


Worksheet 4

Unless specified, all questions are in Java .

1. Trace the following program by hand. Write its output.

```
1  public class Main {
2      public static void main(String[] args) {
3          for (int i = 0; i < 100; ++i) {
4              if (i % 3 == 0 && i % 5 == 0) {
5                  System.out.print(i + " ");
6              }
7          }
8      }
9  }
```

Hint: The modulo operator `%` gets the remainder. `num % d == 0` tests if `num` is divisible by `d`.

2. Describe with one sentence in your own words what the program above does.

3. Trace the following program by hand. Write its output.

```
1  public class Main {
2      public static void main(String[] args) {
3          int a = 0;
4          int b = 1;
5          int c = 0;
6          System.out.print(a + " " + b + " ");
7          while (b < 50) {
8              c = a + b;
9              System.out.print(c + " ");
10             a = b;
11             b = c;
12         }
13     }
14 }
```

4. (Optional Challenge) What is the sequence of numbers printed by the program above called?

5. Trace the following program by hand. Write its output.

```
1  public class Main {
2      public static void main(String[] args) {
3          String[] northernCities = {
4              "Helsinki", "Somewhere Snowy", "Moscow", "Harbin", "Anchorage", "Toronto", "Longyearbyen"
5          };
6          for (String city : northernCities) {
7              if (city.equals("Longyearbyen")) {
8                  break;
9              }
10             if (city.contains("Somewhere")) {
11                 continue;
12             }
13             System.out.print(city);
14             if (city.equals("Helsinki")) {
15                 System.out.println(", Finland");
16             } else {
17                 char c = city.charAt(0);
18                 if (c == 'H' || c == 'A') {
19                     System.out.println(", China or U.S.");
20                 } else if (c == 'M' || c == 'T') {
21                     System.out.println(", Russia or Canada");
22                 }
23             }
24         }
25     }
26 }
```

6. Use the following Python program to create a **truth table** for the XOR (exclusive OR) operator.

```
1  # Test all possible combinations of True and False for `a` and `b` (4 total).
2  a = False
3  b = False
4  print(a ^ b) # XOR operator: `^`
```

7. What is the output of the following program?

```
1  import java.util.Arrays;
2
3  public class Main {
4      public static void main(String[] args) {
5          int[] nums = {1, 2, 3, 4, 5, 6, 7, 8};
6
7          doSomething(nums);
8
9          System.out.println(Arrays.toString(nums));
10     }
11
12     private static void doSomething(int[] referenceNums) {
13         referenceNums[2] *= 100; // Same as referenceNums[2] = referenceNums[2] * 100.
14         referenceNums[3] *= 100;
15         referenceNums[4] *= 100;
16     }
17 }
```

8. Say that we want a data structure which is fast at inserting new elements at the start and end of a sequence.

What data structure should we use?

9. Say that we want a data structure which is fast at accessing an element at any position in a sequence, but is also flexible in size.

What data structure should we use?