**PROJECT 2 – SUMMARY**

**OVERVIEW:**

The project was to simulate a postal office with 3 postal workers and 50 customers by using threads to model customer and employee behavior. At one time 10 customers can be inside the Post Office and each of these customers is randomly assigned one task. With the task of mailing a package, the worker has to use the only one scale in this post office.

## **Simulation of the program**

I simulated Post Office by use of Java semaphores and threads. There is 3 classes in this program, “PostOffice”,”PostalWorker”and “Customer”. In the run method of class “Customer”, the maximum number of customer in the post office is 10, the customers and their tasks are queued and waiting for postal worker to get free. Once a worker is free, the customer is assigned, and once the task is finished, customer will leave the post office and the next customer will enter. In the run method of “PostalWorker” class, workers are waiting a customer to be ready. Once a customer is ready, a worker will start to sever the corresponding customer. Different task takes different amount of time as given in the task time table. The worker uses a scale while mailing a package and there’s only one scale in the post office.

## **Difficulties Faced**

The first difficulty I faced was that I didn’t know how to create threads and how to run them. I learnt the professor’s samples, tried to code myself, compile and run simple thread program in JAVA, then I figured out how it works. Secondly, I felt hard to realize the scale function while mailing a package. After studying barber shop semaphore, I put wait and signal while using scale to let only one worker to use the scale at one time.

## **What I learnt**

From this project, I learnt the coordination of multiple threads using semaphores and how to realize it in JAVA. I also learnt how to prevent mutual exclusion and the use of mutex semaphores.

## **Results**

Simulating Post Office with 50 customers and 3 postal workers

Creating 50 customers and 3 postal workers in a Post Office:

Customer 0 created

Customer 1 created

Customer 0 enters post office

Customer 2 created

Customer 1 enters post office

Customer 3 created

Customer 2 enters post office

Customer 4 created

Customer 3 enters post office

Customer 5 created

Customer 4 enters post office

Customer 6 created

Customer 5 enters post office

Customer 7 created

Customer 6 enters post office

Customer 8 created

Customer 7 enters post office

Customer 9 created

Customer 8 enters post office

Customer 10 created

Customer 9 enters post office

Customer 11 created

Customer 12 created

Customer 13 created

Customer 14 created

Customer 15 created

Customer 16 created

Customer 17 created

Customer 18 created

Customer 19 created

Customer 20 created

Customer 21 created

Customer 22 created

Customer 23 created

Customer 24 created

Customer 25 created

Customer 26 created

Customer 27 created

Customer 28 created

Customer 29 created

Customer 30 created

Customer 31 created

Customer 32 created

Customer 33 created

Customer 34 created

Customer 35 created

Customer 36 created

Customer 37 created

Customer 38 created

Customer 39 created

Customer 40 created

Customer 41 created

Customer 42 created

Customer 43 created

Customer 44 created

Customer 45 created

Customer 46 created

Customer 47 created

Customer 48 created

Customer 49 created

Postal Worker 0 created

Postal Worker 1 created

Customer 0 asks postal worker 0 mail a package

Postal Worker 2 created

Postal Worker 0 serving customer 0

Customer 1 asks postal worker 1 buy stamps

Postal Worker 1 serving customer 1

Postal Worker 1 finished serving customer 1

Customer 2 asks postal worker 2 mail a letter

Postal Worker 2 serving customer 2

Customer 1 finished buying stamps

Customer 1 leaves post office

Customer 3 asks postal worker 1 mail a letter

Postal Worker 1 serving customer 3

Customer 10 enters post office

Postal Worker 2 finished serving customer 2

Postal Worker 1 finished serving customer 3

Customer 2 finished mailing a letter

Customer 3 finished mailing a letter

Customer 3 leaves post office

Customer 4 asks postal worker 2 mail a package

Postal Worker 2 serving customer 4

Customer 11 enters post office

Customer 5 asks postal worker 1 mail a package

Postal Worker 1 serving customer 5

Customer 2 leaves post office

Customer 12 enters post office

Postal Worker 0 finished serving customer 0

Customer 0 finished mailing a package

Customer 6 asks postal worker 0 buy stamps

Postal Worker 0 serving customer 6

Customer 0 leaves post office

Postal Worker 0 finished serving customer 6

Customer 6 finished buying stamps

Customer 7 asks postal worker 0 mail a letter

Postal Worker 0 serving customer 7

Customer 6 leaves post office

Customer 13 enters post office

Customer 14 enters post office

Joined customer 0

Joined customer 1

Joined customer 2

Joined customer 3

Postal Worker 1 finished serving customer 5

Postal Worker 0 finished serving customer 7

Postal Worker 2 finished serving customer 4

Customer 7 finished mailing a letter

Customer 7 leaves post office

Customer 8 asks postal worker 1 mail a letter

Postal Worker 1 serving customer 8

Customer 5 finished mailing a package

Customer 9 asks postal worker 2 buy stamps

Postal Worker 2 serving customer 9

Postal Worker 2 finished serving customer 9

Customer 15 enters post office

Customer 4 finished mailing a package

Customer 4 leaves post office

Customer 9 finished buying stamps

Customer 9 leaves post office

Customer 10 asks postal worker 0 mail a letter

Customer 17 enters post office

Customer 5 leaves post office

Postal Worker 0 serving customer 10

Customer 16 enters post office

Customer 11 asks postal worker 2 mail a package

Joined customer 4

Postal Worker 2 serving customer 11

Customer 18 enters post office

Joined customer 5

Joined customer 6

Joined customer 7

Postal Worker 1 finished serving customer 8

Customer 8 finished mailing a letter

Customer 12 asks postal worker 1 buy stamps

Postal Worker 1 serving customer 12

Customer 8 leaves post office

Postal Worker 1 finished serving customer 12

Customer 19 enters post office

Customer 12 finished buying stamps

Customer 12 leaves post office

Joined customer 8

Customer 20 enters post office

Joined customer 9

Postal Worker 0 finished serving customer 10

Customer 13 asks postal worker 1 mail a package

Postal Worker 1 serving customer 13

Customer 10 finished mailing a letter

Customer 14 asks postal worker 0 mail a letter

Postal Worker 0 serving customer 14

Customer 10 leaves post office

Joined customer 10

Customer 21 enters post office

Postal Worker 2 finished serving customer 11

Customer 11 finished mailing a package

Customer 11 leaves post office

Customer 15 asks postal worker 2 mail a letter

Joined customer 11

Customer 22 enters post office

Joined customer 12

Postal Worker 2 serving customer 15

Postal Worker 0 finished serving customer 14

Customer 14 finished mailing a letter

Customer 14 leaves post office

Customer 17 asks postal worker 0 mail a package

Postal Worker 0 serving customer 17

Customer 23 enters post office

Postal Worker 1 finished serving customer 13

Postal Worker 2 finished serving customer 15

Customer 13 finished mailing a package

Customer 16 asks postal worker 1 mail a package

Postal Worker 1 serving customer 16

Customer 15 finished mailing a letter

Customer 15 leaves post office

Customer 13 leaves post office

Customer 18 asks postal worker 2 mail a letter

Postal Worker 2 serving customer 18

Joined customer 13

Joined customer 14

Customer 24 enters post office

Joined customer 15

Customer 25 enters post office

Postal Worker 0 finished serving customer 17

Postal Worker 2 finished serving customer 18

Customer 17 finished mailing a package

Customer 17 leaves post office

Customer 18 finished mailing a letter

Customer 18 leaves post office

Customer 19 asks postal worker 0 mail a package

Postal Worker 0 serving customer 19

Customer 27 enters post office

Customer 20 asks postal worker 2 mail a letter

Postal Worker 2 serving customer 20

Customer 26 enters post office

Postal Worker 1 finished serving customer 16

Customer 16 finished mailing a package

Customer 16 leaves post office

Customer 21 asks postal worker 1 buy stamps

Postal Worker 1 serving customer 21

Postal Worker 1 finished serving customer 21

Joined customer 16

Customer 21 finished buying stamps

Customer 22 asks postal worker 1 buy stamps

Postal Worker 1 serving customer 22

Customer 28 enters post office

Postal Worker 1 finished serving customer 22

Customer 21 leaves post office

Joined customer 17

Customer 23 asks postal worker 1 mail a letter

Postal Worker 1 serving customer 23

Customer 22 finished buying stamps

Customer 22 leaves post office

Joined customer 18

Customer 29 enters post office

Customer 30 enters post office

Postal Worker 2 finished serving customer 20

Customer 20 finished mailing a letter

Customer 24 asks postal worker 2 buy stamps

Postal Worker 2 serving customer 24

Postal Worker 2 finished serving customer 24

Customer 20 leaves post office

Customer 24 finished buying stamps

Customer 24 leaves post office

Customer 31 enters post office

Customer 25 asks postal worker 2 buy stamps

Postal Worker 2 serving customer 25

Postal Worker 2 finished serving customer 25

Customer 32 enters post office

Customer 25 finished buying stamps

Customer 25 leaves post office

Customer 27 asks postal worker 2 mail a letter

Customer 33 enters post office

Postal Worker 2 serving customer 27

Postal Worker 0 finished serving customer 19

Postal Worker 1 finished serving customer 23

Customer 19 finished mailing a package

Customer 19 leaves post office

Customer 23 finished mailing a letter

Joined customer 19

Joined customer 20

Customer 26 asks postal worker 0 mail a package

Postal Worker 0 serving customer 26

Joined customer 21

Customer 23 leaves post office

Customer 28 asks postal worker 1 mail a package

Customer 35 enters post office

Customer 34 enters post office

Postal Worker 1 serving customer 28

Joined customer 22

Joined customer 23

Joined customer 24

Joined customer 25

Postal Worker 2 finished serving customer 27

Customer 27 finished mailing a letter

Customer 27 leaves post office

Customer 29 asks postal worker 2 mail a letter

Postal Worker 2 serving customer 29

Customer 36 enters post office

Postal Worker 0 finished serving customer 26

Postal Worker 1 finished serving customer 28

Postal Worker 2 finished serving customer 29

Customer 30 asks postal worker 0 buy stamps

Customer 29 finished mailing a letter

Customer 28 finished mailing a package

Customer 28 leaves post office

Customer 26 finished mailing a package

Customer 37 enters post office

Customer 29 leaves post office

Postal Worker 0 serving customer 30

Customer 26 leaves post office

Customer 38 enters post office

Postal Worker 0 finished serving customer 30

Joined customer 26

Customer 31 asks postal worker 1 mail a package

Postal Worker 1 serving customer 31

Customer 39 enters post office

Customer 32 asks postal worker 2 mail a package

Postal Worker 2 serving customer 32

Joined customer 27

Joined customer 28

Joined customer 29

Customer 30 finished buying stamps

Customer 30 leaves post office

Customer 33 asks postal worker 0 buy stamps

Joined customer 30

Postal Worker 0 serving customer 33

Postal Worker 0 finished serving customer 33

Customer 40 enters post office

Customer 35 asks postal worker 0 mail a letter

Postal Worker 0 serving customer 35

Customer 33 finished buying stamps

Customer 33 leaves post office

Customer 41 enters post office

Postal Worker 0 finished serving customer 35

Customer 35 finished mailing a letter

Customer 35 leaves post office

Customer 34 asks postal worker 0 mail a letter

Postal Worker 0 serving customer 34

Customer 42 enters post office

Postal Worker 1 finished serving customer 31

Postal Worker 2 finished serving customer 32

Customer 31 finished mailing a package

Customer 31 leaves post office

Customer 32 finished mailing a package

Customer 43 enters post office

Customer 36 asks postal worker 1 mail a letter

Postal Worker 1 serving customer 36

Customer 32 leaves post office

Joined customer 31

Joined customer 32

Joined customer 33

Customer 44 enters post office

Customer 37 asks postal worker 2 mail a package

Postal Worker 2 serving customer 37

Postal Worker 0 finished serving customer 34

Customer 34 finished mailing a letter

Customer 34 leaves post office

Customer 38 asks postal worker 0 mail a letter

Postal Worker 0 serving customer 38

Customer 45 enters post office

Joined customer 34

Joined customer 35

Postal Worker 1 finished serving customer 36

Customer 36 finished mailing a letter

Customer 36 leaves post office

Customer 39 asks postal worker 1 buy stamps

Joined customer 36

Postal Worker 1 serving customer 39

Postal Worker 1 finished serving customer 39

Customer 46 enters post office

Customer 39 finished buying stamps

Customer 39 leaves post office

Customer 40 asks postal worker 1 mail a letter

Postal Worker 1 serving customer 40

Customer 47 enters post office

Postal Worker 2 finished serving customer 37

Customer 37 finished mailing a package

Customer 37 leaves post office

Customer 41 asks postal worker 2 buy stamps

Postal Worker 2 serving customer 41

Postal Worker 2 finished serving customer 41

Customer 48 enters post office

Customer 41 finished buying stamps

Customer 41 leaves post office

Joined customer 37

Customer 42 asks postal worker 2 buy stamps

Postal Worker 2 serving customer 42

Postal Worker 2 finished serving customer 42

Customer 49 enters post office

Customer 42 finished buying stamps

Customer 42 leaves post office

Customer 43 asks postal worker 2 mail a package

Postal Worker 2 serving customer 43

Postal Worker 0 finished serving customer 38

Customer 38 finished mailing a letter

Customer 38 leaves post office

Customer 44 asks postal worker 0 mail a package

Joined customer 38

Postal Worker 0 serving customer 44

Joined customer 39

Postal Worker 1 finished serving customer 40

Customer 40 finished mailing a letter

Customer 40 leaves post office

Customer 45 asks postal worker 1 mail a package

Postal Worker 1 serving customer 45

Joined customer 40

Joined customer 41

Joined customer 42

Postal Worker 2 finished serving customer 43

Customer 43 finished mailing a package

Customer 43 leaves post office

Customer 46 asks postal worker 2 buy stamps

Postal Worker 2 serving customer 46

Postal Worker 2 finished serving customer 46

Joined customer 43

Customer 46 finished buying stamps

Customer 46 leaves post office

Customer 47 asks postal worker 2 mail a package

Postal Worker 2 serving customer 47

Postal Worker 0 finished serving customer 44

Customer 44 finished mailing a package

Customer 44 leaves post office

Customer 48 asks postal worker 0 mail a package

Postal Worker 0 serving customer 48

Joined customer 44

Postal Worker 1 finished serving customer 45

Customer 45 finished mailing a package

Customer 45 leaves post office

Customer 49 asks postal worker 1 buy stamps

Postal Worker 1 serving customer 49

Postal Worker 1 finished serving customer 49

Joined customer 45

Customer 49 finished buying stamps

Joined customer 46

Customer 49 leaves post office

Postal Worker 2 finished serving customer 47

Customer 47 finished mailing a package

Customer 47 leaves post office

Joined customer 47

Postal Worker 0 finished serving customer 48

Customer 48 finished mailing a package

Customer 48 leaves post office

Joined customer 48

Joined customer 49