1. Trace Code
For each problem below, answer the question(s) about the code.

a. What are the values of each variable (what is stored in their memory locations) after these lines execute?

```java
int x = 3;
int y = x;
x = x + y;
```

b. What are the values of each variable (what is stored in their memory locations) after these lines execute?

```java
int a = 3, b = 4;
double d = a + b;
d = d / 2;
double e = (a + b) / 2;
```

c. What are the values of each variable (what is stored in their memory locations) after these lines execute?

```java
String s = "hello";
int c = 10 % 7;
String t = s + c;
s = s + t;
```

d. What does this code display on the screen?

```java
double x=0.5, y=4.0, z=2.5;
if(y - x > z) {
    System.out.println(z);
}
if(x + y < z * 2) {
    System.out.println(x+y);
}
```

```java
int a=2, b=5, c=7;
if(a < c && b < c) {
    System.out.println(c);
} else if(a+b == c) {
    System.out.println(b);
} else {
    System.out.println(a);
}
```

Output: Output:
e. What does the following code display on the screen?

```java
int i = 3, j = 0, MAX = 5;
while(i + j <= MAX) {
    i = (MAX + j) / 2;
    j++;
    System.out.println(i);
    System.out.println(j);
}
```

f. What does this display on the screen?

```java
String s = "hello", t = "world", u = "goodbye";
for(int i=0; i<3; i++) {
    s = s + " " + u;
    t = u + " " + t;
    System.out.println(s + " " + t);
}
```

g. What is the value of sum at the end of this code?

```java
int sum = 0;
String sumStr = "";
int N = 4259;
while(N>0) {
    sum += N % 10;
    sumStr = sumStr + N % 10;
    N = N / 10;
}
```

Also, what is the value of sumStr at the end of this code?

In one sentence, how would you describe/summarize what this code is doing?
h. int [] a = { 9, 2, 15, -7, 14, 16, 4, 6};
for(int i=1; i<a.length; i++) {
    a[i] += a[i-1];
}

What is in array a at the end of this code?

In one sentence, how would you describe/summarize what this code does?

i. int [] a = { 9, 2, 15, -7, 14, 16, 4, 6};
int pos = 0;
while(pos < a.length - 1) {
    int temp = a[pos];
    a[pos] = a[pos+1];
    a[pos+1] = temp;
    pos = pos + 2;
}

In one sentence, how would you describe/summarize what this code does?
2. Short programming questions
For these kinds of questions,
- You do NOT NEED TO give me a full class (assume “public class <ClassName>” and “public static void main(…)” are already written).
- You do NOT NEED TO write any import statements (assume “import java.util.*;” is already written).
- You can assume
  o “Random rand = new Random();” and
  o “Scanner kb = new Scanner(System.in);”
  have already been written, so rand and kb are available for you to use.

a. Write some code to read in an integer, and print ALL of the factors of that number.

  Hint: Use % to determine if a number is a factor of another number. For instance, (x % y == 0) is true if y is a factor of x, and false if y is not a factor of x.

b. Write some code to read in an array of 20 doubles from the keyboard, determine the position of the smallest number in that array, and swap the smallest number with the number at the beginning of the array.

c. Generate 15 random numbers between 1 and 100, and find the median. The median is defined as the number that is larger than (or equal to) half of the numbers, and smaller than (or equal to) the other half of the numbers.

  Hint: Use Arrays.sort().
3. Write a complete class
Write a complete Java class to be saved in a file called Steps.java to draw a series of Steps on the screen. Read in from the user the number of steps, the width of each step, and the height of each step.

For instance, if the user enters a number = 2, a height of 3, and a width of 5, the program should draw:

```
|     |     |
| 3   |     |
|     |     |
|     |     |
```

```
5 1 5
```

```
11 1
wide  wide
```