MULTIPLE CHOICE QUESTIONS

(1) 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

(2) If a method does not have a return statement, then
   a) it will produce a syntax error when compiled
   b) it must be a void method
   c) it can not be called from outside the class that defined the method
   d) it must be defined to be a public method
   e) it must be an int, double, or String method

(3) What is the value of the String S after the following line?

```java
String S = (new String("arach")) .substring(0,2) +
    (new String("nophobia")) .substring(3);
```

(a) "arachobia"
(b) "arnophobia"
(c) "arhobia"
(d) "rachobia"

(4) The method twist is defined as follows:

```java
public void twist(String[] w) {
    String temp = w[0] .substring(0, 1);
    w[0] = w[1] .substring(0, 1) + w[0] .substring(1);
    w[1] = temp + w[1] .substring(1);
}
```

What is the output of the following code segment?

```java
String[] words = {"HOW", "NEAT"};
twist(words);
System.out.println(words[0] + " " + words[1]);
```
(a) NOW NOW
(b) HOW HOW
(c) NOW HOW
(d) HOW NEAT
(e) NOW HEAT

(5) What is the output of the following code?

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```java
String barb = "BARBARA";
scramble(barb);
System.out.println(barb);
```

The method scramble is defined as follows:

```java
public static String scramble(String str) {
    if (str.length() >= 2){
        int n = str.length() / 2;
        str = scramble(str.substring(n)) + str.substring(0, n);
    }
    return str;
}
```

(1) BARBARA
(b) ARBABAR
(c) AABAR
(d) ARBABARB
(e) ARBABARB

(6) What are the values in arr after the following statements are executed?

```java
int[] arr = {1, 1, 0, 0, 0};
for (int i = 2; i < arr.length; i++)
    arr[i] = arr[i-1] + arr[i-2];
```

(a) 11011
(b) 11210
(c) 11222
(d) 11235
(e) 11248
(7) Given

double x = 5, y = 2;

What is the value of \( m \) after the following statement is executed?

\[
\text{int } m = (\text{int})(x + y + x / y - x * y - x / (10 * y));
\]

(a) -1
(b) -0.75
(c) -0.5
(d) 0
(e) 1

(8) What is the value of \( \text{sum} \) after the following code segment is executed?

\[
\text{int } p = 3, q = 1, \text{sum} = 0;
\text{while } (p <= 10) \{
\text{sum} += p \% q;
\quad p++;
\quad q++;
\}
\]

(a) 0
(b) 10
(c) 12
(d) 14
(e) 52

(9) Consider the following method:

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\[
\text{public int goFigure(int } x) \{ \\
\quad \text{if } (x < 100) \\
\quad \quad x = \text{goFigure}(x + 10); \\
\quad \quad \text{return } (x - 1); \\
\}
\]

\textbf{What does } \text{goFigure}(60) \text{ return?}

(a) 59
(b) 69
(c) 95
(d) 99
(e) 109
(10) What are the values of m and n after the following code runs?

```java
int m = 20, n = 2, temp;
for (int count = 1; count <= 20; count++) {
    temp = m;
    m = n + count;
    n = temp - count;
}
```

(a) m = 230  n = -208  
(b) m = 30  n = -8  
(c) m = 12  n = -10  
(d) m = -12  n = 8  
(e) m = -190  n = 212

Show the EXACT output the following programs generate:

(1) 
```java
public class e21 {
    public static void main (String args[]) {
        int num = 4;
        printNumbers(num);
    }
    private static void printNumbers(int n) {
        for (int i=1; i <= n; i++) {
            for (int k=1; k <= 2*(i-1)+1; k++)
                System.out.print(i);
        }
    }
}
```

```
1
222
33333
4444444
```
int m=63, n=0;
for (; m>0; n++, m/=2);
System.out.println("n = " + n);
}

n = 6

PROGRAMS TO WRITE:

(1) Write a class method that takes as input a String object whose value is an English sentence. The method should return the last word in the sentence. You may assume that the sentence contains words separated by one space and the sentence terminates with a period. For example the following would be a valid sentence:

"The cat ate the rat."

Make sure that the period at the end of the sentence is not included in the result that is returned by the method.

private static String getLastWord(String str) {
    str = str.substring(str.lastIndexOf(' ') + 1, str.length() - 1);
    return str;
}

Write a main method that reads a sentence from the keyboard, calls the above method to get the last word, and prints the last word to the screen.

public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    System.out.println("Please enter a sentence: ");
    String sentence = sc.nextLine();
    System.out.println(getLastWord(sentence));
}
(2) Write a static method named `vowelCount` that accepts a String as a parameter and produces and returns an array of integers representing the counts of each vowel in the String. The array returned by your method should hold 5 elements: the first is the count of A’s, the second is the count of E’s, the third I’s, the fourth O’s, and the fifth U’s. Assume that the string contains no uppercase letters.

For example, the call

```java
vowelCount("i think, therefore i am");
```

should return the array

```java
{1, 3, 3, 1, 0}.
```

```java
private static int[] vowelCount(String str) {
    int[] arr = { 0, 0, 0, 0, 0 };;
    for (int i = 0; i < str.length(); i++)
        if (str.charAt(i) == 'a')
            arr[0]++;
        else if (str.charAt(i) == 'e')
            arr[1]++;
        else if (str.charAt(i) == 'i')
            arr[2]++;
        else if (str.charAt(i) == 'o')
            arr[3]++;
        else if (str.charAt(i) == 'u')
            arr[4]++;
    return arr;
}
```

(3) Write a method named `minGap` that accepts an integer array as a parameter and returns the minimum 'gap' between adjacent values in the array. The gap between two adjacent values in a array is defined as the second value minus the first value.

For example, suppose a variable called `array` is an array of integers that stores the following sequence of values.

```java
int[] array = {1, 3, 6, 7, 12};
```

The first gap is 2 (3 - 1), the second gap is 3 (6 - 3), the third gap is 1 (7 - 6) and the fourth gap is 5 (12 - 7). Thus, the call of `minGap(array)` should return 1 because that is the smallest gap in the array. Notice that the minimum gap could be a negative number. For example, if array stores the following sequence of values:

```java
{3, 5, 11, 4, 8}
```
The gaps would be computed as $2 (5 - 3)$, $6 (11 - 5)$, $-7 (4 - 11)$, and $4 (8 - 4)$. Of these values, $-7$ is the smallest, so it would be returned.

This gap information can be helpful for determining other properties of the array. For example, if the minimum gap is greater than or equal to $0$, then you know the array is in sorted (nondecreasing) order. If the gap is greater than $0$, then you know the array is both sorted and unique (strictly increasing).

If you are passed an array with fewer than $2$ elements, you should return $0$.

```java
private static int minGap(int[] value) {
    if (value.length < 2)
        return 0;
    int min = value[1] - value[0];
    for (int i=1; i<value.length-1; i++)
        if (min > value[i+1] - value[i])
            min = value[i+1] - value[i];
    return min;
}
```

(4) Write a method named `toBinary` that accepts an integer as a parameter and returns a string of that number's representation in binary. For example, the call of `toBinary(42)` should return "101010".

We will assume a positive parameter.

```java
private static String toBinary(int num) {
    if (num == 0)
        return "0";
    String str="";
    while (num != 0) {
        str = (num%2)+str;
        num /= 2;
    }
    return str;
}
```