Lesson 3.13 — while Loops

Overview

Objectives — *Students will be able to...*

- **Trace** while loops to predict:
  - The number of times the body executes
  - The output of the code
- **Differentiate** between while loops, if statements, and for loops

Assessments — *Students will...*

- **Complete** Practice questions

Homework — *Students will...*

- **Read** BJP 5.1 "Random Numbers"
- **Complete** self-check questions #1-4 and exercise 2

Materials & Prep

- **Projector and computer**
- **Whiteboard and markers**
- **Classroom copies** of WS 3.13

Pacing Guide

Section	Total Time
Bell-work and attendance	5min
Introduction & think-pair-share	15min
Student practice activity	35min

Procedure

Bell-work and Attendance [5 minutes]

Introduction & Think-Pair-Share [15 minutes]

1. Ask students to offer pseudocode that explains how they might track damage to a Pokemon.
   - (Student answers should include some of these steps: Start with initial HP, and while HP is greater than 0, ask how much damage, subtract it, and end print with "Pokemon fainted!") Point out that this process has no predetermined length (indefinite looping), so you need to use a new type of loop called a while loop.
   - If students need additional examples of indefinite looping, use a simpler example, asking students how they would double a number until it was bigger than N.
2. Engage students in the introduction today by having students complete the graphic organizer on WS 3.13 as you review the structure, flow, and syntax of the while loop.
3. Compare and contrast the while and for loops (see code snippets below): both are control structures that send the flow of control through a loop, but scope differs, so the loops execute in different ways.
   - Have students point out where i is declared.
   - Introduce the concept of definite vs. indefinite loops and ask students when they might want to use an indefinite loop (they will probably have wanted to use this structure in their earlier programming projects—prompt them with this if no one volunteers an example).

- Call 2 students up to the board; one to trace the flow of control and the other write the output.

```
// while loop:
int i = 0;
while (i < 10) {
    System.out.println (i);
    i++;
}
```

```
// for loop:
for (int i = 0; i < 10; i++) {
System.out.println (i);
}
```

4. Introduce tracing while loops by using a trace table:

   - Columns represent variables
   - Rows represents values variables during each iteration

```
int n = 172;
int sum = n;
while (n<0) {
   int digit = n % 10;
   sum = sum + digit;
   n = n / 10;
}
System.out.println (sum);
```

   - Trace the above code using the trace table below.

n	sum	digit	output

5. Invite students to Think-pair-share on the following example:

```
int n = 91;
int factor = 2;
while (n % factor != 0) {
    factor ++;
}
System.out.println("First factor is " + factor);
```

   - How many times does this loop execute? What is the output?
   - In the same pairs, have students rewrite the while loop as a for loop.

Student Practice Activity [35 minutes]

1. Have students complete the following practice problems:
   1. Self-Check 5.1: whileLoops
   2. Self-Check 5.2: forToWhile
   3. Self-Check 5.3: whileLoopMystery1
   4. Self-Check 5.4: whileLoopMystery2
2. If students complete these problems with time to spare, have them complete Exercise 5.2: gcd.

Accommodation and Differentiation

If students are having difficulty tracing while loops, using proper syntax, or predicting the output of the loop, you can change the Practice-It exercise to a reciprocal teaching exercise, where ¼ of the class does each problem, and they come to the front of the room to explain their solution and process to the rest of the class.

If you have students that finished the classwork ahead of time, encourage them to explore do/while loops (which are NOT part of the AP subset).

Common Mistakes

Loops common mistakes: http://interactivepython.org/runestone/static/JavaReview/LoopBasics/lMistakes.html

Video

- CSE 142, *While Loop* (11:21-15:55) https://www.youtube.com/watch?v=hpDQ9tdrj1Y&start=681

Forum discussion

Lesson 3.13 while Loops (TEALS Discourse account required)