Lab Session 16: Increment operators + More loop examples

Theory:

1. What prints in the following code?

int x = 3;  
int y = ++x;  
int z = x++;  
int a = --x;  
a += z;  
System.out.println(x + “ “ + y + “ “ + z + “ “ + a);

1. What prints in the following code?

int x = 3;  
int y = 2;  
int z = x++ + ++y;  
  
System.out.println(x + “ “ + y + “ “ + z);

1. Write an algorithm to ask the user to enter a number *n*. The program should check if *n* is positive. If it is negative, it should ask the user to re-enter the number (and continue doing so until it is positive number). Once they enter a positive number, the program should count up from 1 until n and then back down until 1. For example, if the user types 5, the program should print 1 2 3 4 5 4 3 2 1.

Application:

1. Implement the theory part question3 above in Java.
2. First have the computer generate a random number between 1 and 1000. Next, make a guess. The computer will tell you "higher" or "lower". Continue doing this until you have made the guess at which point the computer will output how many guesses it took.
3. Write a Java program that counts down from a number the user enters. For example, if the user enters 10, the program should print 10 9 8 7 6 5 4 3 2 1 BLASTOFF!  
     
   To simulate a space craft takeoff, make the program pause between each number. You can do this by changing your program in 2 ways:
   1. Add *throws InterruptedException* to your main method header (which should now be public static void main(String[] args) throws InterruptedException { )
   2. After printing a number, use the command *Thread.sleep(x)* to pause the program for 1 second at every step. You can replace x by any int number and the program will pause for *x* milliseconds. Remember there are 1000 milliseconds in 1 second.
4. Bonus question (good practice to try!): In class today, we wrote a guessing game where the computer guessed a number. We then tried to figure out what number it was thinking of. Now you will switch roles.  
     
   Write a Java program where the user decides on a number between 1 and 1000. The computer should then make a guess of a number. The computer will then ask you if the number you are thinking of is higher or lower or equal to what it guessed. You will then enter 1 for “higher,” 2 for “lower” or 3 for equal and based on this, the computer will make another guess. It will continue guessing until either it guesses the number or concludes that you have lied to it (see below).  
     
   Strategy for guessing:  
     
   At the beginning of your program, define two variables, low and high. Low should be equal to 1 and high should be equal to 1000. The idea is that these variables represent the range of *possible* values that the computer thinks your number might be.  
     
   The computer will then guess the middle number (low + high) / 2. This is the number for its guess. If you say the number you are thinking of is *higher* than its guess, then it will update its *low* range to be one more than middle. If you say the number you are thinking of is *lower* than its guess, then it will update its *high* range to be one more than the middle. If *high* ever becomes lower than *low*, then it knows you are lying.

For example, suppose you think of the number 296:

Low = 1, high = 1000 (initial)

Computer guesses 500 and you say “lower”

‘Now low = 1, high = 499

Computer guesses 250 and you say “higher”

Now low = 251, high = 499

Computer guesses (251 + 499) / 2 = 375 and you say “lower”

Now low = 251, high = 374

Computer guesses (251 + 374) / 2 = 312 and you say “lower”

Now low = 251, high = 311

Computer guesses (251 + 311) / 2 = 281 and you say “higher”

Now low = 282, high = 311

Computer guesses (282 + 311) / 2 = 296 and you say “correct” and stop

OR

Suppose you think of the number 296, but then lie in your answers.

Low = 1, high = 1000 (initial)

Computer guesses 500 and you say “higher” (you are lying!)

Low = 501, high = 1000

Computer guesses 750 and you say “lower”

Low = 501, high = 749

Computer guesses 625 and you say “lower”

Low = 501, high = 624

Computer guesses 562 and you say “lower”

Low = 501, high = 561

Computer guesses 531 and you say “lower”

Low = 501, high = 530

Computer guesses 515 and you say “lower”

Low = 501, high = 514

Computer guesses 507 and you say “lower”

Low = 501, high = 506

Computer guesses 503 and you say “lower”

Low = 501, high = 502

Computer guesses 501 and you say “lower”

Low = 501, high = 500 -🡪 Computer says “You lied!”

Bonus loop practice questions (Do it as homework)

1. Write an algorithm to let the user enter 100 numbers. Afterwards, print how many of those numbers were less than 10.
2. Write an algorithm to let the user enter 100 numbers. Afterwards, print how many of those numbers ended with a 5 in the ones column. (e.g. 45, 55, or 5 but not 111 or 222). Hint: Use the % operator
3. Write an algorithm to let the user enter 10 numbers. Every time the user enters a number that is *more* than the current count of numbers they are up to, the program should increase a variable by one. For example, if they enter :  
     
   3 2 1 6 7 8 1 1 1 1 then your program should have a result of 4 because 3 (the first number they enter) is more than 1, 2 is not more than 2, 1 is not more than 3, 6 is more than 4, 7 is more than 5, 8 is more than 6, 1 is not more than 7, 1 is not more than 8, 1 is not more than 9, and 1 is not more than 10.