

CIS 180 – Object-Oriented Programming
Final Examination

1. (3 pts) Give the sum of the binary numbers 01011 and 01110 in:
 - a) binary _____
 - b) decimal _____
2. (3 pts) Suppose that we are writing a word processing program where there are 8 different properties that can be applied to a string (bold, italic, underline, etc.). The different properties may be applied in any combination. How many bits are required to encode the set of properties applied to a string? _____
3. (5 pts) Give the output of the following program in the space provided:

```
class A
{
    char foo()
    { return 'A'; }
}
class B extends A
{
    char foo()
    { return 'B'; }
}
class C extends B
{
    char foo()
    { return 'C'; }
}
class D extends B { }
class E extends A
{
    public static void main(String[] argv)
    {
        A [] a =
            { new A(), new B(), new C(), new D(), new E() };
        for (int i = 0; i < 5; i++)
            System.out.print(a[i].foo() + " ");
    }
}
```

Output: _____

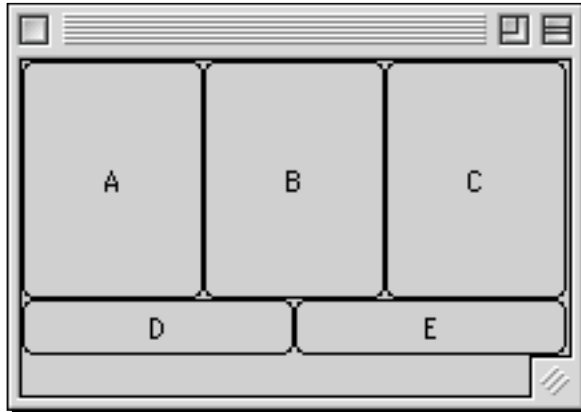
4. (5 pts) Suppose that class C extends class B, and class B extends class A. Also, suppose the following variables are declared:

```
A a = new A();
B b = new B();
C c = new C();
```

Which of the following are true? Circle the letter(s) of **all** that apply:

- a) Any message that can be sent to object **a** can be sent to object **c**.
 - b) Any message that can be sent to object **c** can be sent to object **a**.
 - c) Any message that can be sent to object **c** can be sent to object **b**.
 - d) The assignment $c = a;$ is legal.
 - e) The assignment $a = c;$ is legal.
5. (6 pts) Which of the following are true regarding the relationships between classes and objects? Circle the letter(s) of **all** that apply:
 - a) Every object belongs to a class.
 - b) Every class must contain at least one object.
 - c) Every class is an instance of an object.
 - d) All objects of the same class share the same values for their instance variables.
 - e) All objects of the same class share the same definitions of their methods.
 - f) If x and y are objects belonging to the same class, containing method m , then the messages $x.m()$ and $y.m()$ must return the same result.
 6. (3 pts) Briefly explain the difference between a Java Applet and a Java Application.

7. (14 pts) Complete the constructor for the ButtonFrame class given below to layout the buttons in the following arrangement:



Buttons A, B, and C should shrink and expand both vertically and horizontally to fill the available space in the frame, while maintaining the same relative size and positions. Buttons D and E should stretch and shrink horizontally, but retain their natural height, and should remain centered underneath the row containing buttons A, B, and C.

```
public class ButtonFrame extends JFrame
{
```

```
    private Button a = new Button("A");
    private Button b = new Button("B");
    private Button c = new Button("C");
    private Button d = new Button("D");
    private Button e = new Button("E");
```

```
    public ButtonPanel()
    {
```

8. (13 pts) Consider the following declarations, and give the value and type of each expression in the table below. If the expression is not syntactically correct or will result in an error when evaluated, write "error" for type. **Answer each part assuming that the preceding expressions have all been evaluated.**

```
int i = 1, j = 5, k = 10;
double x = 0, y = 5, z = 10;
boolean p = false, q = true;
int [ ] a = { 1, 3, 5, 7, 9, 11 };
```

Expression	Type	Value
j / k		
$(i < j) \ \&\& \ (j < k)$		
y / k		
$(j / k) < (y / z)$		
$p = (i > j) \ \wedge \ !(k < j)$		
$j / z + k * i$		
$j -= 3$		
$a[++j]$		
$a[j++]$		
$a[j]$		
$a[i--]$		
$--a[i]$		
$a[i]$		

9. (10 pts) Give the output of the following program in the spaces provided.

```
public class A
{
    int x = 5;
    int y = 10;
    int z = 20;

    int foo(int x)
    {
        x = y;
        y = z;
        return x+y;
    }

    void print()
    {
        System.out.println(x + "," + y + "," + z);
    }
}

public class B
{
    public static void main(String[] argv)
    {
        int x = 1;
        int y = 2;
        int z = 3;

        A a1 = new A();
        A a2 = new A();

        x = a1.foo(z);
        System.out.println(x); // _____
        System.out.println(y); // _____
        System.out.println(z); // _____
        a1.print();           // _____
        a2.print();           // _____
    }
}
```

10. (7 pts) Give the output of the following program in the space provided.

```
public class A
{
    char c = 'a';
    StringBuffer s = new StringBuffer("abc");

    void print()
    { System.out.println(c + " " + s); }

    void setC(char c1)
    { c = c1; }

    void setS(StringBuffer s1)
    { s = s1; }

    public static void main(String[] argv)
    {
        char c1 = 'x';
        StringBuffer s1 = new StringBuffer("xyz");
        A a = new A();
        a.setC(c1);
        a.setS(s1);
        s1.setCharAt(1, 'b');
        a.print(); // _____
    }
}
```

11. (8 pts) Consider the code fragment below:

```
int count = 0;
for (int i = 0; i < 5; i++)
    for (int j = 0; j < i; j++)
        count++;
System.out.println(count);
```

What output is produced when the code is executed? _____

