KIT101 Programming Fundamentals

PP Task 3.1 Code Tracing

Overview

Purpose: Demonstrate how the assignment statement works.

Task: Use the instructions to trace the execution of some programs and demonstrate what they do, and answer some questions about data types and expressions. Submit to MyLO when complete.

Learning Outcomes: 1 👁

Time: Complete during your tutorial and submit for feedback before the start of Week 4.

Resources:
- Introductory Programming Notes:
  - 04 Working with Primitive Data (and Strings)
  - 06 Tracing Code by Hand
  - Appendix: Code Tracing Problems
- Online Mini-lectures:
  - Code Tracing: ◼◂ Sequence & Assignment

Submission Details

Upload the following to the MyLO submission folder for this task:
- **Four tracing tables**, one for each of the programs you trace. This can be *either* photos/scans of hand-written tables (recommended) or a Word/PDF document (but not a spreadsheet)
- A Word or PDF **document with answers to the questions** provided

Assessment Criteria

A ▨ Completed submission will:
- Demonstrate the series of values written to each variable, and the line at which each change occurs
- Show what output is produced, if any, and at which line
- Include entries in the tracing tables only for relevant lines of the program (those the change a variable's value or produce output)

- Include valid answers to the at the end of this task, using the provided template

Instructions

Demonstrate how the following snippets of code execute when they are run by the computer.

1. On paper (or in a table in Word/Pages) apply code tracing techniques to record the values of variables at different points in the program. Apply the following rules as you go:
   - First, create a column for the line number, followed by one column for each variable declared and, if the program also produces some visible output, a final column for *Output*.
   - Next, create the table one row at a time as you read through the code.
   - Create a row for each line where a variable's value changes or the program produces some visible output; do not record other lines of code (since nothing will have changed).
   - Leave blank cells in the table for variables that have not yet been assigned a value.
   - When a variable's value changes you may record either the value of all variables immediately after the relevant line has been executed or just the one that changed (both approaches are fine).
   - If the current statement produces visible output then record it in the *Output* column.
   - If working on paper you do not need to draw grid lines.

2. When you finish tracing each program, if you worked on paper then take a photo (or scan) the page, and if you were working in Word/Pages the create a new separate table.

> **Note:** Remember these are commands that are executed in **sequence**. Each statement (line) **does something** and then control moves to the next statement.

Code Sample 1:

```
1    int a, b, c;
2
3    a = 20;
4    b = 40;
5    c = a + b;
6    System.out.println("c is " + c);
```

Code Sample 2:

```java
1  int a;
2
3  a = 2;
4  System.out.println((a - 1) + " " + a);
```

Code Sample 3:

```java
1  int mice = 0;
2  int keyboards = 0;
3  int equipment;
4
5  equipment = mice + keyboards;
6  mice = 10;
7  keyboards = 15;
8  System.out.println("Mice: " + mice + " Keyboards: " + keyboards);
9  System.out.println("Total equipment: " + equipment);
```

Code Sample 4:

```java
1  int a, b, c, d, e;
2
3  a = 10;
4  b = 20;
5  c = 30;
6  d = b;
7  e = 50;
8  b = c;
9  a = b - a;
10 c = e + c;
11 d = a;
```

```
12    e = e + 1;
13    System.out.println(a + " " + b + " " + c + " " + d + " " + e);
```

> **Tip:** Outside class keep practising your code tracing skills on more complex code samples than those above. You can always test yourself by writing a small program containing the code you are tracing and displaying the values of all variables at the end, like in the preceding sample.

Questions

Answer the following questions in the answer sheet accompanying this task on MyLO and submit with your code tracing tables.

1. How does *Code Sample 3* illustrate the importance of **sequence**?

2. The code `mice = 10;` is an example of which kind of programming statement?

3. What **actions** does the computer perform when it executes the statement `b = c;` from *Code Sample 4*?
   (**Hint:** Think in terms of what has been taught in the lectures and notes. You do *not* need to research what happens at the hardware level as that is outside the scope of the unit.)

4. What **actions** does the computer perform when it executes the statement `a = b - a;` from *Code Sample 4*?

5. How would the value of variable `i` change in the statement `i = i + 1;`?

6. What are the value and type of the following expressions (given the associated variable values)? Treat each row independently. (**Hint:** You may wish to review the way literal values of different types are expressed in Java.)

Variable Values	Expression	Value	Type
	`4`		
	`4.5`		
	`"Hey you"`		
	`1 + 3 * 2`		
`a = 1; b = 2;`	`a + b`		

Variable Values	Expression	Value	Type
a = 3;	2 * a		
a = 2.5; b = 2;	2 * a + b		
a = 2.5; b = 2;	a + 2 * b		
a = 1; b = 1; c = 6;	(a + b) * c		
a = 'J';	"Michael " + a + " Fox"		
a = "Doug"	a + " Jones"		
a = 1138;	"THX" + a		

7. What is the most appropriate type to store the following?

Data	Type
Number of students in an online chat room	
A person's name	
Average age of a group of people	
A temperature in Celsius	
The name of a unit	
Points scored in a soccer game	
A student's ID number	
A person's phone number, including area code	
The cost of an item in a shop	