

**Massachusetts Institute of Technology/Alliance High School**  
**African Internet Technology Initiative**  
Summer 2007

# Exam 1

Thursday, June 20<sup>th</sup>, 2007

Name: \_\_\_\_\_

Group: \_\_\_\_\_

You may use the class notes on this exam but you may **NOT** use your computer or any book. You have 2 hours to complete it. It contains 18 questions in 8 pages (including this one), totaling 100 points. Before you start, please check your copy to make sure it is complete. All the code on the exam is legal Java code. There are no compiler errors or runtime errors.

**Write your name on the top of ALL pages.**

Please write neatly; we cannot give credit for what we cannot read.

*Good luck!*

Question(s)	Total	Max
1 to 3		of 7
4 to 5		of 12
6		of 4
7 to 8		of 14
9 to 11		of 22
12		of 7
13 to 14		of 16
15 to 17		of 18
18		Bonus
		<b>of 100</b>



4. (6 Points) Write legal Java code that will implement the following mathematical expression. Assume that `a`, `b`, `c`, and `r` are declared previously. (Remember to adhere to precedence and associativity rules. You should not assign the value of your expression to a variable.)

$$\frac{4}{3(r + 34)} - 9(a + bc)$$

5. (6 Points) Suppose we have 3 integer variables `age`, `salary`, and `performance` that describe an employee. We want to decide if the employee is eligible for a retirement plan. Any employee 45 or older is eligible. Additionally, an employee under 45 is eligible for a retirement plan if her salary is above 5000 and her performance is 5 or above. Write an expression that evaluates to true if an employee is eligible for a retirement plan using the variables `age`, `salary`, and `performance`. You should not define any additional variables for this question.

6. (4 Points) Suppose that `x` is 1. What is the value of `x` after the following expression is evaluated?

`(x > 1) && (x++ > 1)`

7. (7 Points) Show the output for the following program:

```
int i = 1, j = 0, k = 0;
int x = 1, y = 1, z = 1;

if (i > 0)
    if (j > 0)
        x = 0;
    else if (k > 0)
        y = 0;
    else
        z = 0;

System.out.println(x + " " + y + " " + z);
```

8. (7 Points) Compare the following program to the program in Question 7:

```
int i = 1, j = 0, k = 0;
int x = 1, y = 1, z = 1;

if (i > 0) {
    if (j > 0)
        x = 0;
    else if (k > 0)
        y = 0;
} else
    z = 0;

System.out.println(x + " " + y + " " + z);
```

Is it the equivalent? If not, show the output.

9. (8 Points) Show and explain the output of the following code:

```
int i = 0;
System.out.println(--i + i + i++);
System.out.println(i + ++i);
```

10. (6 Points) Study the following valid code carefully. What is the output?

```
int x = 55;
if (x % 10 == 0);
System.out.println("Divisible by 10");
System.out.println(x);
```

11. (8 Points) Explain in detail what the following code does. Assume `scanner` has been initialized properly. Remember to be as specific as possible. Think about all the possible executions of the code.

```
int data = 1;

while (data != 0) {
    data = scanner.nextInt();
    System.out.println(data);
}
```

12. (7 Points) Write a `for` loop that iterates from 1000 **down to** 10 (inclusive) and prints out a number if it is divisible by 18.

13. (8 Points) Will the following program terminate? If so, give the output.

```
int balance = 1000;

while (true) {
    if (balance < 10)
        break;
    balance = balance - 10;
}

System.out.println("Balance is: " + balance);
```

14. (8 Points) Will the following program terminate? If so, give the output.

```
int balance = 1000;

while (true) {
    if (balance < 20)
        continue;
    if (balance < 10)
        break;
    balance = balance - 10;
}

System.out.println("Balance is: " + balance);
```

15. (6 Points) Consider the following code fragment:

```
switch (n+4){  
    case 4:    System.out.println("Case 4 taken");  
              break;  
    case 0:    System.out.println("Case 0 taken");  
              break;  
    case 1:    System.out.println(" Case 1 taken");  
              break;  
}
```

What is the output when  $n = 0$  on entry to the switch statement? What is the output when  $n = 4$  on entry to the switch statement?

16. (4 Points) Can an array be resized? What is the output of the following code?

```
int[] myArray = {1, 2, 3, 4, 5};  
  
System.out.println(myArray[4]);  
myArray = new int[4];  
System.out.println(myArray[3]);
```

17. (8 Points) Write Java code to declare an array of `ints` named `multThree` of length 50. Then, store the first 50 multiples of 3 in the array in ascending order.

18. (Extra Credit) Write code to implement a *bubble sort* that will sort the elements of an array of `ints` in increasing order. A bubble sorting algorithm makes several passes over an array. Each pass compares each pair of neighboring elements. If any neighboring elements are out of order, it swaps the elements. The algorithm completes when no swaps were made in a pass over the array. At this point the array is sorted. Your code should work for an array of any size. (Hint: You will have to use nested loops)