Upon the Distinction Between the Ashes of the Various Tobaccos*

*Based on an example in Ledgard, H., & Singer, A. (1983). *Elementary basic as chronicled by John H. Watson* (No. 001.6425 E4).

> *I have been guilty of several monographs. They are all upon technical subjects. Here, for example, is one "Upon the Distinction between the Ashes of the Various Tobaccos". In it I enumerate a hundred and forty forms of cigar, cigarette, and pipe tobacco, with coloured plates illustrating the difference in the ash. It is a point which is continually turning up in criminal trials, and which is sometimes of supreme importance as a clue.*
>
> (Sherlock Holmes in *The Sign of Four* by Sir Arthur Conan Doyle)

Program 2: Tobacco Ash Classification

Due to the Labor Day and K-Day recesses, this assignment counts as both your lab and program for week 2. You have three days to do it!

This is a group assignment. Work with your lab team.

1   Objectives

To engage in the refactoring of a project.

1. Use if-statements to make decisions.

2. Develop robust software.

3. Test your code to ensure compliance with this specification.

2   A Classification Task

Sherlock Holmes famously wrote a monograph conveying his expertise in the study of cigar ash and employed this knowledge in several investigations. His treatise classified hundreds of cigaret, cigar, and pipe tobaccos according to texture, color, the presence of particulate matter, and the quantity of nicotine. Table 1 displays a small sample of his classification scheme.

Table 1: Brands of Cigar Tobacco and Associated Ash Properties

Tobacco Brand	Texture	Color	Presence of Particles	Nicotine Count
Espanada	caked	dark	false	3
Heritage	flaky	pale	false	2
Roman	caked, flaky, granular, or fluffy	dark	true	1
Londoner	caked	brown	false	2
Lunkah	granular	gray	false	2
MacDuffy	flaky	gray	false	2
Old Wood	caked, flaky, granular, or fluffy	brown	true or false	2
Top Hat	caked	gray	false	2
Trichinopoloy	flaky	dark	false	2
West Country	fluffy	pale	true	2

Your task is determine the brand of tobacco based on the properties of a sample of tobacco ash. Those properties; *texture*, *color*, *presence of particles*, and *nicotine count* may have the following values:

- Valid Textures: caked, flaky, granular, fluffy.

- Valid Colors: dark, pale, gray, brown.

- Valid Presence of Particles: true, false

- Valid Nicotine Counts: 0, 1, 2, 3

2.1 Coding Instructions:

1. Create a Java source file called, `Program2.java`

2. Insert a comment block with the program header:

```
/**
 * Program Name: Program 2
 * Program Description: ?
 * Course: CS 1131
 * Lab Section ?
 * Lab Team Name: ?
 * @author ?, ?, ?, ?
 */
```

3. Declare a class named `Program2`

4. Write a method to classify a sample of tobacco ash. You method should have the following comment block and method header:

```
    public String classifyTobaccoAsh( String texture, String color,
                                      boolean has_particles, int nicotineCount ) {
        // YOUR CODE GOES HERE
    }
```

If any of the input data is invalid, print "INVALID DATA: UNABLE TO CLASSIFY TO-BACCO" and return "INVALID_DATA".

If the input is valid , print the name of the brand of tobacco that produced the ash and return the brand; for example, print "The tobacco brand is: Old Wood" and return "Old Wood"

If the brand of tobacco could not be determined from the input, print "The tobacco brand cannot be determined from the data." and return "UNKNOWN"

2.2   Examples:

Infer the tobacco brand, given a sample having a specified texture, color, presence of particles, and nicotine count of the cigar ash.

Example 1: MacDuffy

Your tobacco ash sample exhibits the following properties: texture = flaky, color = gray, presence of particles = false, nicotine count = 2. What is the brand of tobacco?

```
The tobacco brand is: MacDuffy
```

Example 2: Old Wood

Given sample of cigar ash has the properties; texture is fluffy, color is brown, particles is false and nicotine is 2. What type of tobacco was burned?

```
The tobacco brand is: Old Wood
```

Example 3: West Country

Your sample has the following properties: texture = fluffy, color = pale, presence of particles = false, nicotine count = 2.

```
The tobacco brand is: West Country
```

Example 4: Roman

Your sample has the following properties: texture = caked, color = dark, presence of particles = true, nicotine count = 1.

```
The tobacco brand is: Roman
```

Example 5: Unknown

Your sample has the following properties: texture = caked, color = brown, presence of particles = false, nicotine count = 2.

```
The tobacco brand
cannot be determined from the data.
```

Example 6: Invalid Data

Your sample has the following properties: texture = slimy, color = dark, presence of particles = false, nicotine count = 2.

```
INVALID DATA. UNABLE TO CLASSIFY TOBACCO ASH
```

3 Testing

Test your code by running it and providing values from Table 1 (above). Make sure you can classify each brand of tobacco by the properties of its ash. If valid inputs are given that do not correspond to a brand in the table, the tobacco brand should be reported as "UNKNOWN". If invalid inputs are received, the return "INVALID_DATA"

4 Reflection Questions

1. How did you divide up the work in your team?

2. What alternatives were discussed when designing the code?

3. How could the program be optimized?

4. How did your team resolve ambiguous data?

5. How did your team come up with test cases?

6. What were the least obvious test cases used in your code?

5 Submission

You must conform to the Programming Style Guidelines.

You will receive no credit if you do not make a legitimate attempt to get any part of the code working.

1. Make sure to put your names in the comment at the top of the Java file before submitting.

2. Make sure your class is named Program2.

3. Make sure you have saved your Java program and that you have a working copy of it.

4. Submit your Program2.java and ProgramReflection2.pdf file to Canvas.

6 References

- Doyle, A. C. (1890). The Sign of Four. Spencer Blackett.
- Ledgard, H., & Singer, A. (1983). Elementary basic as chronicled by John H. Watson.

7 Skeleton Code

Listing 1: Program2.java

```java
/**
 * Program Name: Program 2
 * Program Description: ?
 * Course: CS 1131
 * Lab Section ?
 * Lab Team Name: ?
 * @author ?, ?, ?, ?
 */

public class Program2 {
```

```
11      /**
12       * Your task is to determine the brand of tobacco based on the properties of a
              ↪ sample of tobacco ash.
13       * Those properties; texture, color, presence of particles, and nicotine count may
              ↪ have the following values:
14       *
15       * Valid Textures : "caked", "flaky", "granular", "fluffy".
16       * Valid Colors : "dark", "pale", "gray", "brown".
17       * Valid Presence of Particles : true, false
18       * Valid Nicotine Counts: 0, 1, 2, 3
19       *
20       * If any of the input data is invalid,
21       * print "INVALID DATA: UNABLE TO CLASSIFY TOBACCO" and return "INVALID_DATA".
22       *
23       * If the input is valid , print the name of the brand of tobacco that produced
              ↪ the ash and return the brand;
24       * for example, print "The tobacco brand is: Old Wood" and return "Old Wood"
25       *
26       * If the brand of tobacco could not be determined from the input,
27       * print "The tobacco brand cannot be determined from the data." and return
              ↪ "UNKNOWN"
28       *
29       * @param texture - a String representing the texture of the sample: "caked",
              ↪ "flaky", "granular", "fluffy"
30       * @param color - a String representing the color of the sample; "dark", "pale",
              ↪ "grey", "brown"
31       * @param has_particles - a boolean representing the presence of particles in the
              ↪ sample
32       * @param nicotineCount - an int representing the nicotine count in the sample of
              ↪ tobacco ash
33       * @return a String representing the brand of tabacco as determined from the
              ↪ properties of the ash,
34       * or "INVALID_DATA", or "UNKNOWN"
35       */
36      public String classifyTobaccoAsh( String texture, String color, boolean
              ↪ has_particles, int nicotineCount ) {
37          // YOUR CODE GOES HERE
38      }
39  }
```

8 Sample Test Code

Listing 2: Program2Test.java

```
1  public class Program2Test {
2      public static void main(String[] args) {
3          Program2 program2 = new Program2();
4          if (program2.classifyTobaccoAsh("caked","dark",false,3).equals("Espanada")) {
```

```
 5              System.out.println("Espanada (caked,dark,false,3) test passed.");
 6         } else {
 7              System.out.println("Espanada (caked,dark,false,3) test failed.");
 8         }
 9
10         if (program2.classifyTobaccoAsh("flaky","pale",false,2).equals("Heritage")) {
11              System.out.println("Heritage (flaky,pale,false,2) test passed.");
12         } else {
13              System.out.println("Heritage (flaky,pale,false,2) test failed.");
14         }
15
16         if (program2.classifyTobaccoAsh("caked","dark",true,1).equals("Roman")) {
17              System.out.println("Roman (caked,dark,true,1) test passed.");
18         } else {
19              System.out.println("Roman (caked,dark,true,1) test failed.");
20         }
21
22         if (program2.classifyTobaccoAsh("caked","brown",false,2).equals("UNKNOWN")) {
23              System.out.println("Londoner (caked,brown,false,2) test successfully returned
                     ↪ \"UNKNOWN\" due to multiple possible matches.");
24         } else {
25              System.out.println("Londoner (caked,brown,false,2) test failed.");
26         }
27
28         if (program2.classifyTobaccoAsh("granular","gray",false,2).equals("Lunkah")) {
29              System.out.println("Lunkah (granular,gray,false,2) test passed.");
30         } else {
31              System.out.println("Lunkah (granular,gray,false,2) test failed.");
32         }
33
34         if (program2.classifyTobaccoAsh("flaky","gray",false,2).equals("MacDuffy")) {
35              System.out.println("MacDuffy (granular,gray,false,2) test passed.");
36         } else {
37              System.out.println("MacDuffy (granular,gray,false,2) test failed.");
38         }
39
40         if (program2.classifyTobaccoAsh("caked","brown",true,2).equals("Old Wood ")) {
41              System.out.println("Old Wood (caked,brown,false,1) test passed.");
42         } else {
43              System.out.println("Old Wood (caked,brown,false,2) test failed.");
44         }
45
46         if (program2.classifyTobaccoAsh("caked","gray",false,2).equals("Top Hat")) {
47              System.out.println("Top Hat (caked,gray,false,2) test passed.");
48         } else {
49              System.out.println("Top Hat (caked,gray,false,2) test failed.");
50         }
51
52         if (program2.classifyTobaccoAsh("flaky","dark",false,2).equals("Trichinopoly")) {
53              System.out.println("Trichinopoly (flaky,dark,false,2) test passed.");
54         } else {
```

```java
55              System.out.println("Trichinopoly (flaky,dark,false,2) test failed.");
56          }
57
58          if (program2.classifyTobaccoAsh("fluffy","pale",true,2).equals("West Country")) {
59              System.out.println("West Country (fluffy,pale,true,2) test passed.");
60          } else {
61              System.out.println("West Country (fluffy,pale,true,2) test failed.");
62          }
63
64          if (program2.classifyTobaccoAsh("spongy","red",false,5).equals("INVALID_DATA"))
                ↪ {
65              System.out.println("INVALID (spongy,red,false,5) test passed.");
66          } else {
67              System.out.println("INVALID (spongy,red,false,5) test failed.");
68          }
69
70      }
71  }
```