Queues

Fundamentals

- A **queue** is an ordered list in which the first element added is the first element retrieved or removed (First-In, First-Out).
- The first element in the queue is known as the **head** of the queue.
- *Example:* A queue of customers: Lisa, Jennie, Jisoo, Rose

Lisa
Jennie
Jisoo
Rose

  Lisa is the customer who has been waiting the longest, while Rose is the one who last arrived. Lisa will be the first customer removed from the queue.
- Queues are used in any of the following:
  - CPU and disk scheduling
  - Serving requests on a single shared resource, such as a printer
  - Managing customers trying to get hold of a hotline.
- The methods of the **`Queue`** interface from the **`java.util`** package are used to implement queues in Java. Since interfaces cannot be instantiated, `LinkedList` is used to instantiate a `Queue` object.
- The methods of **`collections.deque`** are used to implement queues in Python. The *import* statement shall be **`from collections import deque`**.
- The list methods can also be used to implement queues in Python.
- The two (2) main queue operations are the following:
  - **Enqueue** – adds an item into the queue
    - Method in Java: `offer()`

```
Queue queue = new LinkedList();
queue.offer("Lisa");
```

    - Method in Python: `append()`

```
queue = deque([])
queue.append("Jennie")
```

  - **Dequeue** – removes the head of the queue
    - Method in Java: `poll()`
    - Method in Python: `popleft()`

- Other queue operations:
  - **Peek** – retrieves the head of the queue
    - Method in Java: `peek()`
    - Syntax in Python: `queue_name[0]`
  - **Test whether queue is empty**
    - For Java, use the **`isEmpty()`** method.
    - For Python, use the **`if not`** condition, followed by the queue name and a colon.
      Example:

```
queue = deque([])
if not queue:
    print("Queue is empty.")
```

Other Queue Methods

- Java methods `offer()`, `poll()`, and `peek()` do not throw exceptions. The methods **`add()`**, **`remove()`**, and **`element()`** perform the same tasks but throw exceptions.
- Other methods that can be used for both queues and lists are the following:

Function	Java	Python
Delete all elements	`clear()`	`clear()`
Copy all elements	`clone()`	`copy()`
Return length/size	`size()`	`len()`
Reverse the elements	`Collections.reverse()`	`reverse()`

References:
Koffman, E. & Wolfgang, P. (2016). *Data structures: Abstraction and design using Java.* Hoboken: John Wiley & Sons, Inc.
Python Software Foundation (n.d.). *The Python tutorial.* Retrieved from https://docs.python.org/3/tutorial/index.html