

DASC 5333 Database Systems for Data Science
CSCI 4333 Design of Database Systems
Fall 2023
Homework #7

Suggested Solution to Question (1)

GW's relation schema with entries for normalization analysis:

1	GWMember(GWId, LName, FName, Email, Since)
Candidate Keys	[1] GWId
Foreign Keys	
Nullable Attributes	
Non-nullable Attributes	MemberId, LName, FName, Email, Since
Notes	
Normalization Analysis	[FD]: GWId -> LName, FName, Email, Since [Highest NF]: BCNF
2	Group(GroupId, Name, Description)
Candidate Keys	[1] GroupId, [2] Name
Foreign Keys	
Nullable Attributes	Description
Non-nullable Attributes	GroupId, Name
Notes	
Normalization Analysis	[FD]: [1] GroupId -> Name, Description; [2] Name -> GroupId [Highest NF]: BCNF
3	GroupMembership(GM_Id, GWId, GroupId, JoinTime, MemberNum, IsAdmin, AdminPhone)
Candidate Keys	[1] GM_Id, [2] GWId, GroupId
Foreign Keys	[1] GWId references GWMember(GWId), [2] GroupId references Group(GroupId)
Nullable Attributes	AdminPhone
Non-nullable Attributes	GM_Id, MemberId, GroupId, JoinTime, MemberNum, IsAdmin
Notes	[1] A surrogate key, GM_Id, is created as the primary key. [2] In this design, the three inheritance classes, GroupMembership, RegularMember, and Admin are transformed to a single relation. Other designs are possible. [3] Since there are only two kinds of members, IsAdmin is created as a Boolean attribute to specify the subclass. When it is false, it indicates a regular member. Other designs are possible. [4] As a result, AdminPhone is optional. It is only required when IsAdmin is true.
Normalization Analysis	[FD]: [1] GM_Id -> GWId, GroupId, JoinTime, MemberNum, IsAdmin, AdminPhone; [2] GWId, GroupId -> GM_Id [Highest NF]: BCNF
4	Rule(RuleId, Rule, RuleNum, GroupId)
Candidate Keys	[1] RuleId, [2] GroupId, RuleNum

Foreign Keys	[1] GroupId references Group(GroupId)
Nullable Attributes	
Non-nullable Attributes	RuleId, Rule, RuleNum, GroupId
Notes	[1] A surrogate key, RuleId, is created as the primary key.
Normalization Analysis	[FD]: [1] RuleId -> Rule, RuleNum, GroupId; [2] GroupId, RuleNum -> RuleId [Highest NF]: BCNF
5	Category(CategoryId, Category, Description)
Candidate Keys	[1] CategoryId, [2] Category
Foreign Keys	
Nullable Attributes	Description
Non-nullable Attributes	CategoryId, Category
Notes	
Normalization Analysis	[FD]: CategoryId -> Category, Description; [2] Category -> CategoryId [Highest NF]: BCNF
6	GroupCategory(GC_Id, GroupId, CategoryId)
Candidate Keys	[1] GC_Id, [2] GroupId, CategoryId
Foreign Keys	[1] GroupId references Group(GroupId), [2] CategoryId references Category(CategoryId)
Nullable Attributes	
Non-nullable Attributes	GC_Id, GroupId, CategoryId
Notes	[1] A surrogate key, GC_Id, is created as the primary key.
Normalization Analysis	[FD]: [1] GC_Id -> GroupId, CategoryId; [2] GroupId, CategoryId -> GC_Id [Highest NF]: BCNF
7	Recommend(RecommendId, Recommendation, Description, DisplayLink)
Candidate Keys	[1] RecommendId
Foreign Keys	
Nullable Attributes	Description
Non-nullable Attributes	RecommendId, Recommendation, DisplayLink
Notes	[1] A surrogate key, RecommendId, is created as the primary key.
Normalization Analysis	[FD]: [1] RecommendId -> Recommendation, Description, DisplayLink [Highest NF]: BCNF
8	Event(EventId, EventName, Place, Date, Time, Description, GroupId)
Candidate Keys	[1] EventId
Foreign Keys	[1] GroupId references Group(GroupId)
Nullable Attributes	Description
Non-nullable Attributes	EventId, EventName, Place, Date, Time, GroupId
Notes	
Normalization Analysis	[FD]: [1] EventId -> EventName, Place, Date, Time, Description, GroupId [Highest NF]: BCNF
9	Posting(PostingId, PostTime, Subject, Body, Priority, GroupId)
Candidate Keys	[1] PostingId
Foreign Keys	[1] GroupId references Group(GroupId)
Nullable Attributes	
Non-nullable Attributes	PostingId, PostTime, Subject, Body, Priority, GroupId
Notes	[1] A surrogate key, PostingId, is created as the primary key. [2] In this design, this table captures only the class Posting. There are separate tables

	for the subclasses. This provides more flexibility for other functions. Other designs are possible.
Normalization Analysis	[FD]: [1] PostingId -> PostTime, Subject, Body, Priority, GroupId [Highest NF]: BCNF
10	EP_Type(EP_TypeId, EP_Type)
Candidate Keys	[1] EP_TypeId, [2] EP_Type
Foreign Keys	
Nullable Attributes	
Non-nullable Attributes	EP_TypeId, EP_Type
Notes	
Normalization Analysis	[FD]: [1] EP_TypeId -> EP_Type; [2] EP_Type -> EP_TypeId [Highest NF]: BCNF
11	EventPosting(EP_Id, PostingId, EP_TypeId, AdminId)
Candidate Keys	[1] EP_Id, [2] PostingId
Foreign Keys	[1] PostingId references Posting(PostingId), [2] AdminId references GroupMembership(GM_Id), [3] EP_TypeId references EP_Type(EP_TypeId)
Nullable Attributes	
Non-nullable Attributes	EP_Id, PostingId, EP_TypeId, AdminId
Notes	[1] A surrogate key, EP_Id, is created as the primary key. [2] Note that AdminId references GM_Id, not GWId.
Normalization Analysis	[FD]: [1] EP_Id -> PostingId, EP_TypeId, AdminId; [2] PostingId -> EP_Id [Highest NF]: BCNF
12	RegularPosting(RP_Id, PostingId, MembershipId)
Candidate Keys	[1] RP_Id
Foreign Keys	[1] PostingId references Posting(PostingId), [2] MembershipId references GroupMembership(GM_Id)
Nullable Attributes	
Non-nullable Attributes	RP_Id, PostingId, MembershipId
Notes	[1] A surrogate key, RP_Id, is created as the primary key.
Normalization Analysis	[FD]: [1] RP_Id -> PostingId, MembershipId; [2] PostingId -> RP_Id [Highest NF]: BCNF
13	Comment(CommentId, CommTime, Comment, PostingId, ParentCommentId, GWMemberId)
Candidate Keys	[1] CommentId
Foreign Keys	[1] PostingId references Posting(PostingId), [2] ParentCommentId references Comment(CommentId), [3] GWMemberId references GWMember(GWId)
Nullable Attributes	ParentCommentId, PostingId
Non-nullable Attributes	CommentId, CommTime, Comment, GWId
Notes	[1] A surrogate key, CommentId, is created as the primary key.
Normalization Analysis	[FD]: CommentId -> CommTime, Comment, PostingId, ParentCommentId, GWMemberId [Highest NF]: BCNF