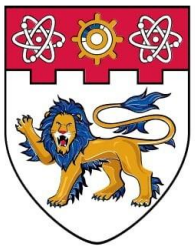
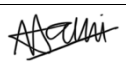


NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

SC2207 Lab3

Lab index	SCMB	
Group number	3	
Team Members	Guo Yichen	U2320626C
	Mahi Pandey	U2321382F
	Mehta Rishika	U2323133H
	Zhao Qixian	U2321752L

APPENDIX C: INDIVIDUAL CONTRIBUTION FORM

Full Name	Individual Contribution to Lab 1 Submission	Percentage of Contribution	Signature
Guo Yichen	Entity refinements and ERD drawing	25	
Mahi Pandey	Created Entities and Attributes in the ERD	25	
Mehta Rishika	Entity attribute, and ERD plotting	25	
Zhao Qixian	Entity attribute tables and ERD plotting	25	

Full Name	Individual Contribution to Lab 3 Submission	Percentage of Contribution	Signature
Guo Yichen	Refinements of relation schema	25	
Mahi Pandey	Cross check the relational schema tables	25	
Mehta Rishika	Making the relational Schema	25	
Zhao Qixian	Find potential 3NF violations	25	

Full Name	Individual Contribution to Lab 5 Submission	Percentage of Contribution	Signature

APPENDIX D: USE OF AI TOOL(S) IN LAB WORK

Each team member should indicate either A or B:

A. I affirm that my contribution(s) to the lab work is my own, produced without help from any AI tool(s).

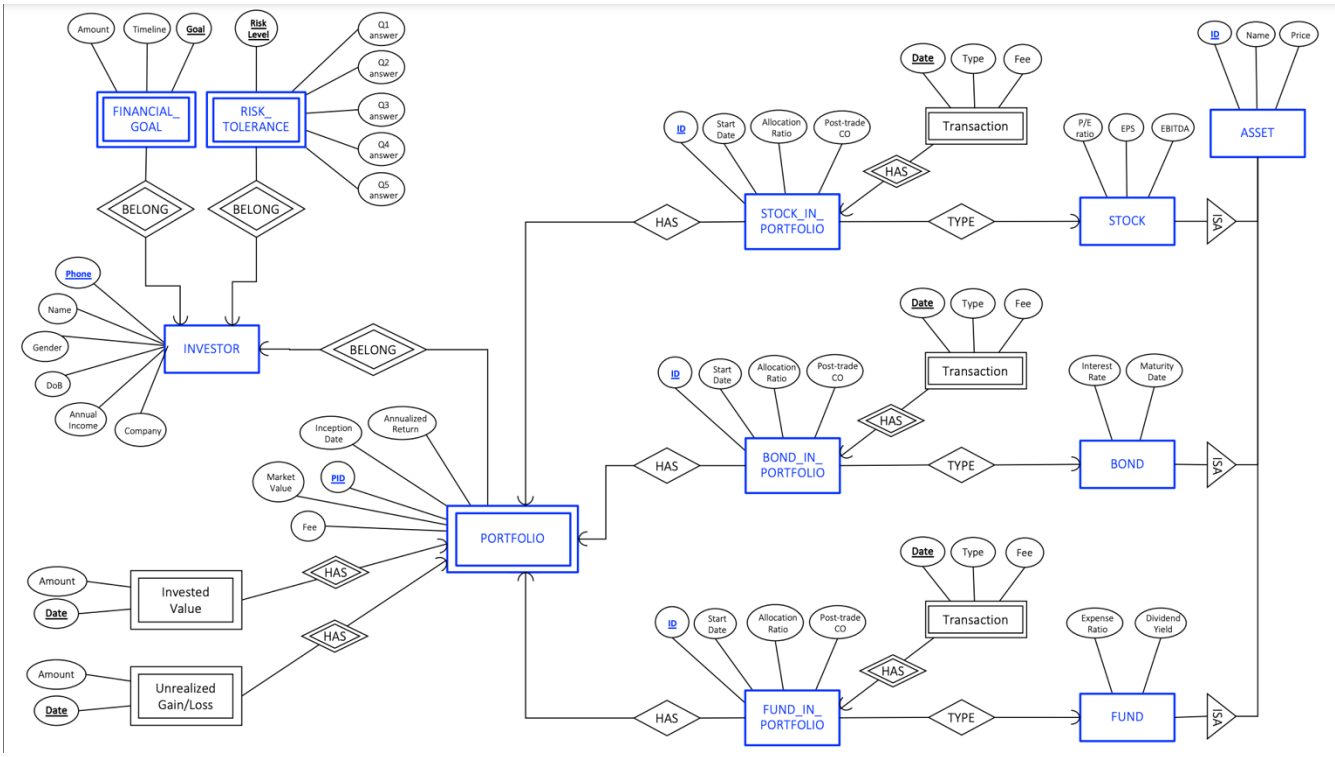
B. I affirm that my contribution(s) to the lab work has been produced with the use of AI tool(s).

Team member	Signature	Date	A or B
Guo Yichen		4/2/2025	A
Mahi Pandey		4/2/2025	A
Mehta Rishika		4/2/2025	A
Zhao Qixian		4/2/2025	A

By signing this form, you declare that the above affirmation made is true and that you have read and understood NTU's policy on the use of AI tools.

If any team member answered B, the team member(s) must indicate and replicate the table below for every instance that AI tool(s) is used:

Name of AI tool	< For example, ChatGPT >
Input prompt	< Insert the question that you asked ChatGPT >
Date generated	< Insert the date when the response was generated >
Output generated	< Insert the response verbatim from ChatGPT >
Output screenshots	< Attach or reference screenshots of the response if applicable >
Impact on submission	< Briefly explain which part of your submitted work was ChatGPT's response applied >



1. **Transaction**(<u>ID</u>, <u>Date</u>, PID, Phone, Type, Fee)

   Keys: {ID, Date}
   Primary Key: {ID, Date}

   Assumption: The type determines the Fee through some rule. There should actually **be 3 separate tables** for each weak transaction entity for stocks bond and fund, but since table name and attributes in er diagram all same, we only show a Transaction table here.

   FDs:

   - {ID, Date} → {Type, Fee, PID, Phone}
   - Type → Fee

   Type is not a key but determines Fee, we have a transitive dependency namely, {ID, Date} → Type → Fee . This violates 3NF because Fee is not fully, directly dependent on the primary key alone; it depends on Type, a non-key attribute.

   A table satisfies 3NF, if and only if for every non-trivial X → Y

   - Either X contains a key
   - Or each attribute in Y is contained in a key

   In this table we observe that non-key attribute → non-key attribute. Therefore, this table is **not** in 3NF.

   <u>Decomposing StockTransaction to Achieve 3NF</u>

Step 1: Create a Minimal Basis for Transaction

From the FDs, we isolate each left-hand side (LHS) and right-hand side (RHS):

- (ID, Date) → PID
- (ID, Date) → Phone
- (ID, Date) → Type
- (ID, Date) → Fee
- Type → Fee

Step 2: Combine FDs with the Same LHS

- (ID, Date) → {PID, Phone, Type, Fee}
- Type → Fee

Step 3: Create a Relation for Each Remaining FD

StockTransaction1(ID, Date, PID, Phone, Type)

Keys: {ID, Date}

Primary Key: {ID, Date}

FDs: (ID, Date) → {PID, Phone, Type}

This table is in 3NF and BCNF.

TransactionFees(Type, Fee)

Keys: {Type}

Primary Key: {Type}

FDs: Type → Fee

This table is in 3NF and BCNF.

Step 4: Check: StockTransaction1 has {ID, Date} as its primary key, which was the original table's primary key.

Step 5: Check: There are no redundant tables.

2. **STOCK_IN_PORTFOLIO**(StockID, PID, Phone, StartDate, AllocationRatio, Post-tradeCO)
   Keys: {StockID}
   Primary Key: {StockID}
   FDs:
   - {StockID} → StartDate, AllocationRatio, Post-tradeCO, PID, Phone

The table is in BCNF.

The table is in 3NF.

3. **STOCK**(AssetID, P-ERatio, EPS, EBITDA)
   Keys: {AssetID}
   Primary Key: {AssetID}
   FDs:
   - {AssetID} → P-ERatio, EPS, EBITDA

   The table is in BCNF.

   The table is in 3NF

4. **BOND**(AssetID, InterestRate, MaturityDate)
   Keys: {AssetID}
   Primary Key: {AssetID}
   FDs:
   - {AssetID} → InterestRate, MaturityDate

   The table is in BCNF.

   The table is in 3NF.

5. **FUND**(AssetID, ExpenseRatio, DividendYield)
   Keys: {AssetID}
   Primary Key: {AssetID}
   FDs:
   - {AssetID} → ExpenseRatio, DividendYield

   The table is in BCNF.

   The table is in 3NF.

6. **BOND_IN_PORTFOLIO**(BondID, PID, Phone, StartDate, AllocationRatio, Post-tradeCO)
   Keys: {BondID}
   Primary Key: {BondID}
   FDs:
   - {BondID} → StartDate, AllocationRatio, Post-tradeCO, PID, Phone

   The table is in BCNF.

The table is in 3NF.

7. **FUND_IN_PORTFOLIO**(FundID, PID, Phone, StartDate, AllocationRatio, Post-tradeCO)
   Keys: {FundID}
   Primary key: {FundID}
   FDs:
   - {FundID}→ PID, Phone, StartDate, AllocationRatio, Post-tradeCO

   The table is in BCNF.

   The table is in 3NF.

8. **PORTFOLIO**(Phone, PID, Fee, MarketValue, InceptionDate, AnnualizedReturn)
   Keys: {Phone,PID}
   Primary Key: {Phone, PID}
   Assumption: The MarketValue determines the Fee through some rule. Hence for each specific MarketValue range, we have a fixed Fee. This implies a functional dependency: MarketValue → Fee

   FDs:
   - {Phone, PID} → {Fee, MarketValue, InceptionDate, AnnualizedReturn}
   - MarketValue → Fee

   MarketValue is not a key but determines Fee, leading to transitive dependency: (Phone, PID) → MarketValue → Fee
   This violates 3NF because Fee is not fully, directly dependent on the primary key alone; it depends on MarketValue, a non-key attribute.

   A table satisfies 3NF, if and only if for every non-trivial X → Y

   - Either X contains a key
   - Or each attribute in Y is contained in a key

   In this table we observe that non-key attribute → non-key attribute. Therefore, this table is **not** in 3NF.

   Decomposing PORTFOLIO to Achieve 3NF

   Step 1: Create a Minimal Basis for PORTFOLIO

   From the FDs, we isolate each left-hand side (LHS) and right-hand side (RHS):

   - (Phone, PID) → MarketValue
   - (Phone, PID) → InceptionDate
   - (Phone, PID) → AnnualizedReturn
   - (Phone, PID) → Fee

- MarketValue → Fee

Step 2: Combine FDs with the Same LHS

- (Phone, PID) → {MarketValue, Fee, InceptionDate, AnnualizedReturn}
- MarketValue → Fee

Step 3: Create a Relation for Each Remaining FD

Portfolio1(Phone, PID, MarketValue, InceptionDate, AnnualizedReturn)

Keys: {Phone, PID}

Primary key: {Phone, PID}

FDs: (Phone, PID) → MarketValue, InceptionDate, AnnualizedReturn

This table is in 3NF and BCNF.

PortfolioFeeStructure(MarketValue, Fee)

Keys: {MarketValue}

Primary key: {MarketValue}

FDs: MarketValue → Fee

This table is in 3NF and BCNF (MarketValue is the key, and it determines Fee).

Step 4: Check: Portfolio1 has (Phone, PID) as its primary key, which was the original table's primary key.
Step 5: Check: There are no redundant tables.

9. **InvestedValue**(Phone, PID, Date, Amount)
   Keys: {Phone, PID, Date}
   Primary Key: {Phone, PID, Date}
   FDs:
   - {Phone, PID, Date} → Amount

   The table is in BCNF.

   The table is in 3NF.

10. **UnrelizedGainLoss**(Phone, PID, Date, Amount)
    Keys: {Phone, PID, Date}
    Primary Key: {Phone, PID, Date}
    FDs:
    - {Phone, PID, Date} → Amount

    The table is in BCNF.
    The table is in 3NF.

11. **INVESTOR**(Phone, Name, Gender, DoB, AnnualIncome, Company)
    Keys: {Phone}
    Primary Key: {Phone}
    FDs:
    - {Phone} → Name, Gender, DoB, AnnualIncome, Company

    The table is in BCNF.
    The table is in 3NF.

12. **RISK_TOLERANCE**(Phone, RiskLevel, Q1A, Q2A, Q3A, Q4A, Q5A)
    Keys: {Phone, RiskLevel}
    Primary Key: {Phone, RiskLevel}

    FDs:
    - {Phone, RiskLevel} → Q1A, Q2A, Q3A, Q4A, Q5A
    The table is in BCNF.
    The table is in 3NF.

13. **FINANCIAL_GOAL**(Goal, Phone, Amount, Timeline)
    Keys: {Goal, Phone}
    Primary Key: {Goal, Phone}

    FDs:
    - {Goal, Phone} → Amount, Timeline

    The table is in BCNF.

    The table is in 3NF.

14. **ASSET**(AssetID, name, Price)
    Keys: {AssetID}
    Primary key: {AssetID}
    FDs:
    - {AssetID} → Name, Price
    The table is in BCNF.
    The table is in 3NF.