

Nanyang Technological University
College of Computing and Data Science (CCDS)



Third Laboratory Session: Generation of Normalized Database Schema

Lab TCCA - GROUP 4

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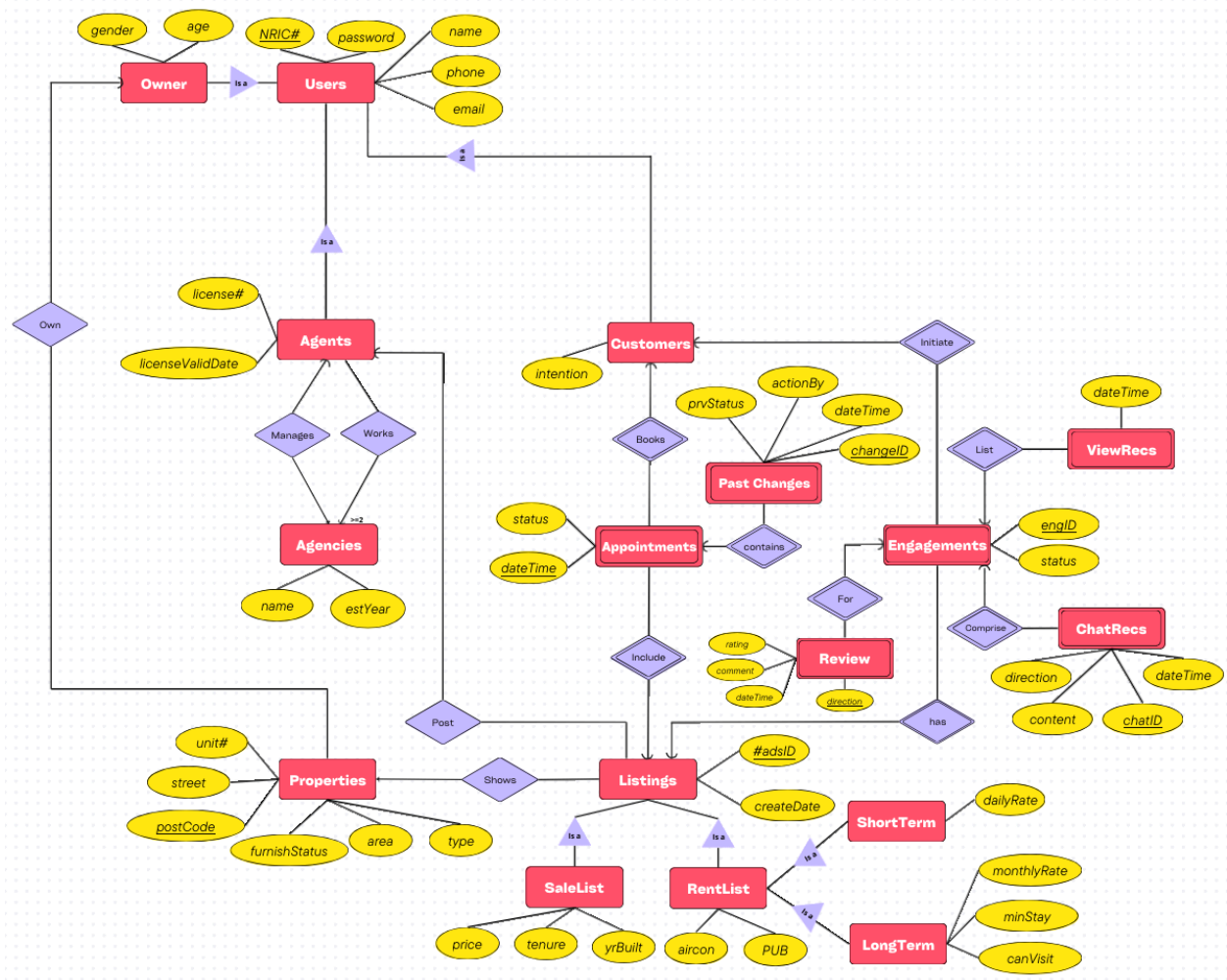
Course Name:

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A. ER Diagram



Please refer to this link for a better image quality:

https://www.canva.com/design/DAGPNSU-g7s/WTSe_-uO_2epfIFID6H17w/edit

Assumption:

1. One listing has exactly one property
2. One listing has exactly one Agent
3. One agency must have exactly one Agent as manager
4. One agent can have multiple listing
5. Property unit number includes floor
6. Owner is a user, required to have email and password.

B. Normalized Relations

1. Users (<i>NRIC, password, name, phoneNo, email</i>)
Keys: (NRIC), (phoneNo) Primary Key: (NRIC)
FDs: a. $NRIC \rightarrow name, phoneNo, email, password$ b. $phoneNo \rightarrow NRIC$
No violation. The relation is in 3NF.

2. Owners (<i>NRIC, gender, age</i>)
Keys: (NRIC) Primary Key: (NRIC)
FDs: a. $NRIC \rightarrow gender, age$
No violation. The relation is in 3NF.

3. Agents (<i>NRIC, licenseNo, licenseValidDate, agencyName</i>)
Keys: (NRIC), (licenseNo) Primary Key: (NRIC)
FDs: a. $NRIC \rightarrow licenseNo$ b. $licenseNo \rightarrow NRIC, licenseValidDate, agencyName$
No violation. The relation is in 3NF.

4. Customers (<i>NRIC, intention</i>)
Keys: (NRIC) Primary Key: (NRIC)

FDs:

- a. $\text{NRIC} \rightarrow \text{intention}$

No violation.

The relation is in 3NF.

5. Agencies (*name, estYear, managerNRIC*)

Keys: (name)

Primary key: (name)

FDs:

- a. $\text{name} \rightarrow \text{estYear}, \text{managerNRIC}$

No violation.

The relation is in 3NF.

6. Properties (*unitNo, street, postCode, furnishStatus, area, type, NRICNo*)

Keys: (unitNo, street, postCode)

Primary key: (unitNo, street, postCode)

FDs:

- a. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{furnishStatus}, \text{area}, \text{type}, \text{NRICNo}$
- b. $\text{street}, \text{postCode} \rightarrow \text{area}$

The FD $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{furnishStatus}, \text{area}, \text{type}, \text{NRICNo}$ violates 3NF.

Performing 3NF decomposition:

Split RHS of FDs:

- a. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{furnishStatus}$
- b. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{area}$
- c. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{type}$
- d. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{NRICNo}$
- e. $\text{street}, \text{postCode} \rightarrow \text{area}$

Remove redundant FDs.

We notice that the FD (b) is redundant since there exists (e). Thus, we can remove the FD (b).

The new FDs are:

- a. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{furnishStatus}$
- b. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{type}$
- c. $\text{unitNo}, \text{street}, \text{postCode} \rightarrow \text{NRICNo}$

- d. $\text{street, postCode} \rightarrow \text{area}$

There is no redundant attributes from any LHS of FDs. Thus, FDs cannot be reduced further. Therefore, we obtain the minimal basis.

Now, we combine the FDs with the same LHS:

- a. $\text{unitNo, street, postCode} \rightarrow \text{furnishStatus, type, NRICNo}$
b. $\text{street, postCode} \rightarrow \text{area}$

Creating decomposed relations:

- a. $R1(\text{unitNo, street, postCode, furnishStatus, type, NRCNo})$
b. $R2(\text{street, postCode, area})$

These are the final decomposed relations.

7. Listings (*adsID, createDate, unitNo, street, postCode, agentNRIC*)

Keys: (adsID)

Primary Key: (adsID)

FDs:

- a. $\text{adsID} \rightarrow \text{createDate, unitNo, street, postCode, agentNRIC}$
b. $\text{unitNo, street, postCode} \rightarrow \text{agentNRIC}$

The FD $\text{unitNo, street, postCode} \rightarrow \text{agentNRIC}$ violates 3NF.

Performing 3NF decomposition:

Split RHS of FDs:

- a. $\text{adsId} \rightarrow \text{createDate}$
b. $\text{adsId} \rightarrow \text{unitNo}$
c. $\text{adsId} \rightarrow \text{street}$
d. $\text{adsId} \rightarrow \text{postCode}$
e. $\text{adsId} \rightarrow \text{agentNRIC}$
f. $\text{unitNo, street, postCode} \rightarrow \text{agentNRIC}$

Remove redundant FDs:

We can remove FD (e), since without (e), $\{\text{adsId}\}^+ = \{\text{createDate, unitNo, street, postCode, agentNRIC}\}$, which means part (e) could be replenished. So, the new FDs will be

- a. $\text{adsId} \rightarrow \text{createDate}$
b. $\text{adsId} \rightarrow \text{unitNo}$
c. $\text{adsId} \rightarrow \text{street}$
d. $\text{adsId} \rightarrow \text{postCode}$
e. $\text{unitNo, street, postCode} \rightarrow \text{agentNRIC}$

Remove redundant attribute in LHS of FDs:

If we remove either unitNo, street, or postCode in our new (e) Functional dependencies, we could not get two of them combined as an FD to determine agentNRIC. The rest from (a) to (d) are not redundant, since on LHS and RHS, there is only 1 element.

Minimal basis is found:

- a. $\text{adsId} \rightarrow \text{createDate}$
- b. $\text{adsId} \rightarrow \text{unitNo}$
- c. $\text{adsId} \rightarrow \text{street}$
- d. $\text{adsId} \rightarrow \text{postCode}$
- e. $\text{unitNo, street, postCode} \rightarrow \text{agentNRIC}$

Combining FDs with same LHS:

- a. $\text{adsID} \rightarrow \text{createDate, unitNo, street, postCode}$
- b. $\text{unitNo, street, postCode} \rightarrow \text{agentNRIC}$

Creating decomposed relations:

- a. $R1(\text{adsID, createDate, unitNo, street, postCode})$
- b. $R2(\text{unitNo, street, postCode, agentNRIC})$

These are the final decomposed relations.

8. SaleList (*adsId, price, tenure, yearBuilt*)

Keys: (adsId)

Primary Key: (adsId)

FDs:

- a. $\text{adsId} \rightarrow \text{price, tenure, yearBuilt}$

No violation.

The relation is in 3NF

9. RentList (*adsId, aircon, pub*)

Keys: (adsId)

Primary Key: (adsId)

FDs:

- a. $\text{adsId} \rightarrow \text{aircon, pub}$

No Violation

The relation is in 3NF

10. ShortTerm (<i>adsId, dailyRate</i>)
Keys: (adsId) Primary Key: (adsId)
FDs: a. $adsId \rightarrow dailyRate$
No Violation. The relation is in 3NF.

11. LongTerm (<i>adsId, canVisit, minStay, monthlyRate</i>)
Keys: (adsId) Primary Keys: (adsId)
FDs: a. $adsId \rightarrow canVisit, minStay, monthlyRate$
No Violation. The relation is in 3NF

12. Appointment (<i>dateTime, NRIC, adsID, status</i>)
Keys: (dateTime, NRIC, adsID) Primary Key: (dateTime, NRIC, adsID)
FDs: a. $dateTime, NRIC, adsID \rightarrow status$
No violation. The relation is in 3NF.

13. PastChanges(<i>NRIC, adsID, appointmentDateTime, changeID, dateTime, actionBy, prvStatus</i>)
Keys: (NRIC, adsID, appointmentDateTime, dateTime), (changeID) Primary Key: (changeID)
FDs: a. $changeID \rightarrow appointmentDateTime, NRIC, adsID, dateTime, actionBy, prvStatus$ b. $appointmentDateTime, NRIC, adsID, dateTime \rightarrow changeID$

No violation.
The relation is in 3NF.

14. Engagement (*NRIC, adsID, engID, status*)

Keys: (NRIC, adsID), (engID)
Primary Key: (NRIC, adsID)

FDs:
a. $\text{engID} \rightarrow \text{NRIC, adsID, status}$
b. $\text{NRIC, adsID} \rightarrow \text{engID}$

No violation.
The relation is in 3NF.

15. ViewRecs (*NRIC, adsID, engID, dateTime*)

Keys: (NRIC, adsID, dateTime), (engID, dateTime)
Primary Key: (engID, dateTime)

FDs:
a. $\text{NRIC, adsID} \rightarrow \text{engID}$
b. $\text{engID} \rightarrow \text{NRIC, adsID}$

No violation, all attributes in the RHS are contained in a candidate key.
The relation is in 3NF.

16. ChatRecs (*NRIC, adsID, engID, chatID, dateTime, content, direction*)

Keys: (NRIC, adsID, chatID), (engID, chatID)
Primary Key: (engID, chatID)

FDs:
a. $\text{chatID} \rightarrow \text{content, direction, dateTime}$
b. $\text{NRIC, adsID} \rightarrow \text{engID}$
c. $\text{engID} \rightarrow \text{NRIC, adsID}$

FD [$\text{chatID} \rightarrow \text{content, direction, dateTime}$] violates 3NF
Performing 3NF decomposition: Split RHS of FDs:
1. $\text{ChatID} \rightarrow \text{content}$

2. ChatID \rightarrow direction
3. ChatID \rightarrow dateTime
4. NRIC, adsID \rightarrow engID
5. engID \rightarrow NRIC
6. engID \rightarrow adsID

Remove redundant FDs:

No FDs are redundant.

Remove redundant attributes in LHS of FDs:

We only need to check for NRIC, adsID \rightarrow engID.

1. If we remove NRIC: {adsID} $^+$ = {adsID}, which cannot derive engID.
2. If we remove adsID: {NRIC} $^+$ = {NRIC}, which also cannot derive engID. Therefore, there is no redundant LHS on the FD.

Minimal basis is found:

1. ChatID \rightarrow content
2. ChatID \rightarrow direction
3. ChatID \rightarrow dateTime
4. NRIC, adsID \rightarrow engID
5. engID \rightarrow NRIC
6. engID \rightarrow adsID

Combining FDs with same LHS:

1. chatID \rightarrow dateTime, content, direction
2. NRIC, adsID \rightarrow engID
3. engID \rightarrow NRIC, adsID

Create tables:

1. R1(chatID, dateTime, content, direction)
2. R2(engID, NRIC, adsID)
3. R3(engID, NRIC, adsID)
4. R4(engID, chatID) *This is for preserving the primary key.

Remove redundant relations:

1. R1(chatID, dateTime, content, direction)
2. R2(engID, NRIC, adsID)
3. R4(engID, chatID).

These are the final decomposed relations.

17. Review (NRIC, adsID, engID, direction, rating, comment, dateTime)

Keys: (NRIC, adsID, direction), (engID, direction)

Primary Key: (engID, direction)

FDs:


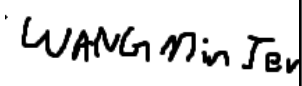



- a. $\text{NRIC, adsID, engID, direction} \rightarrow \text{rating, comment, dateTime}$
- b. $\text{NRIC, adsID} \rightarrow \text{engID}$
- c. $\text{engID} \rightarrow \text{NRIC, adsID}$

No Violation.

- a. $[\text{NRIC, adsID, engID, direction} \rightarrow \text{rating, comment, dateTime}]$: LHS is a superkey.
- b. $[\text{NRIC, adsID} \rightarrow \text{engID}]$: every RHS attribute is in a key-attribute.
- c. $[\text{engID} \rightarrow \text{NRIC, adsID}]$: every RHS attribute is in a key-attribute.

The relation is in 3NF.

APPENDIX C: INDIVIDUAL CONTRIBUTION FORM

Full Name	Individual Contribution to Lab 1 Submission	Percentage of Contribution	Signature
Vannes Wijaya	Relation 1-4	16.6	
Wang Min-Jen	Relation 14-17	16.6	
Melisa Lee	Relation 5-6	16.6	
Denzel Elden Wijaya	Relation 7-11	16.6	
Dosi Veer	Relation 14-17	16.6	
Lionel Owen Wijaya	Relation 12-13	16.6	