

**GTU Department of Computer Engineering**  
**CSE 344 – Spring 2024**  
**Final Project Report**

**Bariş Batuhan Bolat**  
**210104004029**

## PideShop (Server)

- **Threads and Synchronization:** Threads for concurrent handling of orders and deliveries. Various mutexes (**pthread\_mutex\_t**) and condition variables (**pthread\_cond\_t**) are employed to synchronize access to shared resources such as orders and the ready queue.
- **Signals Handling:** Signals (**SIGINT**, **SIGTERM**, **SIGTSTP**) are handled using `signal_handler` function to gracefully terminate the server and clean up resources when necessary.
- **Semaphores:** Semaphores (**sem\_t**) to control access to resources like the oven and place for cooking.
- **Structures:** Order and Person structures to manage orders and track delivery personnel statistics.
- **Logging:** Logging to a file (**pide.log**) to record events such as order placements, cancellations, and deliveries.

### Workflow:

- **Initialization:** Parses command-line arguments to set up server parameters such as IP, port, thread pool sizes for cooks and delivery personnel, and delivery speed.
- **Signal Setup:** Registers signal handlers to respond to termination signals (**SIGINT**, **SIGTERM**, **SIGTSTP**) for graceful shutdown.
- **Socket Handling:** Creates and manages a socket to accept client connections and handle incoming orders and cancellation requests.
- **Multithreaded Processing:**
  - **Cook Threads:** Multiple threads (**cook\_threads**) to prepare orders concurrently. Each cook operates in a loop where they retrieve orders, prepare them, place them in the oven, and finally notify delivery personnel.
  - **Delivery Threads:** Concurrent threads (**delivery\_threads**) handle delivery of ready orders. They wait for orders to be prepared, calculate delivery distances, simulate delivery times, and update delivery statistics.

### Algorithms:

- **Order Handling:**
  - Orders are managed using mutexes and semaphores.
  - Cooks prepare orders based on a simulated cooking time (**calculate\_pseudo\_inverse\_time()**) and place them in a simulated oven.
  - Delivery personnel calculate delivery distances and simulate delivery times based on a given speed (**delivery\_speed**).

- **Cancellation Handling:**
  - Clients can send cancellation requests (**Cancel PID <pid>**) to cancel their orders.
  - Cancellation requests are processed by canceling pending orders and updating the log file accordingly.
- **Logging:**
  - Utilizes mutexes to ensure thread safety during file write operations (**log\_event function**).
  - Logs events such as order placements, preparations, deliveries, cancellations, and shutdowns with timestamps.

## HungryVeryMuch (Client)

- **Client Socket:** Creates a socket to connect to the **PideShop** server and send order requests and cancellation messages.
- **Signal Handling:** Registers signal handlers (**SIGINT**, **SIGTERM**) to gracefully cancel orders and exit.
- **Randomized Orders:** Generates random order requests (**Order <id> from location (<x>, <y>)**) based on provided dimensions (**p** and **q**).
- **Initial Connection:** Sends initial connection information (**Client PID <pid>**: **<number\_of\_clients> clients, p=<p>, q=<q>**) to the server.

### Workflow:

- **Initialization:** Parses command-line arguments to set up client parameters such as server IP, port, number of clients (**numberOfClients**), and dimensions (**p**, **q**).
- **Signal Setup:** Registers signal handlers to gracefully handle termination signals (**SIGINT**, **SIGTERM**) by sending cancellation messages to the server.
- **Socket Handling:** Creates a socket to connect to the server, sends initial client information, and subsequently sends randomized order requests.
- **Order Generation:** Generates random order requests with coordinates (**x**, **y**) within the given dimensions (**p**, **q**).
- **Cancellation:** Sends cancellation messages (**Cancel PID <pid>**) to the server upon receiving termination signals.

### Algorithms:

- **Order Generation:**
  - Generates random order requests (**Order <id> from location (<x>, <y>)**) using **rand()** function within the specified dimensions (**p**, **q**).
- **Signal Handling:**
  - Handles termination signals (**SIGINT**, **SIGTERM**) to gracefully cancel orders by sending cancellation messages (**Cancel PID <pid>**) to the server.

## Test Cases

- Test Case 1 :
  - IP : 127.0.0.1, Port : 8080
  - CookthreadPoolSize : 4, DeliveryPoolSize : 6, k : 1
  - numberOfClients : 50, p : 10, q : 20

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./PideShop "127.0.0.1" 8080 4 6 1
> PideShop 127.0.0.1 8080 4 6 1
> PideShop active waiting for connection ...
> Waiting to receive all orders at once...
> 50 new customers.. Serving
> All orders received. Total: 50
> Cook 0 started.
> Cook 2 started.
> Cook 1 started.
> Delivery person 0 started.
> Delivery person 0 waiting for ready orders.
> Cook 3 started.
```

...

```
> Delivery person 4 waiting for ready orders.
> Delivery person 5 finished delivering order 43. Total deliveries by deliverer: 10
> Delivery person 5 waiting for ready orders.
> Delivery person 1 finished delivering order 42. Total deliveries by deliverer: 7
> Delivery person 1 waiting for ready orders.
> Delivery person 3 finished delivering order 41. Total deliveries by deliverer: 7
> Delivery person 3 waiting for ready orders.
> Cook 1 prepared 13 orders
> Cook 2 prepared 13 orders
> Cook 3 prepared 12 orders
> Cook 4 prepared 12 orders
> done serving client @ XXX PID 61266
> Thanks Cook 2 and Moto 5
> active waiting for connections
```

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./HungryVeryMuch "127.0.0.1" 8080 50
10 20
> HungryVeryMuch 127.0.0.1 8080 50 10 20
> PID 61266.. Order sent: Order 1 from location (7, 3)
> PID 61266.. Order sent: Order 2 from location (1, 1)
> PID 61266.. Order sent: Order 3 from location (2, 17)
> PID 61266.. Order sent: Order 4 from location (8, 10)
> PID 61266.. Order sent: Order 5 from location (2, 2)
> PID 61266.. Order sent: Order 6 from location (5, 12)
> PID 61266.. Order sent: Order 7 from location (3, 18)
> PID 61266.. Order sent: Order 8 from location (3, 18)
> PID 61266.. Order sent: Order 9 from location (9, 3)
> PID 61266.. Order sent: Order 10 from location (2, 3)
> PID 61266.. Order sent: Order 11 from location (7, 7)
> PID 61266.. Order sent: Order 12 from location (7, 4)
> PID 61266.. Order sent: Order 13 from location (0, 2)
> PID 61266.. Order sent: Order 14 from location (4, 11)
> PID 61266.. Order sent: Order 15 from location (6, 0)
```

...

```
> PID 61266.. Order sent: Order 40 from location (7, 14)
> PID 61266.. Order sent: Order 41 from location (0, 18)
> PID 61266.. Order sent: Order 42 from location (2, 18)
> PID 61266.. Order sent: Order 43 from location (7, 7)
> PID 61266.. Order sent: Order 44 from location (7, 10)
> PID 61266.. Order sent: Order 45 from location (7, 16)
> PID 61266.. Order sent: Order 46 from location (2, 0)
> PID 61266.. Order sent: Order 47 from location (3, 9)
> PID 61266.. Order sent: Order 48 from location (9, 0)
> PID 61266.. Order sent: Order 49 from location (6, 6)
> PID 61266.. Order sent: Order 50 from location (3, 3)
> ...
> All customers served
> log file written ..
```

- **Test Case 2 (Invalid IP) :**
  - **IP : 999.999.999.999, Port : 8080**
  - **CookthreadPoolSize : 4, DeliveryPoolSize : 6, k : 1**
  - **numberOfClients : 50, p : -5, q : 0**

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./HungryVeryMuch "999.999.999.999" 80
80 50 10 20
> HungryVeryMuch 999.999.999.999 8080 50 10 20
Invalid address/ Address not supported: Success
```

- **Test Case 3 (CTRL+C at client):**
  - **IP : 127.0.0.1, Port : 8080**
  - **CookthreadPoolSize : 4, DeliveryPoolSize : 6, k : 1**
  - **numberOfClients : 5, p : 15, q : 15**

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./PideShop "127.0.0.1" 8080 4 6 1
> PideShop 127.0.0.1 8080 4 6 1
> PideShop active waiting for connection ...
> Waiting to receive all orders at once...
> 5 new customers.. Serving
> order cancelled @YYY PID 65399
> Cook 0 started.
> Order 1 cancelled, cook 0 stopping preparation.
> Cook 1 started.
> Cook 2 started.
> Cook 3 started.
> Delivery person 0 started.
> Delivery person 0 waiting for ready orders.
> Delivery person 1 started.
> Delivery person 1 waiting for ready orders.
> Delivery person 2 started.
> Delivery person 2 waiting for ready orders.
> Delivery person 3 started.
> Delivery person 3 waiting for ready orders.
> Waiting to receive all orders at once...
> Delivery person 4 started.
> Delivery person 4 waiting for ready orders.
> Delivery person 5 started.
> Delivery person 5 waiting for ready orders.
^C> ^C or ^Z.. Upps quitting.. writing log file
> Delivery person 0 shutting down.
> Delivery person 3 shutting down.
> Delivery person 2 shutting down.
> Delivery person 1 shutting down.
> Delivery person 5 shutting down.
> Delivery person 4 shutting down.
```

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./HungryVeryMuch "127.0.0.1" 8080 5 1
5 15
> HungryVeryMuch 127.0.0.1 8080 5 15 15
> PID 65399.. Order sent: Order 1 from location (0, 14)
^C
^C signal.. cancelling orders.. editing log..
```

```
1 [Sat Jun 15 05:51:12 2024] Order cancelled by client 65399
```

- **Test Case 4 :**
  - **IP : 127.0.0.1, Port : 8080**
  - **CookthreadPoolSize : 10, DeliveryPoolSize : 10, k : 10**
  - **numberOfClients : 10, p : 20, q : 30**

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./PideShop "127.0.0.1" 8080 10 10 10
> PideShop 127.0.0.1 8080 10 10 10
> PideShop active waiting for connection ...
> Waiting to receive all orders at once...
> 10 new customers.. Serving
> All orders received. Total: 10
> Cook 0 started.
> Cook 1 started.
> Cook 2 started.
> Cook 3 started.
> Cook 4 started.
> Cook 6 started.
> Cook 5 started.
> Cook 7 started.
> Cook 8 started.
> Cook 9 started.
> Delivery person 1 started.
> Delivery person 1 waiting for ready orders.
> Delivery person 0 started.
> Delivery person 0 waiting for ready orders.
```

...

```
> Delivery person 1 waiting for ready orders.
> Cook 1 prepared 1 orders
> Cook 2 prepared 1 orders
> Cook 3 prepared 1 orders
> Cook 4 prepared 1 orders
> Cook 5 prepared 1 orders
> Cook 6 prepared 1 orders
> Cook 7 prepared 1 orders
> Cook 8 prepared 1 orders
> Cook 9 prepared 1 orders
> Cook 10 prepared 1 orders
> done serving client @ XXX PID 66792
> Thanks Cook 10 and Moto 9
> active waiting for connections
```

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./HungryVeryMuch "127.0.0.1" 8080 10
20 30
> HungryVeryMuch 127.0.0.1 8080 10 20 30
> PID 66792.. Order sent: Order 1 from location (13, 16)
> PID 66792.. Order sent: Order 2 from location (6, 26)
> PID 66792.. Order sent: Order 3 from location (4, 17)
> PID 66792.. Order sent: Order 4 from location (17, 2)
> PID 66792.. Order sent: Order 5 from location (2, 21)
> PID 66792.. Order sent: Order 6 from location (12, 6)
> PID 66792.. Order sent: Order 7 from location (2, 9)
> PID 66792.. Order sent: Order 8 from location (5, 13)
> PID 66792.. Order sent: Order 9 from location (16, 11)
> PID 66792.. Order sent: Order 10 from location (6, 27)
> ...
> All customers served
> log file written ..
```

- **Test Case 5 :**
  - **IP : 127.0.0.1, Port : 8080**
  - **CookthreadPoolSize : 15, DeliveryPoolSize : 25, k : 20**
  - **numberOfClients : 30, p : 10, q : 20**

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./PideShop "127.0.0.1" 8080 15 25 20
> PideShop 127.0.0.1 8080 15 25 20
> PideShop active waiting for connection ...
> Waiting to receive all orders at once...
> 30 new customers.. Serving
> All orders received. Total: 30
> Cook 0 started.
> Cook 1 started.
> Cook 2 started.
> Cook 3 started.
> Cook 4 started.
> Cook 5 started.
> Cook 6 started.
> Cook 8 started.
> Cook 7 started.
> Cook 10 started.
> Cook 11 started.
> Cook 9 started.
> Cook 12 started.
> Cook 13 started.
> Delivery person 0 started.
```

...

```
> Delivery person 3 waiting for ready orders.
> Cook 1 prepared 3 orders
> Cook 2 prepared 3 orders
> Cook 3 prepared 1 orders
> Cook 4 prepared 4 orders
> Cook 5 prepared 3 orders
> Cook 6 prepared 3 orders
> Cook 7 prepared 2 orders
> Cook 8 prepared 3 orders
> Cook 9 prepared 1 orders
> Cook 10 prepared 1 orders
> Cook 11 prepared 1 orders
> Cook 12 prepared 1 orders
> Cook 13 prepared 2 orders
> Cook 14 prepared 1 orders
> Cook 15 prepared 1 orders
> done serving client @ XXX PID 67499
> Thanks Cook 4 and Moto 24
> active waiting for connections
```

```
baris@Baris:/mnt/c/Users/baris/Desktop/GTU/3.Sınıf/CSE344/Final$ ./HungryVeryMuch "127.0.0.1" 8080 30
10 20
> HungryVeryMuch 127.0.0.1 8080 30 10 20
> PID 67499.. Order sent: Order 1 from location (8, 19)
> PID 67499.. Order sent: Order 2 from location (4, 2)
> PID 67499.. Order sent: Order 3 from location (9, 1)
> PID 67499.. Order sent: Order 4 from location (3, 9)
> PID 67499.. Order sent: Order 5 from location (3, 2)
> PID 67499.. Order sent: Order 6 from location (2, 19)
> PID 67499.. Order sent: Order 7 from location (6, 0)
> PID 67499.. Order sent: Order 8 from location (6, 7)
> PID 67499.. Order sent: Order 9 from location (7, 0)
> PID 67499.. Order sent: Order 10 from location (8, 4)
> PID 67499.. Order sent: Order 11 from location (6, 17)
> PID 67499.. Order sent: Order 12 from location (8, 1)
> PID 67499.. Order sent: Order 13 from location (7, 9)
> PID 67499.. Order sent: Order 14 from location (0, 15)
> PID 67499.. Order sent: Order 15 from location (8, 11)
> PID 67499.. Order sent: Order 16 from location (4, 8)
> PID 67499.. Order sent: Order 17 from location (0, 10)
> PID 67499.. Order sent: Order 18 from location (2, 1)
> PID 67499.. Order sent: Order 19 from location (3, 16)
> PID 67499.. Order sent: Order 20 from location (0, 16)
> PID 67499.. Order sent: Order 21 from location (8, 15)
> PID 67499.. Order sent: Order 22 from location (8, 7)
> PID 67499.. Order sent: Order 23 from location (5, 16)
> PID 67499.. Order sent: Order 24 from location (6, 2)
> PID 67499.. Order sent: Order 25 from location (6, 14)
> PID 67499.. Order sent: Order 26 from location (9, 12)
> PID 67499.. Order sent: Order 27 from location (2, 17)
> PID 67499.. Order sent: Order 28 from location (5, 1)
> PID 67499.. Order sent: Order 29 from location (8, 6)
> PID 67499.. Order sent: Order 30 from location (6, 18)
> ...
> All customers served
> log file written ..
```