Answers to End of Section and Review Exercises for Chapter 8

Exercises 8.1

1. Table:

Operation	State of the Queue After the Operation	Value Returned	Comment
`q = <Queue Type>()`			Initially, the queue is empty.
`q.add(a)`	`a`		The queue contains the single item `a`.
`q.add(b)`	`a b`		`a` is the front item and `b` is the rear item on the queue.
`q.add(c)`	`a b c`		`a` is the front item and `c` is the rear item on the queue.
`q.pop()`	`b c`	`a`	Remove the front item from the queue and return it. `b` is now the front item.
`q.pop()`	`c`	`b`	Remove the front item from the queue and return it. `c` is now the front item.
`q.peek()`	`c`	`c`	Return the front item on the queue without removing it.
`q.add(x)`	`c x`		`c` is the front item and `x` is the rear item on the queue.
`q.pop()`	`x`	`c`	Remove the front item from the queue and return it. `x` is now the front item.
`q.pop()`		`x`	Remove the front item from the queue and return it.
`q.pop()`		`Exception`	Popping an empty queue raises an exception.

2. Here is the code:

```
def stackToQueue(stack):
   """Builds and returns a queue containing the items in stack.
   Postconditions: stack is not changed and item at front of
                   queue is also at top of stack"""
```

```
queue = LinkedQueue()
temp = LinkedStack()            # Create a new stack
while not stack.isEmpty():
    item = stack.pop()
    queue.enqueue(item)
    temp.push(item)             # Save item to restore to stack
while not temp.isEmpty():
    stack.push(temp.pop())
return queue
```

Exercises 8.2

1. There are 1,440 minutes in 24 hours, so there are 720 customers to be processed. If each customer takes 5 minutes, the total minutes are 3600. Thus, at least three cashiers will be needed to process all the customers. If a new customer arrives at a checkout every 5 minutes, no one will have to wait in line. If each cashier takes 1/3 of the customers, each cashier serves them a total of 1,200 minutes. Thus, each cashier is idle a total of 240 minutes, or 10 minutes each hour.
2. If the rate of arrival or processing time increases past a certain amount, some customers have to wait in line, but the average idle time per cashier will not vary, and all the customers will still be served within 24 hours.

Exercises 8.3

1. Here is the code:

```
if self._rear == len(self._items) - 1:   # End of array?
    self._rear = 0
else:
    self._rear += 1
```

2. Here is the code:

```
self._rear = (self._rear + 1) % len(self._items)
```

Exercises 8.4

An array-based implementation essentially places a sorted list within an array. Suppose that a circular array implementation is used. Then the `add` operation is linear, whereas a `pop` operation is constant, on the average. Thus, its run-time performance is similar to that of a linked priority queue. The array-based priority queue uses less memory after the array becomes half full.

Answers to Review Questions

1. a and d
2. b
3. a
4. b
5. a
6. a
7. b
8. c
9. a
10. a