Chapter 8: More About Iteration

- **8.1 Iteration Revisited**
    - **Iteration**: Repeated execution of a set of programming statements.
    - **Loop**: A statement or group of statements that execute repeatedly until a terminating condition is satisfied.
    - **Body**: The indented statements after a heading ending in a colon (e.g., after a loop heading).
- **8.2 The for loop revisited**
    - Used for **definite iteration** (loop with a known number of repetitions).
    - **Loop variable**: Controls iteration and is part of the loop's terminating condition.
    - Often used with **counters** (initialized to zero, incremented inside loop).

Example:

```
for i in range(5):
  print(i)
```

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- **8.3 The while Statement**
    - Used for **indefinite iteration** (repeats until a condition is met).
    - Risk of **infinite loop** if terminating condition is never satisfied.

Example:

```
while n > 0:
  print(n)
  n -= 1
```

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- **8.4 Randomly Walking Turtles**
    - Illustrates iteration in simulations.

    - Turtles move randomly on the screen, using loops and random choices.
    - Reinforces how **iteration** drives repeated actions until a stop condition.
- **8.5 The 3n + 1 Sequence (Collatz Problem)**
    - Example of iteration with unpredictable termination.
    - Rules:
        - If n is even → divide by 2.
        - If n is odd → compute 3n + 1.
    - Continues until n = 1.
    - Shows importance of **indefinite iteration**.
- **8.6 Newton's Method**
    - An **algorithm**: a step-by-step process for solving a category of problems.
    - Used to approximate square roots.
    - Iteratively improves guesses until close enough.
    - Demonstrates generalization: replacing specific values with variables for reusable code.
- **8.7 The Accumulator Pattern Revisited**
    - Uses a variable to **accumulate** results across iterations.
    - Often involves **reassignment** (assigning new values to the same variable in a loop).
    - Example: summing a list of numbers.
- **8.8 Other Uses of while**
    - **8.8.1 Sentinel Values**
        - Special values that signal termination of input or a loop.
        - Example: entering -1 to stop input.

- **8.8.2 Validating Input**
  - Keeps prompting until valid input is provided.

Example:

```
 age = -1
while age < 0:
    age = int(input("Enter a positive age: "))
```