

# ENGR 131 - MIDTERM #1 REVIEW

PROF. BRANICKY

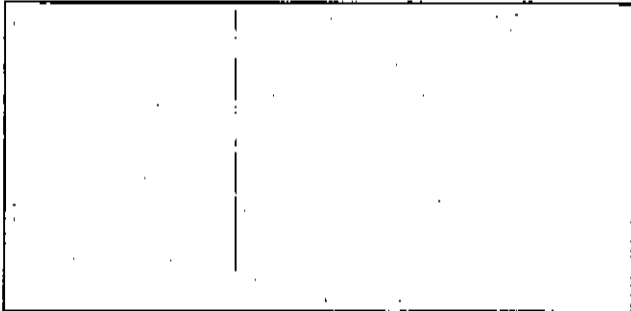
```

Console Input

Scanner input = new Scanner(System.in);
int intValue = input.nextInt();
long longValue = input.nextLong();
double doubleValue = input.nextDouble();
float floatValue = input.nextFloat();
String string = input.next();

Console Output

System.out.println(anyValue);
    
```



**Primitive Data Types**

byte	8 bits
short	16 bits
int	32 bits
long	64 bits
float	32 bits
double	64 bits
char	16 bits
boolean	true/false

**Arithmetic Operators**

+	addition
-	subtraction
*	multiplication
/	division
%	modulus
var++	postincrement
var--	postdecrement

**Assignment Operators**

=	assignment
+=	addition assignment
-=	subtraction assignment
*=	multiplication assignment
/=	division assignment
%=	modulus assignment

**Relational Operators**

<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to
==	equal to
!=	not equal

**Logical Operators**

&&	AND
	OR
!	NOT

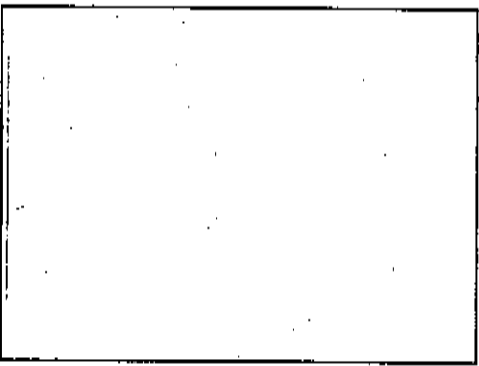
**if statements**

```

if (condition) {
    statements;
}

if (condition) {
    statements;
}
else {
    statements;
}

if (condition1) {
    statements;
}
else if (condition2){
    statements;
}
else {
    statements;
}
    
```



**loop statements**

```

while (condition) {
    statements;
}

for (init; condition;
    adjustment) {
    statements;
}
    
```

Companion Website: [www.prenhall.com/liang](http://www.prenhall.com/liang)

**SOURCE:** Introduction to Java Programming: Fundamentals First, 6/e  
by Y. Daniel Liang

2.10 Test your understanding of Java with the following:

- What does `System.out.println()`; do?
- What does the statement `System.out.println(3 + 2)`; do?
- What does the statement `System.out.println("The answer is: " + 3 + 2)`; do?
- What does the statement `System.out.println("Hi " + " there")`; do?

2.11 Test your understanding of Java with the following:

- What does the code `int x = 3; System.out.println("The result is" + x)`; do?
- What does the code `String firstName = "Sue"; System.out.println(firstName)`; do?
- What does the code `System.out.println(2 < 3)`; do?
- What does the code `System.out.println(2 == 3)`; do?
- What does the code `System.out.println(3 >= 2)`; do?

2.12 What does `int x = 1 / 3; System.out.println(x)`; do and why?

2.13 What does `double d = 1 / 2.0; System.out.println(d)`; do and why?

2.14 What does `double d1 = 1 / 3; System.out.println(d1)`; do and why?

2.15 What does the `double d2 = (double) 1 / 3; System.out.println(d2)`; do and why?

2.16 Declare variables for each of the following:

- the number of people in your family
- the cost of a video game
- your name
- answer to, "Are you righthanded?"
- the temperature in your room
- the number of items in a shopping cart

WRITE THE OUTPUT IN EACH CASE:

```
> int x = 20;
> System.out.println(x <= 30);
> System.out.println(x > 30);
> System.out.println(x == 20);
> System.out.println(x != 20);
```

```
> int x = 3;
> int y = 5;
> System.out.println(x < 5 && y < 6);
> System.out.println(x > 5 && y < 6);
> System.out.println(x < 5 && y > 6);
> System.out.println(x > 5 && y > 6);
> System.out.println(x > 5 || y < 6);
```

6.9 What is the result from the following:

```
boolean value1 = true;
boolean value2 = false;
if (value1 && value2)
    System.out.println("first if is true");
if (value1 || value2)
    System.out.println("second if is true");
if (value1 && !value2)
    System.out.println("third if is true");
if (value1 || !value2)
    System.out.println("fourth if is true");
if (!value1 && value2)
    System.out.println("fifth if is true");
if (!value1 || value2)
    System.out.println("sixth if is true");
if (!value1 && !value2)
    System.out.println("seventh if is true");
if (value1 || !value2)
    System.out.println("eighth if is true");
```

8.6 What will be output from the following code:

```
public void test1()
{
    int x = 0;
    while (x < 3)
    {
        x = x + 1;
        System.out.println(x);
    }
}
```

8.7 What will be output from the following code:

```
public void test2()
{
    int x = 3;
    while (x > 0)
    {
        x = x + 1;
        System.out.println(x);
    }
}
```

8.9 What will be output from the following code:

```
public void test4()
{
    int x = 2;
    int y = 0;
    while (x < 10 && y < 1)
    {
        x = x + 1;
        y = y + 1;
        System.out.println(x + ", " + y);
    }
}
```

8.10 What will be output from the following code:

```
public void test5() {
    int x = 2;
    int y = 0;
    while (x < 10 || y < 1)
    {
        x = x + 1;
        y = y + 1;
        System.out.println(x + ", " + y);
    }
}
```

8.15 What will be output from the following code:

```
public void test10()
{
    int x = 2;
    int y = 0;
    while (!(x < 10 && y < 1))
    {
        x = x + 1;
        y = y + 1;
        System.out.println(x + ", " + y);
    }
}
```

2.1 Which of the following identifiers are valid?

`applet`, `Applet`, `a++`, `--a`, `4#R`, `#44`, `apps`

2.2 Which of the following are Java keywords?

`class`, `public`, `int`, `x`, `y`, `radius`

2.3 Translate the following pseudocode into Java code:

- Step 1: Declare a **double** variable named `miles` with initial value `100`;
- Step 2: Declare a **double** constant named `MI2KM` with value `1.609`;
- Step 3: Declare a **double** variable named `km` multiply miles and `MI2KM` and assign the result to `km`
- Step 4: Display `km` to the console.

What is `km` after Step 4?

2.4 What are the benefits of using constants? Declare an **int** constant `SIZE` with value `20`.

2.5 Assume that **int** `a = 1` and **double** `d = 1.0`, and that each expression is independent. What are the results of the following expressions?

`a = 46 / 9;`

`a = 46 % 9 + 4 * 4 - 2;`

`a = 45 + 43 % 5 * (23 * 3 % 2);`

2.8 What is the result of `25 / 4`? How would you rewrite the expression if you wished the result to be a floating-point number?

2.10 How would you write the following arithmetic expression in Java?

$$\frac{4}{3(r + 34)} - 9(a + bc) + \frac{3 + d(2 + a)}{a + bd}$$

3.2 Assume that `x` is `1`, show the result of the following Boolean expressions:

`(true) && (3 > 4)`

`!(x > 0) && (x > 0)`

`(x > 0) || (x < 0)`

`(x != 0) || (x == 0)`

`(x >= 0) || (x < 0)`

`(x != 1) == !(x == 1)`

3.3 Write a Boolean expression that evaluates to **true** if a number stored in variable `num` is between `1` and `100`.

3.10 Suppose `x = 3` and `y = 2`, show the output, if any, of the following code. What is the output if `x = 3` and `y = 4`? What is the output if `x = 2` and `y = 2`? Draw a flowchart of the following code:

```
if (x > 2) {
    if (y > 2) {
        int z = x + y;
        System.out.println("z is " + z);
    }
}
else
    System.out.println("x is " + x);
```

3.13 Are the following two statements equivalent?

```
if (income <= 10000)
    tax = income * 0.1;
else if (income <= 20000)
    tax = 1000 +
        (income - 10000) * 0.15;
```

```
if (income <= 10000)
    tax = income * 0.1;
else if (income > 10000 &&
        income <= 20000)
    tax = 1000 +
        (income - 10000) * 0.15;
```

3.14 Which of the following is a possible output from invoking `Math.random()`?

323.4, 0.5, 34, 1.0, 0.0, 0.234

3.15 How do you generate a random integer  $i$  such that  $0 \leq i < 20$ ?

How do you generate a random integer  $i$  such that  $10 \leq i < 20$ ?

4.16 Identify and fix the errors in the following code:

```
1 public class Test {
2     public void main(String[] args) {
3         for (int i = 0; i < 10; i++);
4             sum += i;
5
6         if (i < j);
7             System.out.println(i)
8         else
9             System.out.println(j);
10
11        while (j < 10);
12        {
13            j++;
14        };
15
16        //do {
17            // j++;
18        // } while (j < 10)
19    }
20 }
```

4.24\* (Summing a series) Write a program to sum the following series:

$$\frac{1}{3} + \frac{3}{5} + \frac{5}{7} + \frac{7}{9} + \frac{9}{11} + \frac{11}{13} + \dots + \frac{95}{97} + \frac{97}{99}$$

5.1 What are the benefits of using a method? How do you declare a method? How do you invoke a method?

5.2 What is the `return` type of a `main` method?

### Section 5.9 The Math Class

5.16 True or false? The argument for trigonometric methods represents an angle in radians.

5.17 Write an expression that returns a random integer between 34 and 55. Write an expression that returns a random integer between 0 and 999. Write an expression that returns a random number between 5.5 and 55.5. Write an expression that returns a random lowercase letter.

5.18 Evaluate the following method calls:

- |   |                                  |
|---|----------------------------------|
| A. <code>Math.sqrt(4)</code>                | I. <code>Math.ceil(-2.5)</code>  |
| B. <code>Math.sin(2 * Math.PI)</code>       | J. <code>Math.floor(-2.5)</code> |
| C. <code>Math.cos(2 * Math.PI)</code>       | N. <code>Math.ceil(2.5)</code>   |
| D. <code>Math.pow(2, 2)</code>              | O. <code>Math.floor(2.5)</code>  |
| E. <code>Math.log(Math.E)</code>            |                                  |
| F. <code>Math.exp(1)</code>                 |                                  |
| G. <code>Math.max(2, Math.min(3, 4))</code> |                                  |

5.17\* (Displaying matrix of 0s and 1s) Write a method that displays an  $n$  by  $n$  matrix using the following header:

```
public static void printMatrix(int n)
```

Each element is 0 or 1, which is generated randomly. Write a test program that prints a 3 by 3 matrix that may look like this:

```
0 1 0
0 0 0
1 1 1
```

Java for Engineers and Scientists; 2/e  
by Stephen J. Chapman

1. State whether or not each of the following Java constants is valid. If valid, state what type of constant it is. If not, state why it is invalid. (If you are not certain, try to compile the constant in a Java program to check your answer.)
  - a. 3.141592
  - b. true
  - c. -123,456.789
  - d. +1E-12
  - e. "Who's coming for dinner?"
  - f. 'Hello'
  - g. "Enter name:"
  
2. State whether each of the Java names is valid or not. If not, state why the name is invalid. If a name is valid, state what a name of that sort should represent, using the Java conventions.
  - a. junk
  - b. 3rd
  - c. executeAlgorithm
  - d. timeToIntercept
  - e. MyMath
  - f. START\_TIME
  
3. Which of the following expressions are legal in Java? If an expression is legal, evaluate it.
  - a.  $5 + 10 \% 3 + 2$
  - b.  $5 + 10 \% (3 + 2)$
  - c.  $23 / (4 / 8)$
  
4. Which of the following expressions are legal in Java? If an expression is legal, evaluate it.
  - a.  $((58/4) * (4/58))$
  - b.  $((58/4) * (4/58.))$
  - c.  $((58./4) * (4/58.))$
  - d.  $((58./4 * (4/58.))$
  
5. **M** Assume that the variables a, b, c, i, and j are initialized as shown in the following code fragment. What is the value of each variable after these statements are executed?

```
int i = 5, j = 2;
double a = 6, b, c = 0;
b = i - j;
j = (int) b / 2;
a += b / j;
```

6. What is wrong with each of the following code segments?

a. `x = 5;`  
`while ( x >= 0 )`  
`x++;`

b. `x = 1;`  
`while ( x <= 5 );`  
`x++;`

8. The potential energy of an object due to its height above the surface of the earth is given by the equation

$$PE = mgh \quad (2.10)$$

where  $m$  is the mass of the object,  $g$  is the acceleration due to gravity, and  $h$  is the height above the surface of the earth. The kinetic energy of a moving object is given by the equation

$$KE = \frac{1}{2}mv^2 \quad (2.11)$$

where  $m$  is the object's mass and  $v$  is its velocity. Write a Java statement for the total energy (potential plus kinetic) possessed by an object in the earth's gravitational field.

10. If a stationary ball is released at a height  $h$  above the surface of the earth, the velocity of the ball  $v$  when it hits the earth is given by the equation

$$v = \sqrt{2gh} \quad (2.12)$$

where  $g$  is the acceleration due to gravity, and  $h$  is the height above the surface of the earth (assuming no air friction). Write a Java statement for the velocity of the ball when it hits the earth.

8. Examine the following for statements and determine how many times each loop will be executed. (Assume that all loop index variables are integers.)

a. `for ( range = -32768; range <= 32767; range++ )`

b. `for ( j = 100; j >= 1; j -= 10 )`

c. `for ( k = 2; k <= 3; k += 4 )`

d. `for ( i = -4; i <= -7; i++ )`

e. `for ( x = -10; x <= 10; x -= 10 )`

Java: An Introduction to Computing  
by Joel Adams, Larry R. Nyhoff, and Jeffrey Nyhoff

For Exercises 1–10, assume that  $m$  and  $n$  are integer variables with the values  $-5$  and  $8$ , respectively, and that  $x$ ,  $y$ , and  $z$  are real variables with the values  $-3.56$ ,  $0.0$ , and  $44.7$ , respectively. Find the value of the boolean expression.

1.  $m <= n$
2.  $2 * \text{Math.abs}(m) <= 8$
3.  $x * x < \text{Math.sqrt}(z)$
4.  $(\text{int}) z == (6 * n - 4)$
5.  $(x <= y) \ \&\& \ (y <= z)$
6.  $!(x < y)$
7.  $!((m <= n) \ \&\& \ (x + z > y))$
8.  $!(m <= n) \ || \ !(x + z > y)$
9.  $!((m <= n) \ || \ (x + z > y))$
10.  $!((m > n) \ \&\& \ !(x < z))$

For Exercises 11–16, use truth tables to display the value of the boolean expression for all possible (boolean) values of  $a$ ,  $b$ , and  $c$ :

11.  $a \ || \ !b$
12.  $!(a \ \&\& \ b)$
13.  $!a \ || \ !b$
14.  $(a \ \&\& \ b) \ || \ c$
15.  $a \ \&\& \ (b \ || \ c)$
16.  $(a \ \&\& \ b) \ || \ (a \ \&\& \ c)$

For Exercises 17–25, write Java boolean expressions to express the following conditions:

17.  $x$  is greater than 3
18.  $y$  is strictly between 2 and 5
19.  $r$  is negative and  $z$  is positive
20. Both  $\alpha$  and  $\beta$  are positive
21.  $\alpha$  and  $\beta$  have the same sign (both are negative or both are positive)
22.  $-5 < x < 5$
23.  $a$  is less than 6 or is greater than 10
24.  $p$  is equal to  $q$ , which is equal to  $r$
25.  $x$  is less than 3, or  $y$  is less than 3, but not both

Exercises 26–28 assume that  $a$ ,  $b$ , and  $c$  are boolean values.

26. Write a boolean expression that is true if and only if  $a$  and  $b$  are true and  $c$  is false.
27. Write a boolean expression that is true if and only if  $a$  is true and at least one of  $b$  or  $c$  is true.
28. Write a boolean expression that is true if and only if exactly one of  $a$  and  $b$  is true.

For Exercises 1–5, describe the output produced.

1. 

```
for (int i = -2; i <= 3; i++)
    theScreen.println(i + " squared = " + i*i);
```
2. 

```
for (int i = 1; i <= 5; i++)
{
    theScreen.println(i);
    for (int j = i; j >= 1; j--)
        theScreen.println(j);
}
```
3. 

```
int k = 5;
for (int i = -2; i <= 3; i++)
{
    theScreen.println(i + k);
    k = 1;
}
```
4. 

```
for (int i = 1; i <= 3; i++)
    for (int j = 1; j <= 3; j++)
        for (int k = 1; k <= j; k++)
            theScreen.print(i + " " + j + " " + k);
```

4. Write a method `range()` that finds and returns the range between two integers—that is, the absolute value of their difference.
5. Write a method `wages()` that receives the hours worked and an hourly pay rate for an employee and returns the wages earned.
6. Write a method that receives the radius of a circle and returns its circumference. ( $C = 2\pi r$ )
7. Write a method that receives the radius of a circle and returns its area. ( $A = \pi r^2$ )
8. Write a method that receives the lengths of the sides of a rectangle and returns its perimeter. ( $P = 2l + 2w$ )
9. Write a method that receives the lengths of the sides of a rectangle and returns its area. ( $A = lw$ )
10. Write a method that receives the lengths of the three sides of a triangle and returns its perimeter. ( $P = s_1 + s_2 + s_3$ )
- L 11. Write a method that receives the lengths of the three sides of a triangle and returns its area. (The area of a triangle can be found by using *Hero's formula*:

$$\sqrt{s(s-a)(s-b)(s-c)}$$

where  $a$ ,  $b$ , and  $c$  are the lengths of the sides and  $s$  is one half of the perimeter.)

12. The number of bacteria in a culture can be estimated by  $Ne^{kt}$ , where  $N$  is the initial population,  $k$  is a rate constant, and  $t$  is time. Write a method to calculate the number of bacteria present for values of  $N$ ,  $k$ , and  $t$ .
13. Write a method that receives a number of seconds and returns the equivalent number of minutes.
14. Write a method that receives a number of minutes and returns the equivalent number of hours.
15. Write a method that receives a number of hours and returns the equivalent number of days.
16. Using the methods from Exercises 13–15, write a method that receives a number of seconds and returns the equivalent number of days.
- T 17. Write a method that receives a 7-digit integer representing a phone number and displays it in the format `abc-defg`.
- L 19. The wind chill index (see Exercise 18) was developed in 1941. It is a measure of discomfort due to the combined cold and wind, and is based on the rate of heat loss due to various combinations of temperature and wind. The *heat index*, developed in 1979, is a measure of discomfort due to the combination of heat and high humidity, and is based on studies of evaporative skin cooling for combinations of temperature and humidity. It is computed using the following formula:

$$\begin{aligned} \text{heat index} = & (-42.379 + 2.04901523 \times t + 10.14333127 \times r - 0.22475541 \times t \times r \\ & - (6.83783\text{E}-3) \times t^2 - (5.481717\text{E}-2) \times r^2 + (1.22874\text{E}-3) \times t^2 \times r \\ & + (8.5282\text{E}-4) \times t \times r^2 - (1.99\text{E}-6) \times t^2 \times r^2) \end{aligned}$$

where  $t$  is the temperature in degrees Fahrenheit and  $r$  is the relative humidity. Write a method to compute the heat index.

12. For a positive integer  $n$ , use a `for` loop to find the sum  $1 + 2 + \dots + n$  and return this sum.
13. For two integers  $m$  and  $n$  with  $m \leq n$ , use a `for` loop to find the sum  $m + m+1 + \dots + n$  and return this sum.

For Exercises 14–20, write a loop to do what is asked for.

14. Display the squares of the first 100 positive integers in increasing order.
15. Display the cubes of the first 50 positive integers in decreasing order.
16. Display the square roots of the first 25 odd positive integers.
18. Display the value of  $x$  and decrease  $x$  by 0.5 as long as  $x$  is positive.
20. Calculate and display the squares of consecutive positive integers until the difference between a square and the preceding one is greater than 50.