
obj1.m2();
```

The code segment is intended to produce the output `AB`. Which of the following best explains why the code segment does not produce the intended output?

(A) A compile-time error occurs because `obj1` is declared as type `C1` but instantiated as type `C2`.

(B) A runtime error occurs because method `m1` does not appear in `C2`.

(C) Method `m1` is not executed because it does not appear in `C2`.

(D) Method `m2` is executed from the subclass instead of the superclass because `obj1` is instantiated as a `C2` object.

(E) Method `m2` is executed twice (once in the subclass and once in the superclass) because it appears in both classes.

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25. Consider the following two class definitions.

```
public class Bike
{
     private int numOfWheels = 2;
     public int getNumOfWheels()
     {
         return numOfWheels;
     }
}
public class EBike extends Bike
{
     private int numOfWatts;
     public EBike(int watts)
     {
         numOfWatts = watts;
     }
     public int getNumOfWatts()
     {
         return numOfWatts;
     }
}
```

The following code segment occurs in a class other than `Bike` or `EBike`.

```
Bike b = new EBike(250);
System.out.println(b.getNumOfWatts());
System.out.println(b.getNumOfWheels());
```

Which of the following best explains why the code segment does not compile?

(A) The `Bike` superclass does not have a constructor.

(B) There are too many arguments to the `EBike` constructor call in the code segment.

(C) The first line of the subclass constructor is not a call to the superclass constructor.

(D) The `getNumOfWatts` method is not found in the `Bike` class.

(E) The `getNumOfWheels` method is not found in the `EBike` class.

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26. Consider the following declarations.

```
public class Example0
{
  public void doNothing(Example1 b, Example2 c)
  {
  }
}
public class Example1 extends Example0
{
}
public class Example2 extends Example1
{
}
```

The following initializations appear in a different class.

```
Example0 e0 = new Example0();
Example1 e1 = new Example1();
Example2 e2 = new Example2();
```

Which of the following is a correct call to doNothing?

(A) e0.doNothing(e0, e0);
(B) e1.doNothing(e1, e1);
(C) e1.doNothing(e2, e1);
(D) e2.doNothing(e0, e0);
(E) e2.doNothing(e2, e2);

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27. Consider the following class definitions.

```
public class Game
{
     private String name;
     public Game(String n)
     {
         name = n;
     }
     // Rest of definition not shown
}
public class BoardGame extends Game
{
     public BoardGame(String n)
     {
         super(n);
     }
     // Rest of definition not shown
}
```

The following code segment appears in a class other than `Game` or `BoardGame`.

```
Game g1 = new BoardGame("checkers");
BoardGame g2 = new Game("chess");
ArrayList<Game> My_Games = new ArrayList();
My_Games.add(g1);
My_Games.add(g2);
```

Which of the following best explains why the code segment does not compile?

(A) A `BoardGame` object cannot be assigned to the `Game` reference `g1`.

(B) A `Game` object cannot be assigned to the `BoardGame` reference `g2`.

(C) The `My_Games` object cannot contain elements of different types.

(D) The object referenced by `g1` cannot be added to `My_Games` since `g1` was instantiated by a call to the `BoardGame` constructor.

(E) The object referenced by `g2` cannot be added to `My_Games` since `g2` was declared to be of type `BoardGame`.

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28. The question refer to the code from the GridWorld case study.

A DancingCritter is a Critter that moves in the following manner. The DancingCritter makes a left turn if at least one of its neighbors is another DancingCritter. It then moves like a Critter. If none of its neighbors are DancingCritter objects, it moves like a Critter without making a left turn. In all other respects, a DancingCritter acts like a Critter by eating neighbors that are not rocks or critters. Consider the following implementations.

I.
```
public class DancingCritter extends Critter
{
  public ArrayList<Actor> getActors()
  {
    ArrayList<Actor> actors = new ArrayList<Actor>();
    for (Actor a : getGrid().getNeighbors(getLocation()))
    {
      if (a instanceof DancingCritter)
        actors.add(a);
    }
    return actors;
  }

  public void processActors(ArrayList<Actor> actors)
  {
    if (actors.size() > 0)
    {
      setDirection(getDirection() + Location.LEFT);
    }
    super.processActors(actors);
```

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```
  }
 }
```

II.
```
public class DancingCritter extends Critter
{
 public void processActors(ArrayList<Actor> actors)
 {
  boolean turning = false;
  for (Actor a : actors)
  {
   if (a instanceof DancingCritter)
     turning = true;
  }
  if (turning)
  {
   setDirection(getDirection() + Location.LEFT);
  }
 }
}
```

III.
```
public class DancingCritter extends Critter
{
 public void makeMove(Location loc)
 {
```

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```
    boolean turning = false;
    for (Actor a : getGrid().getNeighbors(getLocation()))
    {
      if (a instanceof DancingCritter)
        turning = true;
    }
    if (turning)
    {
      setDirection(getDirection() + Location.LEFT);
    }
    super.makeMove(loc);
  }
}
```

Which of the proposed implementations will correctly implement the DancingCritter class?

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

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29. The question refer to the code from the GridWorld case study.

Consider the following declarations.

```
Actor a = new Actor();

Bug b = new Bug();

Rock r = new Rock();

Critter c = new Critter();
```

Consider the following lines of code.

```
Line 1:  int dir1 = c.getDirection();

Line 2:  int dir2 = a.getDirection();

Line 3:  int dir3 = b.getDirection();

Line 4:  ArrayList<Location> rLoc = r.getMoveLocations();

Line 5:  ArrayList<Location> cLoc = c.getMoveLocations();
```

Which of the lines of code above will cause a compile time error?

(A) Line 1 only
(B) Lines 2 and 3 only
(C) Line 4 only
(D) Line 5 only
(E) Lines 4 and 5 only

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30. The question refer to the code from the GridWorld case study.

A RightTurningBug behaves like a Bug, except that when it turns, it turns 90 degrees to the right. The declaration for the RightTurningBug class is as follows.

```
public class RightTurningBug extends Bug
{
  public void turn()
  {
    /* missing implementation */
  }
}
```

Consider the following suggested replacements for /* *missing implementation* */.

I.
```
int desiredDirection = (getDirection() + Location.RIGHT)
                       % Location.FULL_CIRCLE;

while (getDirection() != desiredDirection)
{
  super.turn();
}
```

II.
```
super.turn();
super.turn();
```

III.
```
setDirection(getDirection() + Location.RIGHT);
```

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Which of the replacements will produce the desired behavior?

(A) I only

(B) II only

(C) I and II only

(D) I and III only

(E) I, II, and III

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31. The question refer to the code from the GridWorld case study.

Consider the following TestBug class declaration.

```
public class TestBug extends Bug
{
  public void act()
  {
    if (canMove())
    {
      move();
      if (canMove())
        move();
    }
    else
    {
      setDirection(getDirection() + Location.HALF_CIRCLE);
    }
  }
}
```

The following code segment will produce a grid that has a Rock object and a TestBug object placed as shown.

```
Grid<Actor> g = new BoundedGrid<Actor>(5, 5);
Rock r = new Rock();
r.putSelfInGrid(g, new Location(2, 1));
```

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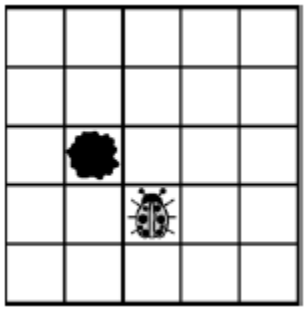
```
Bug t = new TestBug();
t.putSelfInGrid(g, new Location(3, 2));
```



Which of the following best describes what the `TestBug` object `t` does as a result of calling `t.act()`?

(A) Moves forward two locations and remains facing current direction

(B) Moves forward two locations and turns 180 degrees

(C) Moves forward one location and remains facing current direction

(D) Moves forward one location and turns 180 degrees

(E) Stays in the same location and turns 180 degrees

32. Consider the following class definitions.

```
public class Bird
{
     private int beakStrength;

     public Bird(int input)
     {
         beakStrength = input;
     }

     public void setBeakStrength(int strength)
     {
         beakStrength = strength;
     }
}

public class Hawk extends Bird
{
     private int talonStrength;

     public Hawk(int talon, int beak)
     {
         super(beak);
         talonStrength = talon;
     }
}
```

The following statement appears in a method in another class.

```
Bird b = new Hawk(5, 8);
```

Which of the following best describes the effect of executing the statement?

(A) The `Bird` variable `b` is instantiated as a `Hawk`. The instance variable `talonStrength` is initialized with the value from the parameter `talon`. The `Hawk` constructor cannot set the instance variable `beakStrength` because a subclass does not have access to a private variable in its superclass.

(B) The `Bird` variable `b` is instantiated as a `Hawk`. The call `super(beak)` returns a value from the instance variable `beakStrength` in the superclass and makes it accessible in the subclass. The instance variable `talonStrength` is then initialized with the value from the parameter `talon`.

(C) The `Bird` variable `b` is instantiated as a `Hawk`. The instance variable `talonStrength` is initialized with the value from the parameter `talon`. No other initializations are made to any instance variables.

(D) The `Bird` variable `b` is instantiated as a `Hawk`. The call `super(beak)` invokes the `Bird` constructor and initializes the instance variable `beakStrength` with the value from the parameter `beak`. The instance variable `talonStrength` is then initialized with the value from the parameter `talon`.

(E) The code segment will not execute because the `Bird` variable `b` cannot be instantiated as a `Hawk`.

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33. Consider the following partial class definitions.

```
public class Membership
{
     private String id;
     public Membership(String input)
     { id = input; }
     // Rest of definition not shown
}
public class FamilyMembership extends Membership
{
     private int numberInFamily = 2;
     public FamilyMembership(String input)
     { super(input); }
     public FamilyMembership(String input, int n)
     {
         super(input);
         numberInFamily = n;
     }
     // Rest of definition not shown
}
public class IndividualMembership extends Membership
{
     public IndividualMembership(String input)
     { super(input); }
     // Rest of definition not shown
}
```

The following code segment occurs in a class other than `Membership`, `FamilyMembership`, or `IndividualMembership`.

```
FamilyMembership m1 = new Membership("123"); // Line 1
Membership m2 = new IndividualMembership("456"); // Line 2
Membership m3 = new FamilyMembership("789"); // Line 3
FamilyMembership m4 = new FamilyMembership("987", 3); // Line 4
Membership m5 = new Membership("374"); // Line 5
```

Which of the following best explains why the code segment does not compile?

(A) In line 1, `m1` cannot be declared as type `FamilyMembership` and instantiated as a `Membership` object.

(B) In line 2, `m2` cannot be declared as type `Membership` and instantiated as an `IndividualMembership` object.

(C) In line 3, `m3` cannot be declared as type `Membership` and instantiated as a `FamilyMembership` object.

(D) In line 4, `m4` cannot be declared as type `FamilyMembership` and instantiated as a `FamilyMembership` object.

(E) In line 5, `m5` cannot be declared as type `Membership` and instantiated as a `Membership` object.

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34. Consider the following class definitions.

```
public class Apple
{
     public void printColor()
     {
         System.out.print("Red");
     }
}
public class GrannySmith extends Apple
{
     public void printColor()
     {
         System.out.print("Green");
     }
}
public class Jonagold extends Apple
{
     // no methods defined
}
```

The following statement appears in a method in another class.

```
someApple.printColor();
```

Under which of the following conditions will the statement print `"Red"` ?

I. When `someApple` is an object of type `Apple`
II. When `someApple` is an object of type `GrannySmith`
III. When `someApple` is an object of type `Jonagold`

(A) I only

(B) I and II only

(C) I and III only

(D) II and III only

(E) I, II, and III

unit 9 b

35. Consider the following class definitions.

```
public class Rectangle
{
     private int height;
     private int width;
     public Rectangle()
     {
         height = 1;
         width = 1;
     }
     public Rectangle(int x)
     {
         height = x;
         width = x;
     }
     public Rectangle(int h, int w)
     {
         height = h;
         width = w;
     }
     // There may be methods that are not shown.
}
public class Square extends Rectangle
{
     public Square(int x)
     {
         /* missing code */
     }
}
```

Which of the following code segments can replace `/* missing code */` so that the `Square` class constructor initializes the `Rectangle` class instance variables `height` and `width` to `x` ?

(A) `super();`

(B) `super(x);`

(C) `Rectangle(x);`

(D) `Square(x, x);`

(E)
```
height = x;
width = x;
```

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36. Consider the following class definitions.

```
public class A
{
     public String message(int i)
     {
         return "A" + i;
     }
}
public class B extends A
{
     public String message(int i)
     {
         return "B" + i;
     }
}
```

The following code segment appears in a class other than `A` or `B`.

```
A obj1 = new B(); // Line 1
B obj2 = new B(); // Line 2
System.out.println(obj1.message(3));   // Line 3
System.out.println(obj2.message(2));   // Line 4
```

Which of the following best explains the difference, if any, in the behavior of the code segment that will result from removing the `message` method from class `A` ?

(A) The statement in line 3 will cause a compiler error because the `message` method for `obj1` cannot be found.

(B) The statement in line 4 will cause a compiler error because the `message` method for `obj2` cannot be found.

(C) As a result of the method call in line 3, the `message` method in class `B` will be executed instead of the `message` method in class `A`.

(D) As a result of the method call in line 4, the `message` method in class `B` will be executed instead of the `message` method in class `A`.

(E) The behavior of the code segment will remain unchanged.

unit 9 b

37. Consider the following class definitions.

```
public class Road
{
     private String roadName;
     public Road(String name)
     {
         roadName = name;
     }
}
public class Highway extends Road
{
     private int speedLimit;
     public Highway(String name, int limit)
     {
         super(name);
         speedLimit = limit;
     }
}
```

The following code segment appears in a method in another class.

```
Road r1 = new Highway("Interstate 101", 55); // line 1
Road r2 = new Road("Elm Street"); // line 2
Highway r3 = new Road("Sullivan Street"); // line 3
Highway r4 = new Highway("New Jersey Turnpike", 65); // line 4
```

Which of the following best explains the error, if any, in the code segment?

(A) Line 1 will cause an error because a `Road` variable cannot be instantiated as an object of type `Highway`.

(B) Line 2 will cause an error because the `Road` constructor is not properly called.

(C) Line 3 will cause an error because a `Highway` variable cannot be instantiated as an object of type `Road`.

(D) Line 4 will cause an error because the `Highway` constructor is not properly called.

(E) The code segment compiles and runs without error.

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38. Consider the following class definitions.

```
public class Pet
{
     public void speak()
     {
         System.out.print("pet sound");
     }
}
public class Dog extends Pet
{
     public void bark()
     {
         System.out.print("woof woof");
     }
     public void speak()
     {
         bark();
     }
}
public class Cat extends Pet
{
     public void speak()
     {
         System.out.print("meow meow");
     }
}
```

The following statement appears in a method in another class.

```
myPet.speak();
```

Under which of the following conditions will the statement compile and run without error?

I. When `myPet` is an object of type `Pet`
II. When `myPet` is an object of type `Dog`
III. When `myPet` is an object of type `Cat`

(A) I only

(B) I and II only

(C) I and III only

(D) II and III only

(E) I, II, and III

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39. Consider the following class definitions.

```
public class Hero
{
     private String name;
     private int power;
     public Hero(String n, int p)
     {
         name = n;
         power = p;
     }
     public void powerUp(int p)
     {
         power += p;
     }
     public int showPower()
     { return power; }
}
public class SuperHero extends Hero
{
     public SuperHero(String n, int p)
     {
         super(n, p);
     }
     public void powerUp(int p)
     {
         super.powerUp(p * 2);
     }
}
```

The following code segment appears in a class other than `Hero` and `SuperHero`.

```
Hero j = new SuperHero("JavaHero", 50);
j.powerUp(10);
System.out.println(j.showPower());
```

What is printed as a result of executing the code segment?

(A) `10`

(B) `20`

(C) `60`

(D) `70`

(E) `100`

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40. Consider the following class definitions.

```
public class Drink
{
     // implementation not shown
}

public class Coffee extends Drink
{
     // There may be instance variables and constructors that are not
  shown.
     // No methods are defined for this class.
}
```

The following code segment appears in a method in a class other than `Drink` or `Coffee`.

```
Coffee myCup = new Coffee();
myCup.setSize("large");
```

Which of the following must be true so that the code segment will compile without error?

(A) The `Drink` class must have a public method named `getSize` that takes a `String` value as its parameter.

(B) The `Drink` class must have a public method named `getSize` that takes no parameters.

(C) The `Drink` class must have a public method named `setSize` that takes a `String` value as its parameter.

(D) The `Drink` class must have a public method named `setSize` that takes no parameters.

(E) The `Drink` class must have a `String` instance variable named `size`.

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41. Consider the following class definitions.

```
public class Book
{
     private String author;
     private String title;
     public Book(String the_author, String the_title)
     {
         author = the_author;
         title = the_title;
     }
}

public class Textbook extends Book
{
     private String subject;
     public Textbook(String the_author, String the_title, String
  the_subject)
     {
         /* missing implementation */
     }
}
```

Which of the following can be used to replace `/* missing implementation */` so that the `Textbook` constructor compiles without error?

(A)
```
author = the_author;
title = the_title;
subject = the_subject;
```

(B)
```
super(the_author, the_title);
super(the_subject);
```

(C)
```
subject = the_subject;
super(the_author, the_title);
```

(D)
```
super(the_author, the_title);
subject = the_subject;
```

(E)
```
super(the_author, the_title, the_subject);
```

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42. Consider the following class definitions.

```
public class Thing1
{
     public void calc(int n)
     {
          n *= 3;
          System.out.print(n);
     }
}
public class Thing2 extends Thing1
{
     public void calc(int n)
     {
          n += 2;
          super.calc(n);
          System.out.print(n);
     }
}
```

The following code segment appears in a class other than `Thing1` or `Thing2`.

```
Thing1 t = new Thing2();
t.calc(2);
```

What is printed as a result of executing the code segment?

(A) `4`

(B) `6`

(C) `68`

(D) `124`

(E) `1212`

43. When designing classes, which of the following would be the best reason to use inheritance?

(A) Inheritance allows you to write applications that require fewer base and super classes.

(B) Inheritance allows the creation of a subclass that can use the methods of its superclass without rewriting the code for those methods.

(C) Inheritance allows for data encapsulation, while noninherited classes do not allow for data encapsulation.

(D) Inheritance reduces the number of polymorphic structures encapsulated in applications.

(E) Inheritance guarantees that the applications will compile and execute much more quickly.