

TOPIC 2 EXERCISES

Tracing Exercises

1. Trace each of the following Java programs step by step. Show what each program prints.

```
(a) public class prob2_1a {
    public static void main(String[] args)
    {
        int p,b;

        for (b = 2; b <= 6; b++) {
            p = 2 * b + 3;
            System.out.println(b + " " + p);
        }
    }
}

(b) public class prob2_1b {
    public static void main(String[] args)
    {
        int s,t;

        t = 0;
        for (s = 8; s >= 4; s -= 3) {
            if (s > t)
                t += 3;
            if (s <= t)
                s += 2;
            System.out.println(s + " " + t);
        }
    }
}

(c) public class prob2_1c {
    public static void main(String[] args)
    {
        int x,y,z;

        x = -3;
        y = 1;
        z = 2;
        if (Math.abs(x + z) > Math.abs(y))
            System.out.println("yes");
        if (Math.abs(x) + Math.abs(z) > Math.abs(y))
            System.out.println("no");
        System.out.println("maybe");
    }
}
```

```

(d) public class prob2_1d {
    public static void main(String[] args)
    {
        double b;
        int    a;

        System.out.println("number\tsquare root");
        for (a = 0; a <= 6; a++) {
            b = Math.sqrt(a);
            System.out.println(a + "\t" + b);
        }
    }
}

(e) public class prob2_1e {
    public static void main(String[] args)
    {
        int c;
        double d;

        System.out.println("number\treciprocal\tcheck");
        for (c = 1; c <= 8; c++) {
            d = 1.0 / c;
            System.out.println(c + "\t" + d + "\t" + c*d);
        }
    }
}

(f) public class prob2_1f {
    public static void main(String[] args)
    {
        double n,v;

        for (n = .4; n < 3.6; n += 1.2) {
            v = n * .5 + 1.7;
            System.out.println(n + " " + v);
        }
    }
}

(g) public class prob2_1g {
    public static void main(String[] args)
    {
        double x,y;

        for (x = 17.5; x >= .5; x -= 4.5) {
            y = x + 2.5;
            System.out.println(x + " " + y);
        }
    }
}

```

2. For each of the following series of Java statements, try to describe in words what is accomplished (e.g., the larger of x and y is put into max and then max is printed; or x is multiplied over and over by 2 until it is more than 30, etc.). For parts (a)-(c), (f), and (g), assume that x and y have been given certain values. All variables have data type **int**.

- (a)

```
if (x > y)
    max = x;
if (x <= y)
    max = y;
System.out.println(max);
```
- (b)

```
if (x > y)
    ans = x;
if (x < y)
    ans = y;
if (x == y)
    ans = 1;
```
- (c)

```
hold = 5;
if (x == y)
    hold = x;
if (x < y)
    hold = y;
```
- (d)

```
for (x = 1; x < 100; x *= 2)
    if (x < 50)
        x *= 2;
```
- (e)

```
for (x = 0; x < 15; x += 4)
    if (x == 8)
        System.out.println(x);
```
- (f)

```
for (x = 0; x < 15;) {
    x = x + y;
    if (x < y)
        x = y;
}
```
- (g)

```
if (x == y)
    System.out.println(x);
if (x != y)
    System.out.println(y);
```
- (h)

```
for (x = 0; x <= 6; x++) {
    y = x + 4;
    if (y == 10)
        System.out.println("done");
}
```

3. For each of the following Java statements, show the exact order in which the operations are performed. Assume that all variables have data type **double**, and these are the initial values: a = 5, b = 6, c = 3, d = 2, and e = 2. Where necessary, use the results of previous statements to provide values for the variables.

- (a) `f = -a + b * c / 3 * d + e;`
- (b) `g = -a + b * c / (3 * d) + e;`
- (c) `h = 4 * (a - 1) * (c / (b * d));`
- (d) `i = 4 * a - 2 * c / b * d;`
- (e) `p = -a - b + c * d;`
- (f) `b = -(a - b + c) * d;`
- (g) `r = -b - p + 5;`
- (h) `s = 2 * b / c + 3;`
- (i) `t = 2 * (b / c) + 3;`
- (j) `u = (2 * b) / c + 3;`
- (k) `v = 2 * b / (c + 3);`
- (l) `w = b * (d + 2) / c;`
- (m) `x = 8 * s - t;`
- (n) `y = 100 * v + 10 * w - u;`

Miscellaneous Exercises

4. Which is a correct Java translation of the right-hand side of the following equation? If more than one is correct, which is preferred?

$$y = \frac{(p + q) \times r - s}{p + q}$$

- (a) `(p + q) * r - s / p + q`
- (b) `((p + q) * (r - s)) / (p + q)`
- (c) `((p + q * r) - s) / (p + q)`
- (d) `(p + q * r - s) / (p + q)`
- (e) `((p + q) * r - s) / (p + q)`
- (f) `((p + q) * r) - s / (p + q)`

5. Show what is printed by each of the following:

- (a) `System.out.println("The cat" + '\n' + "stepped over" + '\n' + "the jam closet");`
- (b) `System.out.println('\n' + '\n' + "TADA" + '\n');`
- (c) `System.out.println("\n");`
- (d) `num = 5;`
`System.out.println(num + "%\n");`
- (e) `System.out.println("\nBig deal,\n" she said.);`
- (f) `x = 3;`
`y = 4;`
`System.out.println(x + '\t' + y);`

6. Each of the following program segments is preceded by a comment that describes what we would like to accomplish. Try to use these data values to see if the segment works in all cases. If it does not work, explain exactly what happens and show how to amend it so that it does always work.

```
(a) // set z to the square root of w
    int w;
    double z;

    z = 0.5 * w;                                     (try w = 4, w = 8)
```

```
(b) // if x is negative, print the word negative
    // otherwise print non-negative
    int x;

    if (x < 0)
        System.out.println("negative");
    if (x > 0)
        System.out.println("non-negative");         (try x = -2, x = 0, x = 5)
```

```
(c) // add 4 to x if x is negative; otherwise add 2
    int x;
    if (x < 0)
        x = x + 4;
    if (x >= 0)
        x = x + 2;                                   (try x = -6, x = -2, x = 0, x = 3)
```

```
(d) // if x is larger than 12, print x; otherwise print 12
    int x, ans;

    ans = 12;
    if (x > 12)
        ans = x;
    System.out.println(ans);                         (try x = 5, x = 12, x = 20)
```

```
(e) // find the smallest integer whose
    // square is greater than y
    int number, test, y;

    test = 0;
    for (number = 1; test <= y; number++)
        test = number * number;
    System.out.println(number-1 + " is the smallest"); (try y = 4, y = 5, y = 26)
```

Debugging Exercises

7. The following **if** statement does not generate an error message. Nonetheless, it is probably not what the programmer wants. Can you figure out what the statement does? What is wrong with it if the intention is to print the word "less" if x is less than 7?

```
if (x < 7);  
    System.out.println("less");
```

8. The following program has many bugs in it. Try to find them and identify the type (compilation, execution, or logic) of each error.

```
// do various calculations, including  
/ finding the perimeter of a rectangle  
public class prob2_8 [  
    public static voided mane(String[] args)  
  
    integer x;  
    y: double;  
    int perimeter;length;width;  
    {  
        x == 4.0;  
        y = .5 * 3 \ (x - 4);  
        if x = 5  
            System.out.println('five')  
        2y = x + (5 + 4 % 3;  
        perimeter = length + width * 2;  
        System.out.writelN(perimeter,length,width")  
    }  
];
```