RASMUS PAGH

INTRODUCTION TO DATABASES HAND-IN

THIS IS A "REVERSE" PROBLEM. YOUR TASK IS TO CORRECT AND GRADE TWO ANSWERS TO THE EXAM OF JANUARY 2005. THE MAXIMUM NUMBER OF POINTS FOR EACH QUESTION IS AS FOLLOWS:

1A	1B	2A	2B	2C	3A	4A	4B	4C	4D	4E	5A	5B	6A	6B	6C
10	10	4	6	5	10	6	8	6	6	6	5	5	5	5	5

THE GRADING SCALE FOR THE EXAM WAS:

POINTS ≥	15	30	48	56	64	72	80	88
GRADE	03	5	6	7	8	9	10	11

YOU SHOULD HAND IN COPIES OF THE TWO ANSWERS WITH:

- INDICATIONS OF WHERE POINTS HAVE BEEN DRAWN AND WHY
- A NUMBER OF POINTS FOR EACH QUESTION
- TOTAL POINT SUM AND GRADE.

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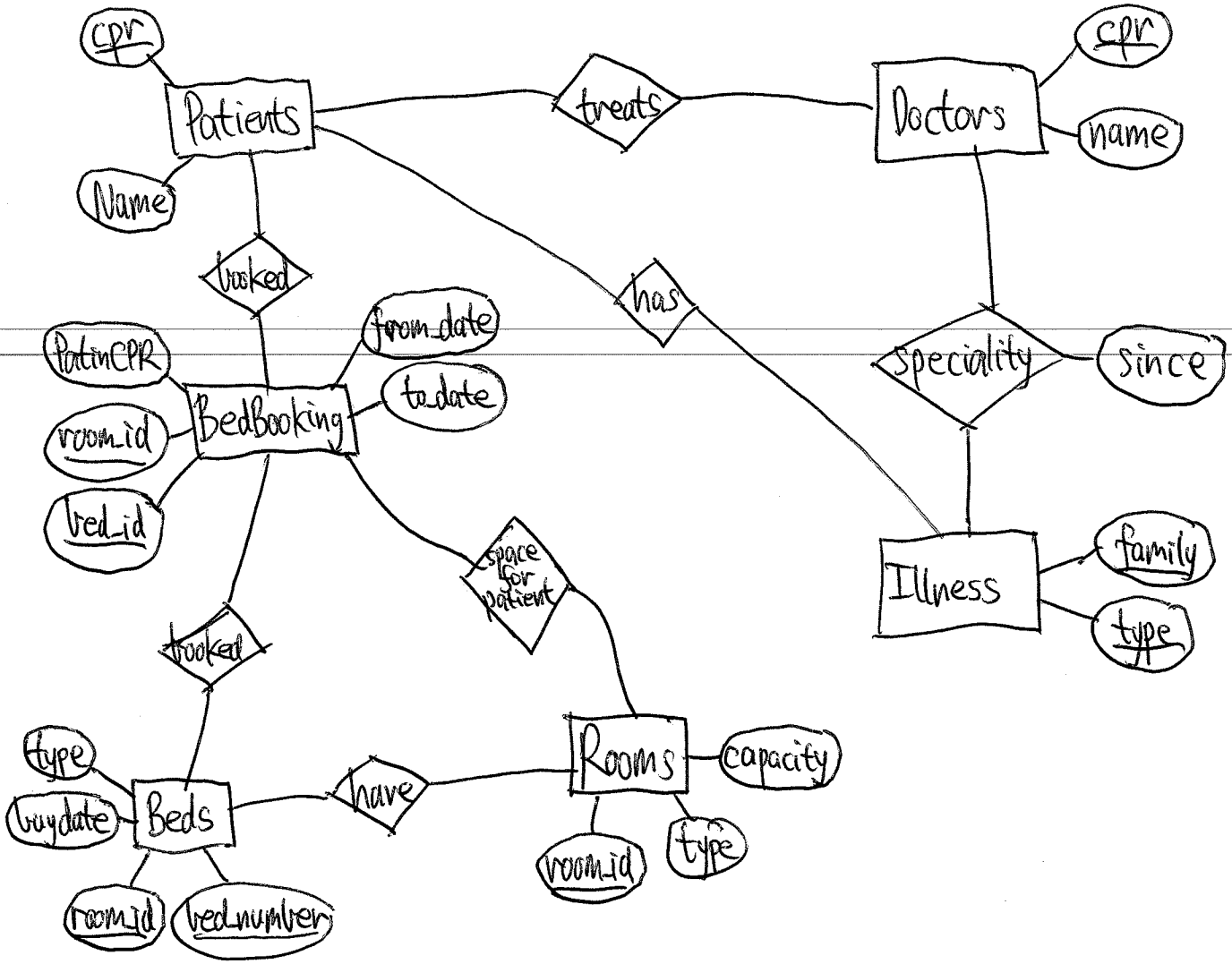
EXAMPLE EXAM ANSWER 1

INTRODUCTION TO DATABASES EXAM, JANUARY 2005

NB! THE ANSWERS COME FROM THE ACTUAL EXAM AND HAVE MISTAKES!

PROBLEM 1

B)



PROBLEM 1

A) Patients (cpr, name)
Doctors (cpr, name)
Beds (room, number, type)
Illness (family, type)

Treats (Patient_cpr, Doctor_cpr)
Occup (cpr, room, number)
Has (cpr, family, type)
Speciality (since, cpr, family, type)

WE CAN POSSIBLY COMBINE BEDS & OCCUP, EG.

Beds (room, number, type, cpr)

PROBLEM 2

A) IN THIS CASE THE REPETITION IS AT TYPE ATTRIBUTE IN BEDS BECAUSE WE SEE ALL THE BEDS BOUGHT AT SAME DATE HAVE SAME TYPE. (REDUNDANCY)

UPDATE ANOMALY: IF WE CHANGE THE room_id IN THE ROOMS RELATION WE HAVE TO UPDATE IT IN BOTH Beds AND BedBookings RELATIONS.

PROBLEM 2

B) Beds: WE DON'T HAVE ANY AVOIDABLE FD BECAUSE WE FIND KEY ELEMENTS ON THE LEFT HAND SIDE.

Rooms: ——————— // ———————

BedBookings: HERE WE FIND TWO AVOIDABLE FDS:

(i) patient_cpr → from_date

(ii) patient_cpr → to_date

C) BCNF DECOMPOSITION:

AFFECTS ONLY BedBookings (FD patient_cpr → from_date, to_date)

BedBookings1 (patient_cpr, from_date, to_date)

BedBookings2 (patient_cpr, room_id, bed_number)

PROBLEM 3

A) YOU MUST BE ALLOWED TO ADD A BED WITHOUT DEFINING end_date. YOU ALSO NEED TO BE ABLE TO SEE THAT A BED IS BOOKED FROM A CERTAIN DATE, EVEN IF YOU HAVEN'T SPECIFIED WHEN A PATIENT IS DISCHARGED (to_date).

1+2: SET TRANSACTION READ WRITE
ISOLATION LEVEL READ COMMITED

3: SERIALIZABLE.

PROBLEM 4

A)
```
SELECT SUM(capacity) AS Total_Capacity
FROM Rooms
WHERE type='T';
```

B)
```
SELECT type, SUM(room_id)
FROM Rooms
WHERE buy_date < '1990'
GROUP BY type;
```

C) THE QUERY HAS TWO PARTS:

(i) THE SUBQUERY RETURNS room_id AND bed_numbers FROM THE Beds TABLE WHICH HAS type SET TO 'old'.

(ii) IN THE MAIN QUERY, THE room_id AND bed_number IN THE BedBookings RELATION IS SET TO NULL IF THE room_id AND bed_number EQUAL ANY OF THOSE RETURNED BY THE SUBQUERY

D)
```
UPDATE Rooms SET capacity = (SELECT SUM(bed_number)
                             FROM Beds
                             GROUP BY room_id
                             WHERE rooms.room_id = beds.room_id;
```

E) a) $\Pi_{SUM(capacity)} (\sigma_{type='T'} (Rooms))$

b) $\Pi_{type, sum(room\_ids)} (\sigma_{buy\_date<'1990'} (Rooms)$ GROUP BY type)

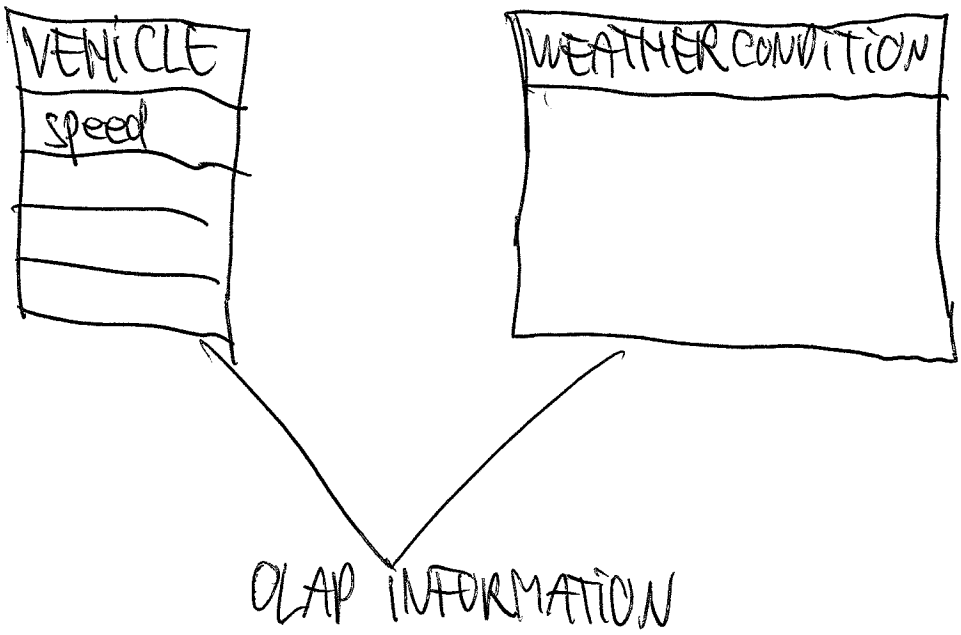
PROBLEM 5

A) FACTS: ABOUT VEHICLES ARE PASSED OR NOT.

MEASURES: SPEED, TYPE, TIME, DAY OF WEEK, WEATHER.

DIMENSIONS: THE INFORMATION IS STORED IN DIFFERENT TABLES LIKE VEHICLE TABLE WHICH STORES INFORMATION LIKE SPEED, TYPE, TIME, DAY OF WEEK. THE OTHER INFORMATION LIKE WEATHER CONDITIONS IS STORED IN ANOTHER TABLE WEATHER FOR ALL TIMES, ALL DAYS OF WEEK AND THEIR WEATHER. THE INFORMATION IS COLLECTED FROM THE TWO FACT TABLES LIKE VEHICLES AND WEATHER TO GET RESULTS.

B) THE STAR SCHEMA CAN BE LIKE:



OPGAVE 6

A) DOC HAS THE FOLLOWING PRIVILEGES ON BedBookings:
- CAN SEE THE DATA (SELECT)
- CAN UPDATE from_date AND to_date AND MAY GIVE OTHERS THE PRIVILEGE TO DO THIS.

(- CAN NOT DELETE TUPLES, SINCE adm DOES NOT HAVE THE RIGHT TO PASS ON THIS PRIVILEGE).

B) DOC NOW HAS THE FOLLOWING PRIVILEGES:
- CAN UPDATE 'to_date' AND PASS ON THIS PRIVILEGE.

C)
```
CREATE VIEW BedInfo AS
    SELECT room_id, bed_number, from_date, to_date
    FROM BedBookings
    WHERE (patient_cpr%2=0);

GRANT SELECT ON BedBookings TO public;
```

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EXAMPLE EXAM ANSWER 2

INTRODUCTION TO DATABASES EXAM, JANUARY 2005
NB! THE ANSWERS COME FROM THE ACTUAL EXAM AND HAVE MISTAKES!

PROBLEM 1

A) SINCE THERE IS A 1-1 RELATIONSHIP BETWEEN Patients AND Beds I HAVE CHOSEN TO COMBINE THEM INTO ONE RELATION (POSSIBLY WITH TUPLES PADDED WITH NULLS):

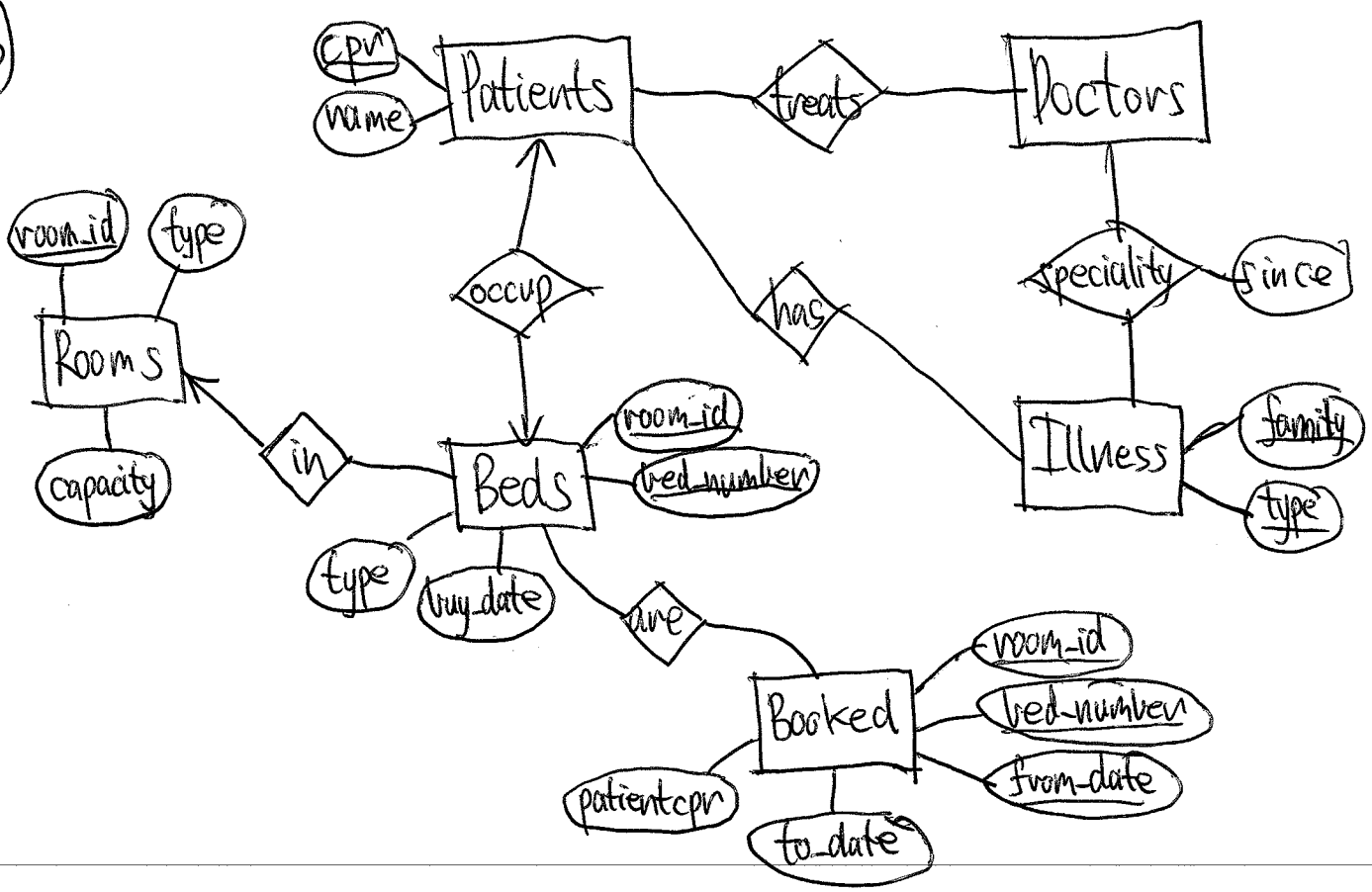
Patients (pcpr, name, room, number, type)

THE REST OF THE CONVERSION IS:

Doctors (dcpr, name)
Treats (pcpr, dcpr)
Illnesses (family, type)
Speciality (dcpr, family, type, since)
Has (pcpr, family, type)

PROBLEM 1

B)



PROBLEM 2

A) REDUNDANCY: TYPE IN BEDS WOULD BE THE SAME FOR MORE BEDS, BUT COULD BE DERIVED FROM buy_date.

UPDATE ANOMALY: WHEN UPDATING from_date THERE IS NO CONSTRAINT ON to_date, I.E. from_date COULD BE FALSELY A DATE GREATER THAN to_date. THE KEY ON BEDS IS ALSO A PROBLEM IF THE BED CHANGES ROOM.

PROBLEM 2

B) SINCE (room_id, bed_number) IS A KEY, bed_number DOES NOT DETERMINE room_id. AVOIDABLE FDs IN Beds:

buy_date → type

IN Rooms NEITHER TYPE NOR CAPACITY NOR THE TWO TOGETHER CAN DETERMINE room_id OR EACH OTHER. HENCE THERE IS NO AVOIDABLE FD.

IN BedBookings THERE IS ALSO NO AVOIDABLE FD.

C) Beds IS DECOMPOSED INTO:

Beds(room_id, bed_number, buy_date)
Type(buy_date, type)

PROBLEM 3

A) 1) HERE I WOULD CHOOSE ISOLATION LEVEL SERIALIZABLE TO AVOID THAT SEVERAL ATTEMPTS TO BOOK THE SAME BED.

2) ISOLATION LEVEL READ COMMITTED – IT IS VERY UNLIKELY THAT TWO PEOPLE WILL DISCHARGE THE SAME PATIENT AT THE SAME TIME.

3) READ COMMITTED HERE TOO.

PROBLEM 4

A) SELECT SUM(capacity) AS totalCapacity
FROM Rooms
WHERE type='t'

B) SELECT Rooms.room_id, Rooms.type
FROM Rooms, Beds
WHERE Rooms.room_id = Beds.room_id AND buy_date < '1990'

C) THE STATEMENT SETS room_id AND bed_number IN BEDBOOKINGS TO NULL FOR ALL BEDS OF TYPE 'old'.

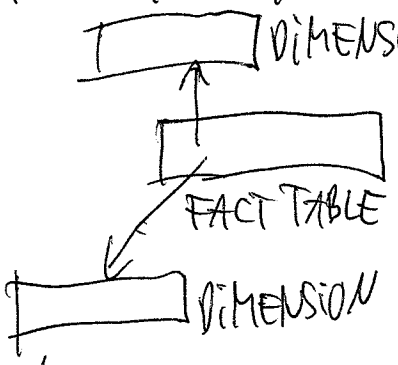
D) UPDATE Rooms
SET capacity = SELECT COUNT(Beds.room_id) AS numbeds
FROM Beds, Rooms
WHERE Beds.room_id = Rooms.room_id

E) $\Pi_{totalcapacity}(\sigma_{type='t'}(\gamma_{SUM(capacity)\rightarrow totalcapacity}(Rooms)))$

$\Pi_{Rooms.room\_id, Rooms.type}(\sigma_{Rooms.roomid=Beds.room\_id \text{ AND } buydate<'1990'}(Rooms \bowtie Beds))$

PROBLEM 5

A) FACTS: SPEED, TYPE, DATE, WEATHER, REGISTRATION ID



DIMENSIONS: ~~type~~

B) FACT TABLE: traffic(trafficRegID, date, speed)

PROBLEM 6

A) DOC MAY SELECT ALL ATTRIBUTES OF BedBookings
DOC MAY UPDATE from_date AND to_date IN BedBookings, BUT NO OTHER ATTRIBUTES. THIS PRIVILEGE CAN BE PASSED ON.
DOC MAY DELETE TUPLES OF BedBookings.

B) DOC CANNOT SELECT FROM BedBookings.
DOC CAN NOW ONLY UPDATE to_date IN BedBookings.
DOC MAY DELETE TUPLES IN BedBookings.

C) CREATE VIEW N_BEDBOOKINGS AS
SELECT room_id, bed_number, from_date, to_date
FROM BedBookings
WHERE (patientcpr%2 = 0)

GRANT SELECT ON N_BEDBOOKINGS TO public.