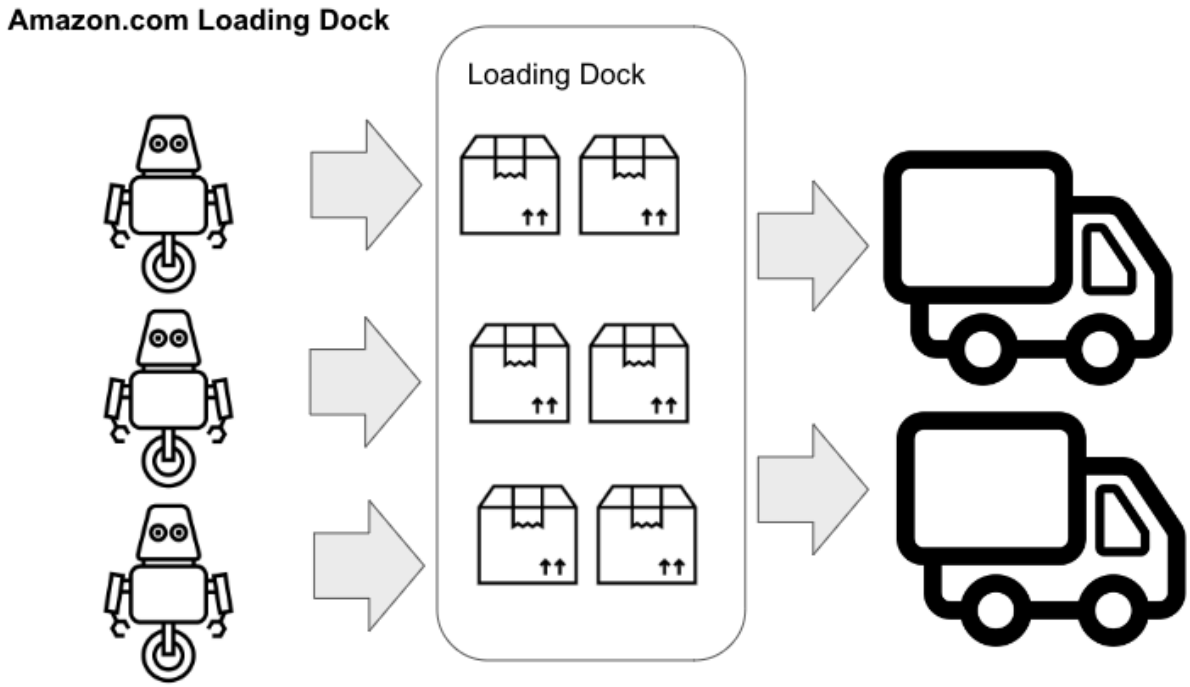
Homework #3: Multithreading

For Homework #3, you are going to build a multithreading application for Amazon.com.

The problem is illustrated as follows:



In this application, you will have two types of tasks. Robot tasks will transfer packages to the loading dock. Truck tasks will transfer packages off the loading dock and to their destination. Your application should have three robots and two trucks and run forever. You must use thread cooperation to make this all work smoothly.

Here are more details.

1. **Robot**: Each robot will have a name. For example “R1” or “R2”. Each robot will run an infinite while loop. At the beginning of the loop, the robot will transfer a random number of packages to the loading dock [**this should be a random number between 1-3 packages**]. After the transfer, the robot will sleep for 1 second.

2. **Truck**. Each truck will have a name. For example, “T1”, or “T2”. Each truck will run an infinite while loop. The truck **will only take off if there are at least 20 packages on the loading dock, and the truck can only take 20 packages at once**. Once it has taken off, the truck will sleep for 1 second.

3. **LoadingDock**. This class should keep track of the total number of packages on the loading dock. It should use **Locks and Conditions to ensure that all threads are cooperating correctly**. It should also have the following public methods:

```
/**
* Add Packages to the Loading Dock.
*/
public void addPackages(String robotName, int numPackagesToAdd)

/**
* Take Packages from the Loading Dock.
*/
public void takePackages(String truckName, int numPackagesToTake)
```

These methods should also output messages to the console, as shown below in the sample output.

4. **Main class**. This class should have a single main method. Create a thread pool with 5 threads, and execute 3 robots and 2 trucks.

Sample output [several seconds]:

```
Welcome to Amazon.com!
[Robot R1] Added 1 packages, Total = 1
[Robot R3] Added 3 packages, Total = 4
[Robot R2] Added 2 packages, Total = 6
[Truck T1] is waiting for 20 packages, but there are only:  6
[Truck T2] is waiting for 20 packages, but there are only:  6
[Robot R1] Added 1 packages, Total = 7
[Robot R3] Added 3 packages, Total = 10
[Robot R2] Added 3 packages, Total = 13
[Truck T1] is waiting for 20 packages, but there are only:  13
[Truck T2] is waiting for 20 packages, but there are only:  13
[Robot R1] Added 1 packages, Total = 14
[Robot R3] Added 2 packages, Total = 16
[Truck T1] is waiting for 20 packages, but there are only:  16
[Truck T2] is waiting for 20 packages, but there are only:  16
[Robot R2] Added 2 packages, Total = 18
[Truck T1] is waiting for 20 packages, but there are only:  18
[Truck T2] is waiting for 20 packages, but there are only:  18
[Robot R1] Added 2 packages, Total = 20
```

```
[Truck T1] is departing with 20 packages.
[Truck T2] is waiting for 20 packages, but there are only:  0
[Robot R3] Added 1 packages, Total = 1
[Robot R2] Added 1 packages, Total = 2
[Truck T2] is waiting for 20 packages, but there are only:  2
[Robot R1] Added 1 packages, Total = 3
[Truck T2] is waiting for 20 packages, but there are only:  3
[Truck T1] is waiting for 20 packages, but there are only:  3
[Robot R3] Added 2 packages, Total = 5
[Robot R2] Added 1 packages, Total = 6
[Truck T2] is waiting for 20 packages, but there are only:  6
[Truck T1] is waiting for 20 packages, but there are only:  6
[Robot R1] Added 1 packages, Total = 7
[Truck T2] is waiting for 20 packages, but there are only:  7
[Truck T1] is waiting for 20 packages, but there are only:  7
[Robot R3] Added 2 packages, Total = 9
[Robot R2] Added 3 packages, Total = 12
[Truck T2] is waiting for 20 packages, but there are only:  12
[Truck T1] is waiting for 20 packages, but there are only:  12
[Robot R1] Added 1 packages, Total = 13
[Truck T2] is waiting for 20 packages, but there are only:  13
[Truck T1] is waiting for 20 packages, but there are only:  13
[Robot R3] Added 3 packages, Total = 16
[Robot R2] Added 3 packages, Total = 19
[Truck T2] is waiting for 20 packages, but there are only:  19
[Truck T1] is waiting for 20 packages, but there are only:  19
[Robot R1] Added 2 packages, Total = 21
[Truck T2] is departing with 20 packages.
[Truck T1] is waiting for 20 packages, but there are only:  1
[Robot R2] Added 1 packages, Total = 2
[Truck T1] is waiting for 20 packages, but there are only:  2
[Robot R3] Added 2 packages, Total = 4
[Truck T1] is waiting for 20 packages, but there are only:  4
[Robot R1] Added 3 packages, Total = 7
[Truck T1] is waiting for 20 packages, but there are only:  7
[Truck T2] is waiting for 20 packages, but there are only:  7
[Robot R2] Added 2 packages, Total = 9
[Truck T1] is waiting for 20 packages, but there are only:  9
[Truck T2] is waiting for 20 packages, but there are only:  9
[Robot R3] Added 3 packages, Total = 12
[Truck T1] is waiting for 20 packages, but there are only:  12
[Truck T2] is waiting for 20 packages, but there are only:  12
```

```
[Robot R1] Added 3 packages, Total = 15
[Truck T1] is waiting for 20 packages, but there are only:  15
[Truck T2] is waiting for 20 packages, but there are only:  15
[Robot R3] Added 3 packages, Total = 18
[Robot R2] Added 2 packages, Total = 20
[Truck T1] is departing with 20 packages.
[Truck T2] is waiting for 20 packages, but there are only:  0
```