CS 2334: Programming Structures and Abstractions: Exam 1
October 2, 2017

General instructions:

- Please wait to open this exam booklet until you are told to do so.
- This examination booklet has 14 pages. You also have been issued a bubble sheet.
- Fill in the identifying information below (signature, name, ID and date) Also, write your name and ID number on your bubble sheet, and fill in the bubbles for your ID.
- You may have up to two pages of your own notes. No electronic devices or books may be used.
- The exam is worth a total of 137 points. Your grade counts for 10% of your final grade.
- You have 1.25 hours to complete the exam. Be a smart test taker: if you get stuck on one problem go on to the next.
- Use your bubble sheet to answer all multiple-choice questions. Make sure that the question number and the bubble row number match.
- Other than **this** page, you may tear any other page out of this booklet that does not contain numbered answers.
- If you cannot effectively erase erroneous answers from the bubble sheet, please clearly cross them out.

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

Signature: _____ **Name:** _____

ID Number: _____ **Date:** _____

Question	Points	Score
Types and Objects	32	
Inheritance and Polymorphism	35	
UML and Object Oriented Design	13	
Abstract Classes and Interfaces	28	
Exceptions and Error Handling	25	
Memory Management	4	
Total:	137	

Part I. Types and Objects

1. (4 points) What is printed by this block of code?

```
1  Double a = 1.4;
2  Integer b = -5.3;
3  Integer c = new Integer(19);
4  System.out.println(c + b + a);
```

A. 15.1 B. 15.4 C. 25.7 D. 19-5.31.4
E. Compilation error or answer not shown

2. (4 points) What is printed by this block of code?

```
1  int i1 = 7;
2  int i2 = 5;
3  System.out.println(i2/i1);
```

A. 0 B. 0.625 C. 1 D. 1.6 E. Compilation error or answer not shown

3. (4 points) What is printed by this block of code?

```
1  int a = 2;
2  String b = "5";
3  int c = 9;
4  System.out.println(c + a + b);
```

A. 11 B. 16 **C. 115** D. 925 E. Compilation error or answer not shown

4. (4 points) What is printed by this block of code?

```
1  int i1 = 2;
2  int i2 = 3;
3  int i3 = 5;
4  System.out.println(i3 + i2 * i1);
```

A. 11 B. 13 C. 16 D. 17 E. Compilation error or answer not shown

5. (4 points) What is printed by this block of code?

```
1  int a = 5;
2  String b = "20";
3  System.out.println(b + Integer.parseInt(b) + a);
```

A. 45 B. 2025 C. 5520 **D. 20205**
E. Compilation error or answer not shown

6. (4 points) What is printed by this block of code?

```
1   String s1 = "LuH";
2   String s2 = "luh";
3   s2 = s2.toUpperCase();
4   if(s1.equals(s2))
5   {
6     System.out.println("Yes:" + s1);
7   }
8   else
9   {
10    System.out.println("No:" + s2);
11  }
```

A. No:LuH **B. No:LUH** C. Yes:LuH D. Yes:luh
E. Compilation error or answer not shown

7. (4 points) What is printed by this block of code?

```
1   int a = 42;
2   String b = "8";
3   System.out.println(b + a);
```

A. 50 B. 336 C. 428 **D. 842** E. Compilation error or answer not shown

8. (4 points) What is printed by this block of code?

```
1   int a = 3;
2   int b = 7;
3   String c = 8;
4   System.out.println(c + a + b);
```

A. 18 B. 810 C. 837 D. 873 **E. Compilation error or answer not shown**

Part II. Inheritance and Polymorphism

Consider the following class definitions:

```
public class X
{
  protected int id;

  public X(int id)
  {
    this.id = id;
  }

  public int getID()
  {
    return this.id;
  }

  public String toString()
  {
    return "X: " + id;
  }

  public String getDescriptor()
  {
    return "D: " + this.getID();
  }
}

public class Y extends X
{
  protected String s;

  public Y(String s, int val)
  {
    super(val);
    this.s = s;
  }

  public String toString()
  {
    return this.s + ": "+ this.id;
  }

  public String superString()
  {
    return super.toString();
  }
}

public class Z extends Y
{
  private int id;

  public Z(String s, int id)
  {
    super(s, id+2);
    this.id = id;
  }

  public int getID()
  {
    return this.id;
  }
}
```

9. (7 points) What is printed by this block of code?

```
X x = new X(17);
System.out.println(x.superString());
```

A. D: 17 B. X: 17 C. D: 19 D. X: 19 **E. Answer not shown**

10. (7 points) What is printed by this block of code?

```
X x = new X(17);
System.out.println(x.getDescriptor());
```

A. D: 17 B. X: 17 C. D: 19 D. X: 19 E. Answer not shown

11. (7 points) What is printed by this block of code?

```
Y y1 = new Y("BAR", 7);
System.out.println(y1.superString());
```

A. BAR: 7 B. D: 7 **C. X: 7** D. X: 9 E. Answer not shown

12. (7 points) What is printed by this block of code?

```
Y y1 = new Y("BAR", 7);
System.out.println(y1);
```

A. BAR: 7 B. D: 7 C. X: 7 D. X: 9 E. Answer not shown

13. (7 points) What is printed by this block of code?

```
X x = new Z("FOO", 42);
System.out.println(x);
```

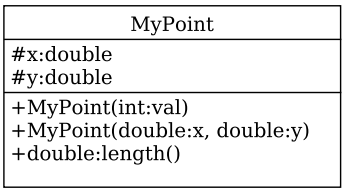
A. FOO: 44 B. D: 42 C. D: 44 D. X: 44 E. Answer not shown

Part III. UML and Object Oriented Design

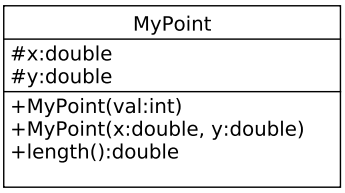
14. (4 points) **Carefully examine** the following UML models and select the one that corresponds to the following code.

```
public class MyPoint
{
    protected double x;
    protected double y;

    public MyPoint(int val)
    {
        this.x = this.y = val;
    }

    public MyPoint(double x, double y)
    {
        this.x = x;
        this.y = y;
    }

    public double length()
    {
        return(Math.sqrt(x * x + y * y));
    }
  }
```

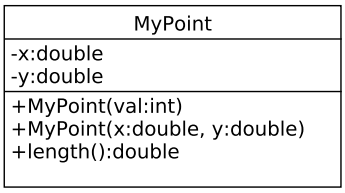
A.



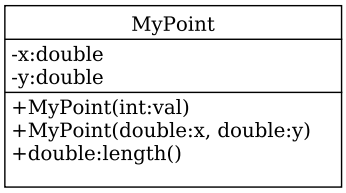
B.



C.



D.

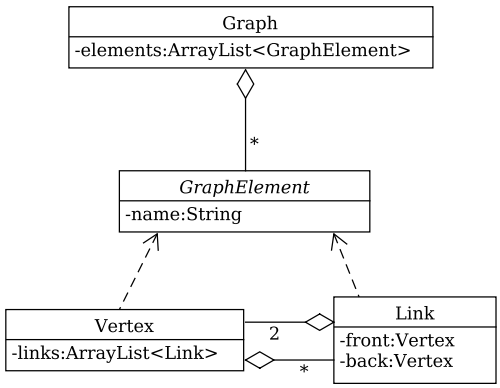


E. Answer not shown

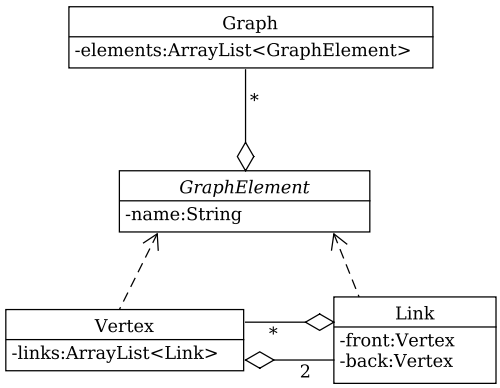
15. (5 points) Which UML diagram corresponds to the following code?

```
public class Graph
{
  private ArrayList<GraphElement> elements;
}

public abstract class GraphElement
{
  private String name;
}

public class Vertex extends GraphElement
{
  private ArrayList<Link> links;
}

public class Link extends GraphElement
{
  private Vertex front;
  private Vertex back;
}
```

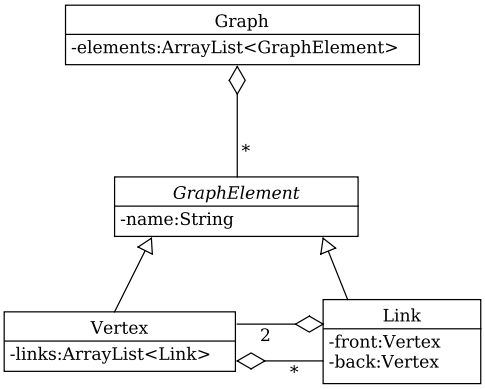
A.



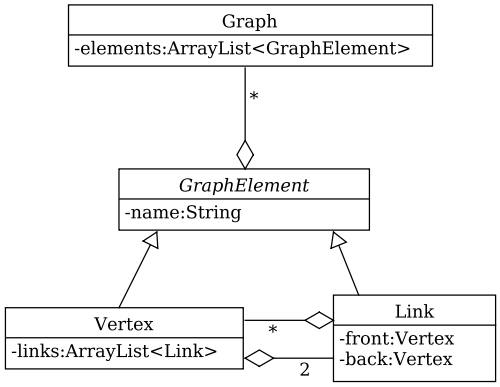
B.



C.



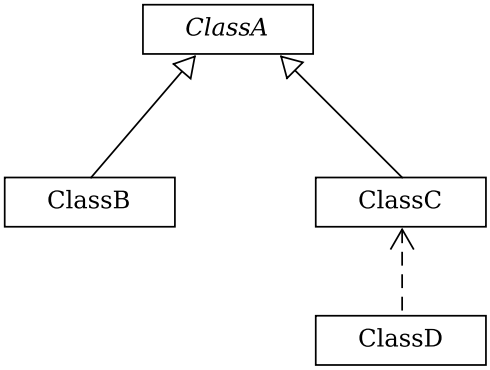
D.



E. Answer not shown

Solution: GraphElement.name was declared on the exam with default visibility. This makes answer E viable.

16. (4 points) Which set of class definitions corresponds to the following UML diagram?



A.
```
public abstract class ClassA {...}
public class ClassB extends ClassA {...}
public class ClassC extends ClassA {...}
public class ClassD extends ClassA {...}
```

B.
```
public abstract class ClassA {...}
public class ClassB extends ClassA {...}
public class ClassC extends ClassA {...}
public class ClassD {...}
```

C.
```
public abstract class ClassA {...}
public class ClassB extends ClassA {...}
public class ClassC extends ClassA {...}
public class ClassD implements ClassC {...}
```

D.
```
public abstract class ClassA {...}
public class ClassB extends ClassA {...}
public class ClassC extends ClassA {...}
public class ClassD extends ClassC {...}
```

E. Answer not shown

Part IV. Abstract Classes and Interfaces

17. (4 points) Which one line (if any) will cause the program not to compile?

```
1   public interface InterfaceA
2   {
3     public abstract void mult(int i);
4   }
5
6   public class ClassA implements InterfaceA
7   {
8     double i;
9
10    public void mult(double i)
11    {
12      this.i *= i;
13    }
14  }
```

A. 1 B. 8 **C. 10** D. 12 E. This code will compile

18. (4 points) Which one line (if any) will cause the program not to compile?

```
1   public class AbstractClass
2   {
3     private String name;
4
5     public AbstractClass(String name)
6     {
7       this.name = name;
8     }
9
10    public abstract String getName();
11  }
```

A. 1 B. 3 C. 5 D. 7 E. This code will compile

19. (4 points) Which one line (if any) will cause the program not to compile?

```
1   public interface InterfaceB
2   {
3     public abstract void foo(int i);
4   }
5
6   public abstract class ClassB implements InterfaceB
7   {
8     private double val;
9
10    public ClassB(double val)
11    {
12      this.val = val;
13    }
14
15    public abstract void foo(double val);
16  }
```

A. 1 B. 3 C. 6 D. 15 **E. This code will compile**

20. (4 points) Any class that implements an interface must provide implementations for all of the abstract methods.

A. True **B. False**

> **Solution:** If an abstract class extends an interface, then it may leave some of the interface's methods unimplemented.

Consider the following class definition for the next three questions:

```
public class NamedInteger implements Comparable<NamedInteger>
{
  private Integer val;
  private String name;

  public NamedInteger(int val, String name)
  {
    this.val = val;
    this.name = name;
  }

  public int compareTo(NamedInteger ni)
  {
    int ret = val.compareTo(ni.val);
    if(ret != 0)
    {
      return ret;
    }
    else
    {
      return -name.compareTo(ni.name);
    }
  }

  public static void main(String[] args)
  {
    NamedInteger i1 = new NamedInteger(5, "Bob");
    NamedInteger i2 = new NamedInteger(7, "Sarah");
    NamedInteger i3 = new NamedInteger(5, "Skip");
    NamedInteger i4 = new NamedInteger(42, "Alice");

    System.out.println(i1.compareTo(i2));  // Line 1
    System.out.println(i1.compareTo(i3));  // Line 2
    System.out.println(i4.compareTo(i2));  // Line 3
  }
}
```

21. (4 points) What integer value is printed at Line 1?

A. Positive value B. Zero **C. Negative value** D. Answer not shown

22. (4 points) What integer value is printed at Line 2?

A. Positive value B. Zero C. Negative value D. Answer not shown

23. (4 points) What integer value is printed at Line 3?

A. Positive value B. Zero C. Negative value D. Answer not shown

Part V. Exceptions and Error Handling

Consider the following program:

```
public class ExceptionTest
{
  public static int foo(Integer a)
  {
    if(a > 8)
    {
      throw new IllegalArgumentException("Too big");
    }
    return 5 / (a - 2);
  }

  public static int bar(Integer b)
  {
     Integer a = null;

     try
     {
       if(b > 5)
       {
         return(foo(b+2));
       }
       else if(b < 0)
       {
         return(foo(a));
       }
       else
       {
         return(foo(b));
       }
     }
     catch(NullPointerException e)
     {
       return 5;
     }
   }
 }
```

Note that *IllegalArgumentException* is a *RuntimeException*.

24. (6 points) What is displayed when the following code is executed?

```
System.out.println(bar(7));
```

A. 0 B. 2 C. 5 **D. IllegalArgumentException** E. Answer not shown

25. (7 points) What is displayed when the following code is executed?

```
System.out.println(bar(4));
```

A. 0 **B. 2** C. 5 D. IllegalArgumentException E. Answer not shown

26. (6 points) What is displayed when the following code is executed?

```
System.out.println(bar(null));
```

A. 0 B. 2 **C. 5** D. IllegalArgumentException E. Answer not shown

27. (6 points) What is displayed when the following code is executed?

```
System.out.println(bar(2));
```

A. 0 B. 2 C. 5 D. IllegalArgumentException **E. Answer not shown**

Part VI. Memory Management

Consider the following program:

```
1   public class MyClass
2   {
3     private double val;
4     protected static char c = 'a';
5
6     public MyClass(double val) {
7       this.val = val;
8     }
9
10    private void print() {
11      System.out.println(c);
12    }
13
14    public double doubleValue() {
15      return val * 2;
16    }
17
18    public static void main(String[] args)
19    {
20      MyClass m = new MyClass('a', 7.2);
21      int a = 4;
22
23      System.out.println(m + a);
24    }
25  }
```

28. (2 points) In which part of memory is the variable declared on line 4 stored?
A. Heap B. Stack C. Answer not shown

29. (2 points) In which part of memory is the variable declared on line 6 stored?
A. Heap **B. Stack** C. Answer not shown