Exercise 2: Solution

Relation, FD, Keys

DBS

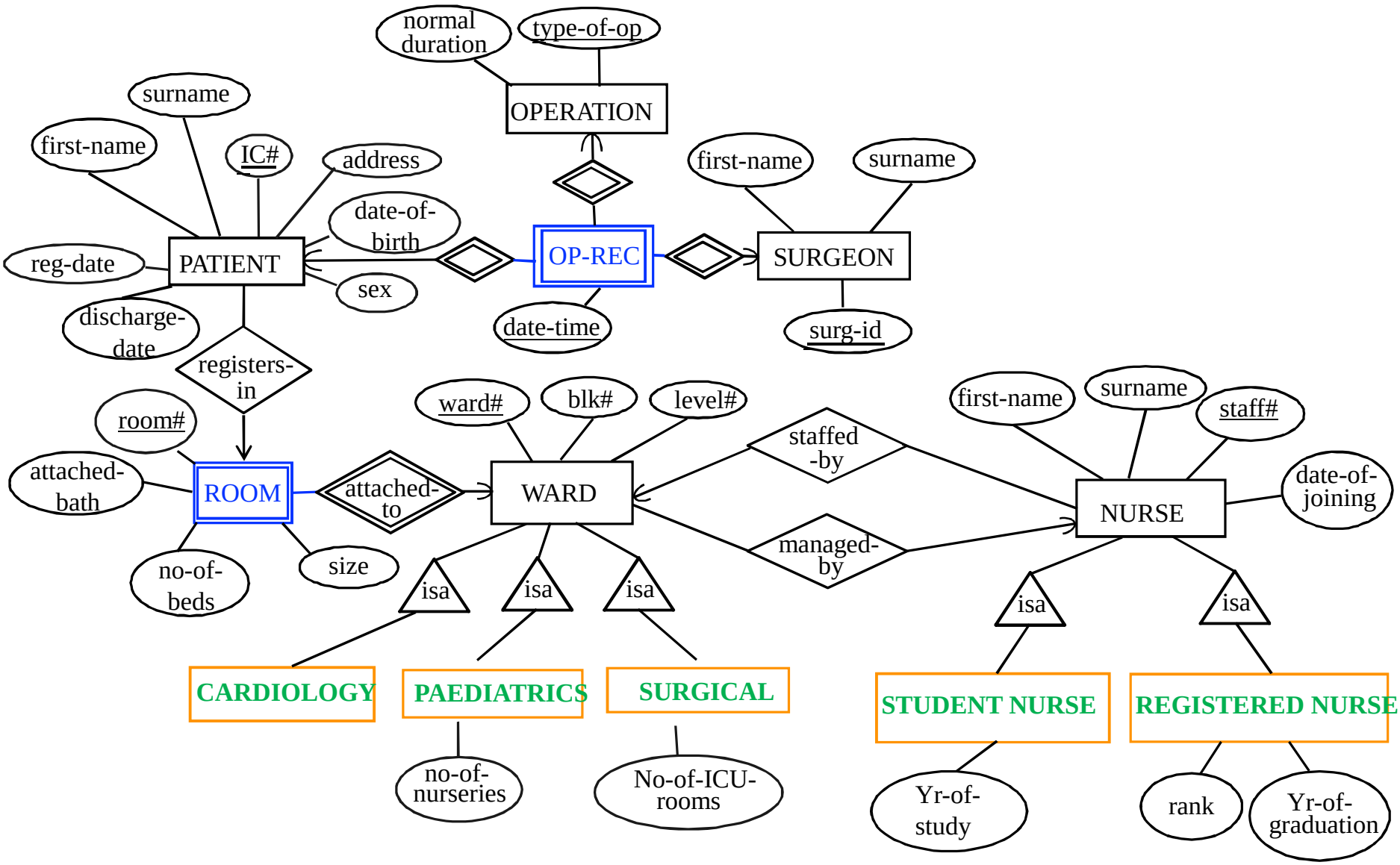
- Multiple correct solutions are possible.

- The model solutions provide only one correct solution/ direction (along with some assumptions → identify those assumptions).

- You must write your additional assumptions together with your solution.

- Discuss your alternative solutions and assumptions with the TA.

Question 1


normal duration
type-of-op
OPERATION
surname
first-name
IC#
address
date-of-birth
reg-date
PATIENT
sex
discharge-date
registers-in
OP-REC
date-time
first-name
surname
SURGEON
surg-id
room#
attached-bath
ROOM
attached-to
ward#
blk#
level#
WARD
no-of-beds
size
isa
isa
isa
staffed-by
managed-by
first-name
surname
staff#
date-of-joining
NURSE
isa
isa
CARDIOLOGY
PAEDIATRICS
SURGICAL
STUDENT NURSE
REGISTERED NURSE
no-of-nurseries
No-of-ICU-rooms
Yr-of-study
rank
Yr-of-graduation

Question 1: Relational Tables

- Surgeon (surg-id, first-name, surname)
- Operation (type-of-op, normal-duration)
- Patient (IC#, first-name, surname, address, date-of-birth, sex, reg-date, discharge-date, room#, ward#) – m2o
- Ward (ward#, blk#, level#, no-of-nurseries, no-of-ICU-rooms, manager) – m2o
- Nurse (staff#, first-name, surname, date-of-joining, wardStaff#) – m2o
- Operate (IC#, surg-id, type-of-op, date-time) – w.e./m2o
- Room (room#, ward#, attached-bath, no-of-beds) – w.e./m2o

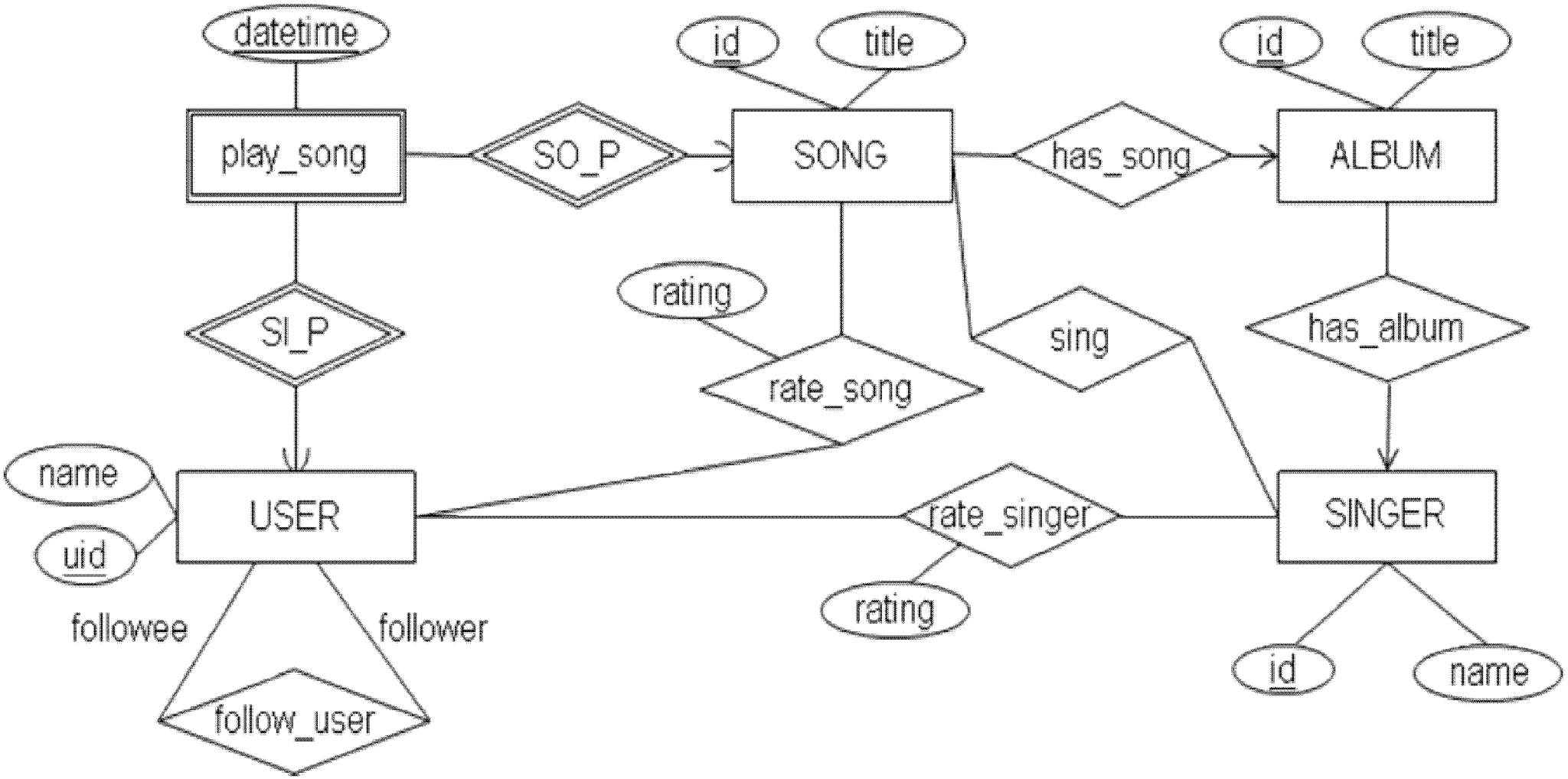
Question 1: Relational Tables

- Subclass relationships:
- Student_Nurse(staff#, Yr-of-study)
- Registered_Nurse(staff#, rank, yr-of-graduation)
- Surgical_Ward(ward#, No_of_ICU_rooms)
- Pediatrics_Ward(ward#, No_of_nurseries)
- Cardiology_Ward(ward#, no_of_heart_equipment)

Question 2

- USER(uid, name)
- SINGER(id, name)
- ALBUM(id, title, singerid) – m2o
- SONG(id, title, albumid) – m2o
- SING(singerid, songid) – m2m
- FOLLOW_USER(followeruid, followeeuid) – m2m
- RATE_SONG(uid, songid, rating) – m2m
- RATE_SINGER(uid, singerid, rating) – m2m
- PLAY_SONG(uid, songid, datetime) – weak entity m2o

Question 2


datetime
play_song
SO_P
id
title
SONG
has_song
id
title
ALBUM
SI_P
rating
rate_song
sing
has_album
name
uid
USER
rate_singer
SINGER
followee
follower
follow_user
rating
id
name

Question 2

• Instead of “play_song” as weak entity, it can also be modelled as a many-to-many relation, with “datetime” as a key attribute associated with that relation.

Question 3(a)

- F1: studentID $\rightarrow$ officePhone, office, email, name
- F2: officePhone $\rightarrow$ Office
- F3: courseID $\rightarrow$ name, description, location
- F4: name $\rightarrow$ description

Question 3(b)

- F5: studentID $\rightarrow$ courseID. This is derived from the TA relationship, F1, and F3.
- F6: studentID $\rightarrow$ name, description, location. This is derived from F3 and F5.

Question 4

- Let us denote attributes STREET, CITY, STATE, ZIP as A, B, C and D respectively.
- Then we have D->BC and ABC->D.
- A+={A}; B+={B}; C+={C}; D+={DBC}
- AB+={AB}; AC+={AC}; AD+={ABCD}; BC+={BC}; BD+={BDC}; CD+={CDB};
- ABC+={ABCD}; ABD+={ABCD}; ACD+={ABCD}; BCD+={BCD}
- FD's: D->BC; AD->BC; BD->C; CD->B; ABC->D; ADB->C; ACD->B;
- Candidate keys: ABC, AD

Question 5

- $(A \rightarrow B) \Rightarrow (AC \rightarrow BC)$
- From reflexivity axiom: $BC \rightarrow B$
- $(AC \rightarrow BC)$ *and* $(BC \rightarrow B) \Rightarrow (AC \rightarrow B)$

Question 5

- Consider the records:
- (a1, b1, c1)
- (a2, b1, c2)
- *Both (A $\rightarrow$ C)* and (AB $\rightarrow$ C) are true but (B $\rightarrow$ C) does not hold