Computer Science 3A

Practical Assignment 4

2 March 2017

Time: 2 March 2017 13:45 – 17:00 Marks: 50

Practical assignments must be uploaded to `eve.uj.ac.za` **before** 17h00 in the practical session.

Late submissions **will not be accepted**, and will therefore not be marked. You are **not allowed to collaborate** with any other student. You **must** upload your assignment to Eve **before** it will be marked.

Producer and Consumer. Two roles found in many systems where if there is a limited amount for each of them can result in a difficult problem to resolve. How are they each allocated fairly? How do we determine what is fair? Enter *queues*. Their job is to ensure that each entity gets fair treatment and everything progresses in a linear order.

For this week's practical we are going to deal with this problem in the form of **Interns** and **Tasks**. Interns perform tasks that are allocated to them and use up energy to perform the task (or a part thereof). You need to implement a Queue-based allocator that ensures the work of the tasks are spread evenly among Interns and the Interns are not overworked.

You are required to implement the following functions:

- **enqueue** - that inserts an element into the queue.
- **dequeue** - that removes an element from the queue.
- **front** - the methods that returns the front element in the queue.
- **allocateInternsRandomly** - A method that allocates interns by random and decreases their energy level by their respective work rate. In every iteration a random intern is chosen for work until each task in order is completed.
- **allocateInternsWithQueue** - The methods that allocates tasks by iterating through interns using an array and according to their work rate energy levels are depleted, along with the work for that respective task. it allocates tasks to interns according to their energy levels using a queue for the interns.

You are required to implement a Java Program that realises the above operations. The output for one function looks similar to:

```
Name: Intern 0 WR: 19 Energy: 100
Name: Intern 1 WR: 14 Energy: 100
Name: Intern 2 WR: 9 Energy: 100
Name: Intern 3 WR: 1 Energy: 100
Name: Intern 4 WR: 10 Energy: 100
Name: Intern 5 WR: 14 Energy: 100
Name: Intern 6 WR: 19 Energy: 100
Name: Intern 7 WR: 19 Energy: 100
Name: Intern 8 WR: 1 Energy: 100
Name: Intern 9 WR: 11 Energy: 100
Name: Task 0 work: 0 of: 28
Name: Task 1 work: 0 of: 48
Name: Task 2 work: 0 of: 46
Name: Task 3 work: 0 of: 18
Name: Task 4 work: 0 of: 20
Name: Task 5 work: 0 of: 39
Name: Task 6 work: 0 of: 23
Name: Task 7 work: 0 of: 56
Name: Task 8 work: 0 of: 60
Name: Task 9 work: 0 of: 4

Allocation by Random:
Task 0 at 32.14285714%
Intern 6 Energy at: 81
Task 0 at 35.71428571%
Intern 2 Energy at: 99
Task 0 completed
Intern 0 Energy at: 81
Task 1 at 2.08333333%
Intern 8 Energy at: 81
Task 1 at 31.25%
Intern 5 Energy at: 86
Task 1 at 68.75%
Intern 4 Energy at: 90
Task 1 completed
Intern 0 Energy at: 81
**********Omitted**********
Task 8 at 100.0%
Intern 1 is tired
Task 9 at 75%
Intern 2 is tired
Task 9 at 100.0%
Intern 3 Energy at: 83
Task 9 completed
All tasks are completed
```

```
Allocation by Queue:
Task 0 at 67.85714285714286%
Intern 0 Energy at: 81
Task 0 at 100.0%
Intern 1 Energy at: 86
Task 0 completed
Task 1 at 39.58333333333333%
Intern 0 Energy at: 62
Task 1 at 68.75%
Intern 1 Energy at: 72
Task 1 at 87.5%
Intern 2 Energy at: 91
Task 1 at 89.58333333333334%
Intern 3 Energy at: 99
Task 1 at 100.0%
Intern 4 Energy at: 90
Task 1 completed
***************Omitted*****************
Task 8 at 100.0%
Intern 2 is tired
Task 9 at 75%
Intern 3 Energy at: 79
Task 9 completed
All tasks are completed
```

The following files must be submitted to EVE:

1. *studentnumber*_p4.zip

Marksheet

1. Queue: enqueue [3]
2. Queue: dequeue [4]
3. Queue: front [3]
4. Main: allocateInternsRandomly [15]
5. Main: allocateInternsWithQueue [15]
6. Compilation and Correct execution. [10]