GEBZE TECHNİCAL UNIVERSITY

CSE344

System Programming

Final Project Report

1. How to Run?

Compile the project with “make”, and clean the resources with “make clean”

Running the server,

./PideShop [portnumber] [CookthreadPoolSize] [DeliveryPoolSize] [delivery_speed_m_per_min]

./PideShop 8080 4 6 50

Running the client,

./HungryVeryMuch [server_ip] [portnumber] [numberOfClients] [town_width_km] [town_height_km]

./HungryVeryMuch 192.168.0.10 8080 50 10 20

2. Signal Handling

- **Client Side**:
  - Pressing ^C or ^D will cancel the orders, sending cancellation requests to the server, and then exit the client.
- **Server Side**:
  - Pressing ^C or ^D will print "Server is quitting..." and shut down the server, logging the current state and delivery counts.

3. Components

- **Manager**: Manages order assignments to cooks and hands over cooked meals to delivery personnel.
- **Cooks**: Prepare meals by calculating the pseudo-inverse of a complex matrix. Place meals in the oven and notify the manager when meals are ready.
- **Delivery Personnel**: Deliver meals to customers based on their location. Deliver in batches, up to their carrying capacity, 3 orders.

4. Synchronization Mechanisms

SEMAPHORES:

- **oven_sem**: Controls access to the oven tools (max 3).
- **oven_capacity_sem**: Controls the oven capacity (max 6 meals).
- **delivery_sem**: Controls the availability of delivery personnel.
- **cook_id_sem and moto_id_sem**: Ensure unique IDs for cooks and delivery personnel.

MUTEXES:

- **log_mutex**: Ensures exclusive access to the log file.
- **order_mutex**: Ensures exclusive access to the order queue.
- **delivery_mutex**: Ensures exclusive access to the delivery queue.
- **id_mutex**: Ensures exclusive access to ID generation.

CONDITION VARIABLES:

- **order_cond**: Signals when a new order is available.
- **delivery_cond**: Signals when a new delivery is ready.

5. Batch Processing

OVEN CAPACITY MANAGEMENT:

- The oven can hold up to 6 meals simultaneously.
- There are 3 tools available for cooks to use.
- The oven has 2 entries, allowing for parallel usage by cooks.

DELIVERY PERSONNEL MANAGEMENT:

- Each delivery person can carry up to 3 meals in their delivery bag.
- Deliveries are dispatched in batches of 3 or when there are fewer than 3 remaining orders.

6. Queues

- Order Queue (order_queue): Holds incoming orders to be processed by the cooks.
- Oven Queue (oven_queue): Holds orders that are currently being cooked in the oven.
- Delivery Queue (delivery_queue): Holds orders that are ready for delivery by the delivery personnel.

7. Struct Definitions

common.h

```
typedef struct {
    int request_type;
    int order_id;
    int sock; // Socket descriptor for client communication
    char client_address[256];
    char status[256]; // placed, prepared, cooked, delivered, canceled
    char data[1024]; // additional information if needed
    int cook_id;
    int delivery_id;
} order_t;
typedef struct {
    int cook_id;
    int current_order_id; // -1 if no current order
    char status[256]; // available, busy
} cook_t;
typedef struct {
    int delivery_id;
    int current_orders[MAX_DELIVERY_CAPACITY]; // -1 if no current order
    int deliveries_count; // Count the number of deliveries
    double total_delivery_time; // Track total delivery time
    char status[256]; // available, busy, on delivery
} delivery_person_t;
```

A manager, cooks, and delivery personnel, working in a defined town area. Orders are received and managed by a central manager, assigned to cooks who prepare meals by calculating the pseudo-inverse of a complex matrix, then place them in an oven that holds up to 6 meals with 3 tools and 2 entries. Delivery personnel handle batches of up to 3 orders, calculating delivery times based on customer locations and delivering orders efficiently. Synchronization is managed using semaphores and mutexes to ensure proper resource utilization. The system handles signals for graceful shutdowns and cancellations, logging all activities for review. IP configurations are set at runtime, and the server listens for client connections, accepting and updating order statuses. Clients can send cancellation requests via signals, which the server processes, discarding orders in any stage of preparation.

8. Output and tests

Except the ID's that assigned to delivery and cook threads and the promotion of the most hard-working deliverer, the server can work with hundreds of orders from many clients. Can quit from client and Server side and can do cancellations.

A customer places an order, and the entire process completes successfully.

Steps:

1. Customer places an order.
2. The cook prepares the order.
3. The order is placed in the oven.
4. The order is cooked.
5. The order is assigned to a delivery person.
6. The delivery person delivers the order to the customer.

Output:

- Order status updates to "Placed," "Cooking," "In Oven," "Cooked," "Delivering," and finally "Delivered."
- Relevant logs and order status changes are recorded and displayed.

CASE 2: ORDER CANCELLATION BEFORE COOKING

Scenario: A customer cancels their order before it is picked up by a cook.

Steps:

1. Customer places an order.
2. Customer cancels the order before it is picked up by a cook.

Output:

- Order status updates to "Placed" and then "Cancelled."
- Logs indicate the order was canceled before cooking.

CASE 3: ORDER CANCELLATION DURING COOKING

Scenario: A customer cancels their order while it is being cooked.

Steps:

1. Customer places an order.
2. The cook picks up the order and starts cooking.
3. Customer cancels the order during the cooking process.

Output:

- Order status updates to "Placed," "Cooking," and then "Cancelled."
- Logs indicate the order was canceled during cooking.

CASE 4: ORDER CANCELLATION DURING DELIVERY

Scenario: A customer cancels their order while it is being delivered. **Steps:**

1. Customer places an order.
2. The cook prepares and cooks the order.
3. The delivery person picks up the order and starts delivering.
4. Customer cancels the order during the delivery process. **Output:**

- Order status updates to "Placed," "Cooking," "In Oven," "Cooked," "Delivering," and then "Cancelled."
- Logs indicate the order was canceled during delivery.

CASE 5: HIGH VOLUME OF ORDERS

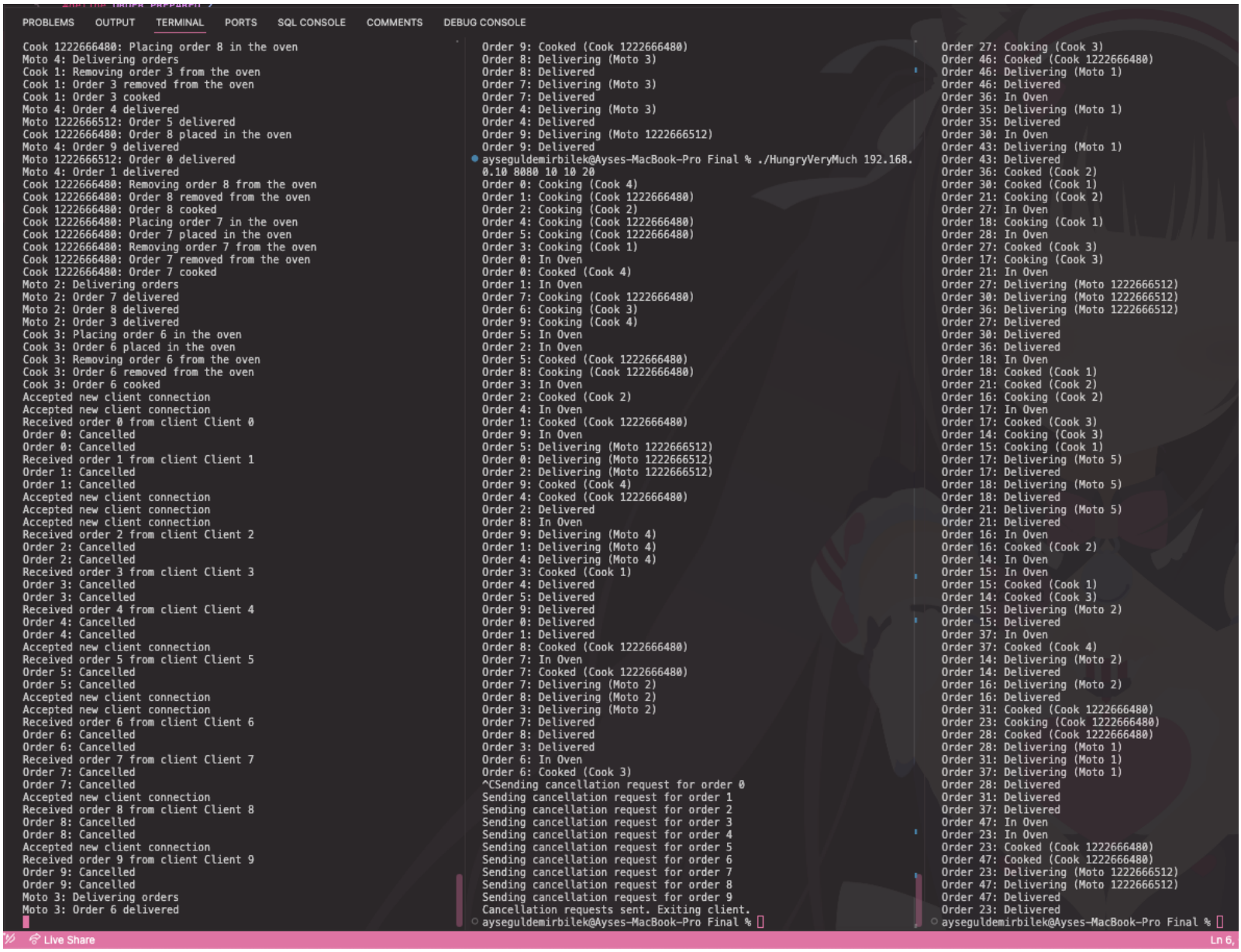
Scenario: A high number of customers place orders, testing the system's capability to handle multiple simultaneous orders.

Steps:

1. Multiple customers place orders simultaneously.
2. Cooks prepare and cook orders.
3. Delivery persons pick up and deliver orders.

Output:

- Multiple orders processed in parallel with status updates for each order.
- Logs show efficient handling of multiple orders with proper synchronization.


PROBLEMS
OUTPUT
TERMINAL
PORTS
SQL CONSOLE
COMMENTS
DEBUG CONSOLE
Cook 1222666480: Placing order 8 in the oven
Moto 4: Delivering orders
Cook 1: Removing order 3 from the oven
Cook 1: Order 3 removed from the oven
Cook 1: Order 3 cooked
Moto 4: Order 4 delivered
Moto 1222666512: Order 5 delivered
Cook 1222666480: Order 8 placed in the oven
Moto 4: Order 9 delivered
Moto 1222666512: Order 0 delivered
Moto 4: Order 1 delivered
Cook 1222666480: Removing order 8 from the oven
Cook 1222666480: Order 8 removed from the oven
Cook 1222666480: Order 8 cooked
Cook 1222666480: Placing order 7 in the oven
Cook 1222666480: Order 7 placed in the oven
Cook 1222666480: Removing order 7 from the oven
Cook 1222666480: Order 7 removed from the oven
Cook 1222666480: Order 7 cooked
Moto 2: Delivering orders
Moto 2: Order 7 delivered
Moto 2: Order 8 delivered
Moto 2: Order 3 delivered
Cook 3: Placing order 6 in the oven
Cook 3: Order 6 placed in the oven
Cook 3: Removing order 6 from the oven
Cook 3: Order 6 removed from the oven
Cook 3: Order 6 cooked
Accepted new client connection
Accepted new client connection
Received order 0 from client Client 0
Order 0: Cancelled
Order 0: Cancelled
Received order 1 from client Client 1
Order 1: Cancelled
Order 1: Cancelled
Accepted new client connection
Accepted new client connection
Accepted new client connection
Received order 2 from client Client 2
Order 2: Cancelled
Order 2: Cancelled
Received order 3 from client Client 3
Order 3: Cancelled
Order 3: Cancelled
Received order 4 from client Client 4
Order 4: Cancelled
Order 4: Cancelled
Accepted new client connection
Received order 5 from client Client 5
Order 5: Cancelled
Order 5: Cancelled
Accepted new client connection
Accepted new client connection
Received order 6 from client Client 6
Order 6: Cancelled
Order 6: Cancelled
Received order 7 from client Client 7
Order 7: Cancelled
Order 7: Cancelled
Accepted new client connection
Received order 8 from client Client 8
Order 8: Cancelled
Order 8: Cancelled
Accepted new client connection
Received order 9 from client Client 9
Order 9: Cancelled
Order 9: Cancelled
Moto 3: Delivering orders
Moto 3: Order 6 delivered
Order 9: Cooked (Cook 1222666480)
Order 8: Delivering (Moto 3)
Order 8: Delivered
Order 7: Delivering (Moto 3)
Order 7: Delivered
Order 4: Delivering (Moto 3)
Order 4: Delivered
Order 9: Delivering (Moto 1222666512)
Order 9: Delivered
ayseguldemirbilek@Ayses-MacBook-Pro Final % ./HungryVeryMuch 192.168.
0.10 8080 10 10 20
Order 0: Cooking (Cook 4)
Order 1: Cooking (Cook 1222666480)
Order 2: Cooking (Cook 2)
Order 4: Cooking (Cook 1222666480)
Order 5: Cooking (Cook 1222666480)
Order 3: Cooking (Cook 1)
Order 0: In Oven
Order 0: Cooked (Cook 4)
Order 1: In Oven
Order 7: Cooking (Cook 1222666480)
Order 6: Cooking (Cook 3)
Order 9: Cooking (Cook 4)
Order 5: In Oven
Order 2: In Oven
Order 5: Cooked (Cook 1222666480)
Order 8: Cooking (Cook 1222666480)
Order 3: In Oven
Order 2: Cooked (Cook 2)
Order 4: In Oven
Order 1: Cooked (Cook 1222666480)
Order 9: In Oven
Order 5: Delivering (Moto 1222666512)
Order 0: Delivering (Moto 1222666512)
Order 2: Delivering (Moto 1222666512)
Order 9: Cooked (Cook 4)
Order 4: Cooked (Cook 1222666480)
Order 2: Delivered
Order 8: In Oven
Order 9: Delivering (Moto 4)
Order 1: Delivering (Moto 4)
Order 4: Delivering (Moto 4)
Order 3: Cooked (Cook 1)
Order 4: Delivered
Order 5: Delivered
Order 9: Delivered
Order 0: Delivered
Order 1: Delivered
Order 8: Cooked (Cook 1222666480)
Order 7: In Oven
Order 7: Cooked (Cook 1222666480)
Order 7: Delivering (Moto 2)
Order 8: Delivering (Moto 2)
Order 3: Delivering (Moto 2)
Order 7: Delivered
Order 8: Delivered
Order 3: Delivered
Order 6: In Oven
Order 6: Cooked (Cook 3)
^CSending cancellation request for order 0
Sending cancellation request for order 1
Sending cancellation request for order 2
Sending cancellation request for order 3
Sending cancellation request for order 4
Sending cancellation request for order 5
Sending cancellation request for order 6
Sending cancellation request for order 7
Sending cancellation request for order 8
Sending cancellation request for order 9
Cancellation requests sent. Exiting client.
ayseguldemirbilek@Ayses-MacBook-Pro Final %
Order 27: Cooking (Cook 3)
Order 46: Cooked (Cook 1222666480)
Order 46: Delivering (Moto 1)
Order 46: Delivered
Order 36: In Oven
Order 35: Delivering (Moto 1)
Order 35: Delivered
Order 30: In Oven
Order 43: Delivering (Moto 1)
Order 43: Delivered
Order 36: Cooked (Cook 2)
Order 30: Cooked (Cook 1)
Order 21: Cooking (Cook 2)
Order 27: In Oven
Order 18: Cooking (Cook 1)
Order 28: In Oven
Order 27: Cooked (Cook 3)
Order 17: Cooking (Cook 3)
Order 21: In Oven
Order 27: Delivering (Moto 1222666512)
Order 30: Delivering (Moto 1222666512)
Order 36: Delivering (Moto 1222666512)
Order 27: Delivered
Order 30: Delivered
Order 36: Delivered
Order 18: In Oven
Order 18: Cooked (Cook 1)
Order 21: Cooked (Cook 2)
Order 16: Cooking (Cook 2)
Order 17: In Oven
Order 17: Cooked (Cook 3)
Order 14: Cooking (Cook 3)
Order 15: Cooking (Cook 1)
Order 17: Delivering (Moto 5)
Order 17: Delivered
Order 18: Delivering (Moto 5)
Order 18: Delivered
Order 21: Delivering (Moto 5)
Order 21: Delivered
Order 16: In Oven
Order 16: Cooked (Cook 2)
Order 14: In Oven
Order 15: In Oven
Order 15: Cooked (Cook 1)
Order 14: Cooked (Cook 3)
Order 15: Delivering (Moto 2)
Order 15: Delivered
Order 37: In Oven
Order 37: Cooked (Cook 4)
Order 14: Delivering (Moto 2)
Order 14: Delivered
Order 16: Delivering (Moto 2)
Order 16: Delivered
Order 31: Cooked (Cook 1222666480)
Order 23: Cooking (Cook 1222666480)
Order 28: Cooked (Cook 1222666480)
Order 28: Delivering (Moto 1)
Order 31: Delivering (Moto 1)
Order 37: Delivering (Moto 1)
Order 28: Delivered
Order 31: Delivered
Order 37: Delivered
Order 47: In Oven
Order 23: In Oven
Order 23: Cooked (Cook 1222666480)
Order 47: Cooked (Cook 1222666480)
Order 23: Delivering (Moto 1222666512)
Order 47: Delivering (Moto 1222666512)
Order 47: Delivered
Order 23: Delivered
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