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CS 1110 Prelim 2 Grading and posting of grades done Wednesday night

21 October 2008

This 90-minute exam has 6 questions (numbered 0..5) worth a total of 100 points. Spend a few minutes looking at all the questions before beginning. Use the back of the pages if you need more space.

Question 0 (2 points). Fill in the information, legibly, at the top of each page. (Hint: do it now.)

## Question 1 (20 points).

- (a) Evaluate the call Tester.f(1) (see the class at the bottom of the page. Note that we have labeled each statement to help you identify them). As you evaluate the call, draw frames for all function calls that are evaluated. Stop executing just *before* executing one of the statements labeled m3 and m4, whichever comes first. Do not continue executing. That way, we will be able to see that you drew frames and executed correctly. Please be sure to maintain the instruction counters of the frames.
- (b) When is parameter k created? When is local variable p created? When is local variable s created?

```
public class Tester {
    public static int f (int k) {
        int p= k+1;
        f1: if (k == 1) {
             f2: return f(p);
        }
        f3: return m(p);
    }

    public static int m(int n) {
        m1: if (n != 1) {
            int s;
            m2: s= n * n;
            m3: return s;
        }
        m4: return n;
}
```

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**Question 2 (18 points).** Below is a class Pres, which contains information about a president of the US. We have omitted many fields, the constructors, and other methods. We put in only the fields that you need to answer this question.

Complete the bodies of the three functions shown in class Pres. In function equals, do not simply test whether **this** and p are equal; implement it as specified.

```
/ * * An instance maintains info about a president */
public class Pres {
    private int sYear;
                             // Was president in years
                             // sYear..eYear
    private int eYear;
    private String name; // name of president
                             // the previous president (null if none)
    private Pres prev;
    /** = the previous president (or null if none)*/
    public Pres getPrevious() {
     /** = number of presidents before this one */
    public int before() {
     /** = "p is a Pres and has the same starting and ending year and
             the same name as this President" */
    public boolean equals(Object p) {
                                 2
```

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**Question 3 (20 points)** At the bottom of the page are two subclasses of class Pres of question 2. We show only the fields and methods that you need to answer this question.

- (a) Complete function beforeInSameParty in both classes.
- **(b)** Suppose variable p is as declared below, and suppose p contains the name of an object of one of the classes Pres, Dem, and Rep.

```
Pres p; // declaration of variable p
```

Consider the call p.beforeInSameParty(). Circle the statement below that you think is correct:

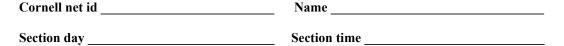
- 1. The call is syntactically illegal.
- 2. The call is syntactically legal, but what happens when it is evaluated depends on the real class of p—whether it contains a Pres, Dem, or Rep object. It may or may not result in an error.
- (c) If you circled 1 above, write down what you would place in class Pres to make the call legal.

If you circled 2 above, rewrite the call, perhaps using a conditional expression, so that it produces 0 if the call would produce an error and the proper value if the call can be evaluated.

```
/** An instance has info about a Democratic president */
public class Dem extends Pres {
    // previous Democratic pres. (null if none)
    private Pres prevDem;
    /** = number of Democratic presidents
        before this one */
    public int beforeInSameParty() {
```

```
/** An instance has info about a Republican president */
public class Rep extends Pres {
    // previous Republican pres. (null if none)
    private Pres prevRep;

    /** = number of Republican presidents
        before this one */
    public int beforeInSameParty() {
```



**Question 4**. (20 points). In answering this question, it will help to draw the objects that are created and the frames for the function calls that are being evaluated. You don't have to do this, but it should help.

Consider the two classes given at the bottom of this page. Suppose the following assignments have been executed (we also give the declarations of the variables being assigned):

(a) Evaluate the following expressions and write their values to the right of the expressions.

```
    Two.add(a, b)
    Two.add(b, d)
    Two.add(a, c)
```

- 4. a instanceof Two
- 5. a instanceof One
- 6. c instanceof One
- 7. c instanceof Two
- 8. ((One)c).altMult()
- (b) In the expression Two.add(a, c):
- 1. What are the apparent and real classes of a?
- 2. What are the apparent and real classes of c?

```
public class Two {
   public int bV;

public Two (int n) {
    bV= n;
  }

public int mult() {
   return 2 * bV;
  }

public static int add(Two a, Two b) {
   return a.mult() + b.mult();
  }
}
```

```
public class One extends Two {
   public One(int n) {
      super(n);
   }

   public int mult() {
      return bV;
   }

   public int altMult() {
      return super.mult();
   }
}
```

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<b>Question 5 (20 points).</b> Write the body merge, whose specification and header appe		0	out of 02
think of the base cases first —parameter value easy to calculate because a parameter is as sm	es where the answer is	1	out of 20
handle the other, recursive, cases.		2	out of 18
Do not use loops. Use only recursion.		3	out of 20
		4	out of 20
		5	out of 20
/** = the characters of s1 and s2, in alphabe Precondition: the characters of s1 are alre order and the characters of s2 are already	ady in alphabetical	Total	_ out of 100
<pre>Examples: merge("ab", "") = "al merge("abbce", "cdg") = "abb public static String merge(Str:</pre>	ccdeg" */	{	