Individual Assignment

You have the solved the following two problems using Java. Besides submitting the Java code, you are also required to submit a short report to explain the approach you used to solve each problem.

a) Cinema Online Seat Reservation System

You are given a task to develop a program to create and simulate an online seat reservation system for a cinema. In this case, you can assume that there are only two theatres in a cinema. Based on rough estimation, at most 200 customers could be using the system to reserve a seat at the same time. When designing such a system, it is very important to ensure that a seat can never be double-booked (a seat cannot be reserved by two different customers at the same time). Listed below are the requirement that the system will need to fulfill:

No.	Description	Marks
1	Each theatre can accommodate 200 customers (or has 200 seats).	1
2	Create 200 customer threads for the simulation. Each customer will select one of the theatres and in between 1 to 3 seats at one time randomly. In real-world scenario, after a seat is selected by one customer (even though he/she has yet to confirm or pay for the selected seat), the other customers are not allowed to select the same seat.	3
3	After selecting the desired seat(s), assume that a customer will experience a delay in between 500ms to 1000ms randomly, before he/she confirms the reservation (to reflect that the seats are taken).	1
4	Appropriate outputs that can be used to verify that the system is working properly.	1

For this problem, you must include the following (with proper explanation and justification) in your report:

No.	Description	Marks
1	How did you block the other customers from selecting the same seat(s)?	2
2	How to interpret the results / prove that the system has fulfilled the requirement?	1
3	Discuss whether careful design is required to avoid deadlock.	1

b) Summarization of FinTech Data

You are given a task to develop a program to generate a summary of total money spent by each user on buying different shares from the stock market in a day. As shown in the table below is an example of raw data recorded by a trade system. Each row (or line) represents a transaction. **The dataset assigned to you contains a lot more transactions (approximately 80,000), and the columns could be arranged in a different way as well. Please download the dataset assigned to you on eLearn based on your student ID. For example, if your student ID is 12345678, please download the dataset with the file name 12345678.xlsx.**

stock_symbol	user_id	share_price	share_bought	transaction_id
KLSE:A	USR0001	25	296	2022051116522808200002
KLSE:A	USR0002	41.83	202	2022051116522808200003
KLSE:B	USR0002	46.31	378	2022051116522808200004
KLSE:B	USR0002	47.84	340	2022051116522808200005
KLSE:B	USR0002	23.89	296	2022051116522808200006
KLSE:B	USR0003	16.57	483	2022051116522808200007

KLSE:C	USR0001	39.82	201	202205111652280820008
KLSE:C	USR0003	12.69	211	202205111652280820009
KLSE:C	USR0001	27.3	493	202205111652280820010
KLSE:A	USR0001	25.72	281	202205111652280820011

Due to the numerous transactions that can happen in a day, doing this sequentially using a single thread can be very slow. Hence, you are required to speed up the process by using multiple threads. Based on the raw data (with only 10 transactions) given above, as shown below is an example of the expected outcome.

user_id	total_money_spent
USR0001	22631.14
USR0002	49291.88
USR0003	10680.90

Listed below are the requirement that the program will need to fulfill:

No.	Description	Marks
1	Able to split the calculations or processing into several threads.	5
2	Able to process dataset with different numbers of transaction.	1
3	Able to generate the expected outcome.	1

For this problem, you must include the following (with proper explanation and justification) in your report:

No.	Description	Marks
1	How did you split the calculations into several threads?	2
2	How did you determine the number of threads that should be used?	2
3	How did you verify that the output(s) is correct?	1
4	Discuss whether careful design is required to avoid deadlock.	1
5	Determine whether using multiple threads can help to speed up the processing.	2

Important:

1. All the code must be properly commented. Otherwise, marks will be deducted.
2. The due date of this assignment is 4th July 2022, 11:59PM.
3. You are required to submit your report to Turnitin (a link will be created on eLearn for this).
4. You are also required to submit another copy of your report, and your code, to eLearn.
5. Prepare the report in the following format using Microsoft Word with not more than 8 pages:
   - Single-Column
   - Single-Spacing
   - Arial
   - Font Size 12
6. You may include diagram(s) that could assist you in explaining your approach in the report.