Multiple choice questions: [5 points each]

1. What is the signature of a method?
   a) the name of the method
   b) the name of a method and the name of its parameters
   c) the names of the parameters
   d) a list of the types of the parameters
   e) the names and types of the parameters

2. What is the value of the following expression, where a=10, b = 2, and c = 5?
   \[ a - b - \frac{a}{b} / c - c \]
   a) \(-19\)
   b) \(2\)
   c) \(9\)
   d) \(7\)
   e) error, division by 0

Explanation: \(a/b/c\) is \(10/2/5 = 5/5 = 1\), since the leftmost division happens first. Thus, also doing the subtraction left to right, \(a-b-a/b/c-c = 10-2-1-5 = 8-1-5 = 7-5 = 2\).

3. Given the following code fragment
   ```java
   String strA = "aBcDeFg";
   String strB = strA.toLowerCase();
   strB = strB.toUpperCase();
   String strC = strA.toUpperCase();
   ```
   a) \(\text{strB.equals(strC)}\) would be true
   b) \(\text{strB.compareTo(strC)}\) would yield 0
   c) \(\text{strA.compareTo(strC)}\) would yield 0
   d) \(\text{strA.equals(strC)}\) would be true
   e) none of the above
Explanation: strB contains the uppercase forms of all the letters in strA; so does strC. So compareTo would yield 0, indicating equality.

OK, that’s what the authors say. However, choice a looks reasonable too.

4. An “alias” is when
   a) two different reference variables refer to the same physical object
   b) two different numeric variables refer to the same physical object
   c) two different numeric variables contain identical values
   d) two variables have the same names
   e) none of the above

Answer: a. Explanation: An “alias” occurs when there are two or more references to the same physical object – so that by following either reference, one can read/write/modify the object.

5. If two variables contain aliases of the same object then
   a) The object may be modified using either alias.
   b) The object cannot be modified unless there’s but a single reference to it
   c) A third alias is created if/when the object is modified
   d) The object will become an “orphan” if both variables are set to null
   e) Answers (a) and (d) are correct

Answer: e. Explanation: By definition, a alias provides a means by which an object can be modified (an alias is like a pointer). If both variables are set to null, then the object is not referenced by any variable (via any alias) and it does, indeed, become an “orphan” – and it will be garbage collected at some point in the future.

6. Given the following code, what is the resulting value of x after the for-loops terminate?
   ```java
   int x=0;
   for (int i=0; i<4; i++)
       for ( int j = 0;  j < i;  j++ )
           {x += j;}
   ```
   a) 0
   b) 4
   c) 5
   d) 10
   e) 15
7. The break statement does which of the following?
   a) ends the program
   **b) transfers control out of the current control structure such as a loop or switch statement**
   c) ends the current line of output, returning the cursor
   d) denotes the ending of a switch statement
   e) indicates the end of line when using System.out.print

The break statement allows the programmer to exit a control structure from inside of that control structure. The statement is most commonly used in a switch statement so that, once a case matches, the statement(s) associated with that case executes and control transfers out of the switch statement rather than testing further cases.

8. Which of the following reserved words in Java is used to create an instance of a class?
   a) class
   b) public
   c) public or private, either could be used
   d) import
   e) new

. Explanation: The reserved word “new” is used to instantiate an object, that is, to create an instance of a class. The statement new is followed by the name of the class. This calls the class’ constructor. Example: Car x = new Car( ); will create a new instance of a Car and set the variable x to it.

9. Consider the following recursive method:

   ```java
   public int computeRec(int n)
   {   
       if (n<=0) return 1;
           if (n==1) return 2;
       return 2*computeRec(n-1)-1;
   }
   ```

If the method is called as computeRec(4), what is returned?
   a) 5
   b) 7
   c) 8
   d) **9**
   e) 17
10. Each row contains the same value written in different bases. Fill in the missing entries in rows a-c. [14 points]

<table>
<thead>
<tr>
<th>decimal</th>
<th>binary</th>
<th>octal</th>
<th>hex</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>01010101</td>
<td>125</td>
<td>55</td>
</tr>
<tr>
<td>a) 57</td>
<td>00111001</td>
<td>71</td>
<td>39</td>
</tr>
<tr>
<td>b) 37</td>
<td>00100101</td>
<td>45</td>
<td>25</td>
</tr>
<tr>
<td>c) 250</td>
<td>11111010</td>
<td>372</td>
<td>fa</td>
</tr>
</tbody>
</table>

11. Our goal here is to compute efficiently a modular power, in particular $x^y \mod n$ (x to the power y, mod n). This is a basic step in much of cryptography. We describe a recursive method as follows:

- if $y=0$, return 1.
- otherwise, compute $x^{2 \cdot \left(\frac{y}{2}\right)} \mod n$
- if $y$ is even, return that value
- if $y$ is odd, return that value times $x$, mod n.

Write a recursive method based on this definition to compute the desired value. [15 points]

*Temporarily removed so you can work on it in the lab.*
12. Write a method which will determine if there is a substring of length 5 of a given String s which contains the both letters ‘a’ and ‘o’. They do not have to be next to each other, nor does it matter which one comes first. An alternate way to word the question is to determine whether there is, within s, an ‘a’ and an ‘o’ with at most 3 characters between them. [16 points]

Also removed for lab work.

13. Consider the two classes below. TwoPairs stores four private integers. UsePairs creates two TwoPairs objects and one int. It then calls one of its methods which changes (or not) these values in various ways.

What values get printed by the main routine of UsePairs? [10 points]

(5,7,6,3)
(5,7,3,4)
0

--UsePairs

public class UsePairs
{
    public static void main (String[] args)
    {
        TwoPairs p1 = new TwoPairs();
        TwoPairs p2 = new TwoPairs(3,4);
        int a = 0;

        modifyValues(p1,p2,a);

        System.out.println(p1.toString());
        System.out.println(p2.toString());
        System.out.println(a);
    }

    public static void modifyValues(TwoPairs t1, TwoPairs t2, int t3)
{  
    t1.setX(5);
    t1.setZ(6);
    t2.setY(7);
    t2 = new TwoPairs(8,9);
    t3 = 10;
  }

---TwoPairs

public class TwoPairs
{
    private static int x=0;
    private static int y=1;

    private int z;
    private int w;

    public TwoPairs() // one constructor sets default values
    {
        z=2;
        w=3;
    }

    public TwoPairs(int setZ, int setW) // another constructor passes in values
    {
        z=setZ;
        w=setW;
    }

    public void setX(int newval)
    { x=newval; }

    public void setY(int newval)
    { y=newval; }

    public void setZ(int newval)
    { z=newval; }

    public void setW(int newval)
    { w=newval; }
}
public String toString()
{
    return "("+x","+y","+z","+w")";
}
}
Useful Methods from String class:

public int indexOf(int ch)
   Returns the index within this string of the first occurrence of the specified character. If no such character occurs in this string, then -1 is returned.

public int indexOf(int ch, int fromIndex)
   Returns the index within this string of the first occurrence of the specified character, starting the search at the specified index. If no such character occurs in this string at or after position fromIndex, then -1 is returned.

public String substring(int beginIndex, int endIndex)
   Returns a new string that is a substring of this string. The substring begins at the specified beginIndex and extends to the character at index endIndex - 1. Thus the length of the substring is endIndex - beginIndex.

Examples:
"hamburger".substring(4, 8) returns "urge"
"smiles".substring(1, 5) returns "mile"