DBS Project Phase 3

A database system for student clubs in University of Tabuk

Team Members:

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Phase 3 Description:

In this phase we will work on Normalizing the relations in our selected case study that we worked on in phase 1 and 2, in order to make our database easier to access and maintain and to make take up minimal storage space.
We will achieve that by going through the following steps:

- **Identify the functional dependencies represented by the attributes shown in the allied tables. State any assumptions you make about the data and the attributes shown in such relations/tables.**
- **Describe and illustrate the process of normalizing the attributes shown in the allied relations/tables to produce a set of well-designed 3NF relations.**
- **Identify the primary, alternate, and foreign keys in your 3NF relations.**

The Process of Normalization

All relations are initially in Unnormalized Form.

Table 1, Clubs:

clubID	clubName	clubMembers	Paths
GDC	Google Developer Club	219	4
TRC	Tourism Club	26	1
PGC	Programming Club	32	2
CTC	Culture Club	25	2
SPC	Sports Club	31	2

Functional Dependencies:
clubID → clubName, clubMembers, Paths.
Assumption:
clubID which is the set of club identifiers determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:
UNF → 1NF
The table doesn't contain any repeating groups, the intersection of each row and column contains one and only one value.
The Table is in First Normal Form

1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.
The Table is in Second Normal Form

2NF → 3NF
No non-primary-key attribute is transitively dependent on the primary key.
The Table is in Third Normal Form.

Normalized Table:

clubID	clubName	clubMembers	Paths
GDC	Google Developer Club	219	4
TRC	Tourism Club	26	1
PGC	Programming Club	32	2
CTC	Culture Club	25	2
SPC	Sports Club	31	2

pathName	pathLeaderName	pathLeaderID	pathMembers	clubID
Game Development	Yazan Barakat	411010698	11	GDC
Artificial Intelligence	Mohamed Ali	3900106332	61	GDC
Computer science	Khalid Dossary	3900150221	104	GDC
Cyber Security	Mousa Ahmed	3800101022	43	GDC
Saudi Culture	Fhad Salah	420100235	15	CTC
Global Culture	Yasser Shehri	3800002252	7	CTC
Football	Fawaz Oribi	3910005555	22	SPC
Body Building	Aziz Hazazi	4210002146	9	SPC
Development	Ahmed Naser	4110103535	15	PGC
Design	Ali Khalid	3900110146	7	PGC
General Tourism	Mohamed Mustafa	3900150846	26	TRC

Functional Dependencies:
pathName → pathLeaderName, pathLeaderID, pathMembers, clubID.
pathLeaderID → pathLeaderName.

Assumption:
pathName which is the set of names of the paths in clubs, determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:
UF → 1NF
The table doesn't contain any repeating groups, the intersection of each row and column contains one and only one value.
The Table is in First Normal Form
1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.
The Table is in Second Normal Form
2NF → 3NF
pathLeaderName is transitively dependent on pathName through pathLeaderID, so we will split the table into two new tables, Paths and pathLeaders.

Table 2.1 Paths:

pathName	pathLeaderID	pathMembers	clubID
Game Development	411010698	11	GDC
Artificial Intelligence	3900106332	61	GDC
Computer science	3900150221	104	GDC

Cyber Security	3800101022	43	GDC
Saudi Culture	420100235	15	CTC
Global Culture	3800002252	7	CTC
Football	3910005555	22	SPC
Body Building	4210002146	9	SPC
Development	4110103535	15	PGC
Design	3900110146	7	PGC
General Tourism	3900150846	26	TRC

Keys:

Super Keys: pathName, pathName&pathLeaderName, pathName&pathMembers, pathLeaderID&pathMembers, pathName&pathLeaderName&pathMembers, pathName&pathLeaderID&pathMembers.

Candidate Keys: pathName.

Primary Key: pathName.

Alternate Keys: None.

Foreign Key: clubID, pathLeaderID.

Functional Dependencies:
pathName → pathLeaderID, pathMembers, clubID.

Assumption:
pathName which is the set of names of the paths in clubs, determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:
UF → 1NF
The table doesn't contain any repeating groups, the intersection of each row and column contains one and only one value.
The Table is in First Normal Form
1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.
The Table is in Second Normal Form
2NF → 3NF
No non-primary-key attribute is transitively dependent on the primary key.
The Table is in Third Normal Form

Normalized Table:

pathName	pathLeaderID	pathMembers	clubID
Game Development	411010698	11	GDC

Artificial Intelligence	3900106332	61	GDC
Computer science	3900150221	104	GDC
Cyber Security	3800101022	43	GDC
Saudi Culture	420100235	15	CTC
Global Culture	3800002252	7	CTC
Football	3910005555	22	SPC
Body Building	4210002146	9	SPC
Development	4110103535	15	PGC
Design	3900110146	7	PGC
General Tourism	3900150846	26	TRC

Table 2.2, Path Leaders:

pathLeaderID	LeaderName	leadFromDate	leadToDate
411010698	Yazan Barakat	19/Jan/2022	01/May/2022
3900106332	Mohamed Ali	22/Aug/2021	Null
3900150221	Khalid Dossary	01/Mar/2020	06/May/2022
3800101022	Mousa Ahmed	29/Fab/2022	09/Dec/2022
420100235	Fhad Salah	19/Oct/2021	11/Jan/2022
3800002252	Yasser Shehri	11/Oct/2020	Null
3910005555	Fawaz Oribi	19/Jan/2022	21/Apr/2022
4210002146	Aziz Hazazi	10/Mar/2022	Null
4110103535	Ahmed Naser	19/Dec/2022	Null
3900110146	Ali Khalid	12/Oct/2022	Null
3900150846	Mohamed Mustafa	22/Jan/2022	05/Nov/2022

Keys:

Super Keys: pathLeaderID, pathLeaderID&LeaderName, pathLeaderID&leadFromDate, pathLeaderID&leadToDate, pathLeaderID&LeaderName&leadFromDate, pathLeaderID&LeaderName&leadToDate. pathLeaderID&leadFromDate&leadToDate, pathLeaderID&LeaderName&leadFromDate&leadToDate.

Candidate Keys: pathLeaderID.

Primary Key: pathLeaderID.

Alternate Keys: None.

Foreign Key: None.

Functional Dependencies:
leaderID → leaderName, leadFromDate, leadToDate.

Assumption:
leaderID which is the set of all possible leaders of Paths identifiers, determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:
UF → 1NF
The table doesn't contain any repeating groups, the intersection of each row and column contains one and only one value.
The Table is in First Normal Form

1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.
The Table is in Second Normal Form

2NF → 3NF
No non-primary-key attribute is transitively dependent on the primary key.
The Table is in Third Normal Form

Normalized Table:

pathLeaderID	LeaderName	leadFromDate	leadToDate
411010698	Yazan Barakat	19/Jan/2022	01/May/2022
3900106332	Mohamed Ali	22/Aug/2021	Null
3900150221	Khalid Dossary	01/Mar/2020	06/May/2022
3800101022	Mousa Ahmed	29/Fab/2022	09/Dec/2022
420100235	Fhad Salah	19/Oct/2021	11/Jan/2022
3800002252	Yasser Shehri	11/Oct/2020	Null
3910005555	Fawaz Oribi	19/Jan/2022	21/Apr/2022
4210002146	Aziz Hazazi	10/Mar/2022	Null
4110103535	Ahmed Naser	19/Dec/2022	Null
3900110146	Ali Khalid	12/Oct/2022	Null
3900150846	Mohamed Mustafa	22/Jan/2022	05/Nov/2022

Table 3 Club Members:

memberName	memberID	clubID	pathName	memberRole
Harethah AbuShariah	4110103535	GDC	Game Development	Participant
Nawaf Al-shihri	411010558	PGC	Development	Participant
Mohamed Yasser	411000235	TRC	Local Tourism	Participant
Khaled Naser	421000235	CTC	Saudi Culture	Participant
Mazen Ali	390001154	SPC	Football	Participant
Ahmed Naser	4110103535	PGC	Development	Participant
Ali Khalid	3900110146	PGC	Design	Participant
Mohamed Mustafa	3900150846	TRC	General Tourism	Participant
Yazan Barakat	411010698	GDC	Game Development	Leader
Mohamed Ali	3900106332	GDC	Artificial Intelligence	Leader
Khalid Dossary	3900150221	GDC	Computer science	Leader
Mousa Ahmed	3800101022	GDC	Cyber Security	Leader
Fhad Salah	420100235	CTC	Saudi Culture	Leader
Yasser Shehri	3800002252	CTC	Global Culture	Leader
Fawaz Oribi	3910005555	SPC	Football	Leader
Aziz Hazazi	4210002146	SPC	Body Building	Leader
Ahmed Naser	4110103535	PGC	Development	Leader
Ali Khalid	3900110146	PGC	Design	Leader
Mohamed Mustafa	3900150846	TRC	General Tourism	Leader

Functional Dependencies:
memberID → memberName, clubID, pathName.
pathName → clubID.

Assumption:
memberID which is the set of member identifiers determines the rest of the attributes in the relation, so it's selected to be a primary key.
pathName determines clubID.

Normalization:
UF → 1NF
The table contains repeating groups in clubID and pathName attributes, to solve that we will remove the clubID attribute from the table because it already exists as a foreign key in the Paths table.
The emerging Table will be in First Normal Form

1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.

The Table is in Second Normal Form

2NF → 3NF
No non-primary-key attribute is transitively dependent on the primary key.
The Table is in Third Normal Form

Normalized Table:

memberName	memberID	pathName	memberRole
Harethah AbuShariah	4110103535	Game Development	Participant
Nawaf Al-shihri	411010558	Development	Participant
Mohamed Yasser	411000235	Local Tourism	Participant
Khaled Naser	421000235	Saudi Culture	Participant
Mazen Ali	390001154	Football	Participant
Ahmed Naser	4110103535	Development	Participant
Ali Khalid	3900110146	Design	Participant
Mohamed Mustafa	3900150846	General Tourism	Participant
Yazan Barakat	411010698	Game Development	Leader
Mohamed Ali	3900106332	Artificial Intelligence	Leader
Khalid Dossary	3900150221	Computer science	Leader
Mousa Ahmed	3800101022	Cyber Security	Leader
Fhad Salah	420100235	Saudi Culture	Leader
Yasser Shehri	3800002252	Global Culture	Leader
Fawaz Oribi	3910005555	Football	Leader
Aziz Hazazi	4210002146	Body Building	Leader
Ahmed Naser	4110103535	Development	Leader
Ali Khalid	3900110146	Design	Leader
Mohamed Mustafa	3900150846	General Tourism	Leader

Keys:

Super Keys: MemberID, memberName&MemberID,
MemberID&pathName, MemberID&memberRole, memberName&MemberID&memberRole,
memberName&MemberID&pathName,
memberName&MemberID&pathName&memberRole.

Candidate Key: memberID.

Primary Key: memberID.

Alternate Key: none.

Foreign Keys: pathName.

Table 4, Organizations:

orgID	orgName	orgSpecialty	orgCollabCount
Org01	Google	Computer Technology	1
Org02	Chalk Studio	Game Development	1
Org03	Ministry of Tourism	Tourism	1
Org04	National Cybersecurity	Cyber Security	1
Org05	Ministry of Sports	Sports	1

Functional Dependencies:
orgID, → orgSpecialty, orgName ,orgCollabCount.

Assumption:
orgID which is the set of Organization identifiers determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:
UF → 1NF
The table doesn't contain any repeating groups, the intersection of each row and column contains one and only one value.
The Table is in First Normal Form

1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.
The Table is in Second Normal Form

2NF → 3NF
No non-primary-key attribute is transitively dependent on the primary key.
The Table is in Third Normal Form

Normalized Table:

orgID	orgName	orgSpecialty	orgCollabCount
Org01	Google	Computer Technology	1
Org02	Chalk Studio	Game Development	1
Org03	Ministry of Tourism	Tourism	1
Org04	National Cybersecurity	Cyber Security	1
Org05	Ministry of Sports	Sports	1

Table 5, Club Activities:

activityName	activityType	Participants	Date	clubID
Game Jam	Online	7	19-Jan-2022	GDC
Java Course	Online	30	12-Mar-2021	PGC
Visiting Mount Al-Loz	Outdoors	13	1-Apr-2021	TRC
Hackathon	Online	142	10-Jan-2022	GDC
Html Contest	Online	34	20-Jan-2022	PGC
Football Tournament	Outdoors	88	10-Feb-2021	SPC

Functional Dependencies:
activityName → activityType, Participants, Date, clubID

Assumption:
activityName which is the set of the names of activities done by clubs determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:

UF → 1NF
The table doesn't contain any repeating groups, the intersection of each row and column contains one and only one value.
The Table is in First Normal Form.

1NF → 2NF
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Normalized Table:

activityName	activityType	Participants	Date	clubID
Game Jam	Online	7	19-Jan-2022	GDC
Java Course	Online	30	12-Mar-2021	PGC
Visiting Mount Al-Loz	Outdoors	13	1-Apr-2021	TRC
Hackathon	Online	142	10-Jan-2022	GDC
Html Contest	Online	34	20-Jan-2022	PGC
Football Tournament	Outdoors	88	10-Feb-2021	SPC

Table 6, Club Collaborations:

collabNo	orgID	clubID	collabType	collabDesc	activityName
C001	Org01	GDC	General	Create and sponsor the club	Null
C002	Org02	GDC	Specific	Organize a game design competition	Game Jam
C003	Org03	TRC	Specific	Organize multiple tours around Tabuk	Null
C004	Org04	PGC	Specific	Organize a programming competition	Hackathon
C005	Org05	SPT	General	Provide Club with equipment and support	Null

Functional Dependencies:
collabNo, →orgID, clubID, collabType, collabDesc, activityName.

Assumption:
collabNo which is the set of all possible collaboration numbers, determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:
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1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.
The Table is in Second Normal Form

2NF → 3NF
No non-primary-key attribute is transitively dependent on the primary key.
The Table is in Third Normal Form

Normalized Table:

collabNo	orgID	clubID	collabType	collabDesc	activityName
C001	Org01	GDC	General	Create and sponsor the club	Null
C002	Org02	GDC	Specific	Organize a game design competition	Game Jam
C003	Org03	TRC	Specific	Organize multiple tours around Tabuk	Null
C004	Org04	PGC	Specific	Organize a programming competition	Hackathon

C005	Org05	SPT	General	Provide Club with equipment and support	Null

Table 7, Club Supervisors:

supervisorName	supervisorFaculty	supervisorID	clubID
Dr. Majed	Computer And IT	101101	GDC
Dr. Ahmad	Art And Design	105664	CTC
Dr. Awad	Computer And IT	102246	PGC
Dr. Khaled	Toursim	109531	TRC
Dr. Yasir	Applied Sciences	105411	SPC

Functional Dependencies:
supervisorID → supervisorName, supervisorFaculty, clubID.

Assumption:
supervisorID which is the set of all possible supervisors Identifiers, determines the rest of the attributes in the relation, so it's selected to be a primary key.

Normalization:
UF → 1NF
The table doesn't contain any repeating groups, the intersection of each row and column contains one and only one value.
The Table is in First Normal Form.

1NF → 2NF
Every non-primary-key attribute is fully functionally dependent on the primary key.
The Table is in Second Normal Form

2NF → 3NF
No non-primary-key attribute is transitively dependent on the primary key.
The Table is in Third Normal Form

Normalized Table:

supervisorName	supervisorFaculty	supervisorID	clubID
Dr. Majed	Computer And IT	101101	GDC
Dr. Ahmad	Art And Design	105664	CTC
Dr. Awad	Computer And IT	102246	PGC
Dr. Khaled	Toursim	109531	TRC
Dr. Yasir	Applied Sciences	105411	SPC