EXAMPLE EXAM ANSWER 1

INTRODUCTION TO DATABASES EXAM, JANUARY 2005

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

PROBLEM 1

b)

[Diagram of a database schema showing entities such as Patients, Doctors, Illness, Beds, Rooms, and their relationships. The diagram includes attributes like name, room_id, bed_id, cpr, and speciality, and highlights redundant data points.]

5 P
Problem 1

A) Patients (cpr, name)
Doctors (cpr, name)
Beds (room, number, type)
Illness (family, type)  REDUNDANT (?)  \[1\, \text{P}\]
Treats (Patient-cpr, Doctor-cpr)
Occup (cpr, room, number)
Has (cpr, family, type)
Speciality (since, cpr, family, type)

WE CAN POSSIBLY COMBINE \[\text{BEDS} \land \text{OCCUP}\], eg.
Beds (room, number, type, cpr)  \[9\, \text{P}\]

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) \[\checkmark\]

UPDATE ANOMALY: IF WE CHANGE THE room.id IN THE Rooms RELATION WE HAVE TO UPDATE IT IN BOTH Beds AND BedBookings RELATIONS.  \[\% \, 2\, \text{P}\]
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 }
\text{CORRECT ASSUMING THAT patient_cpr IS A KEY (BUT THEN NOT AVOIDABLE)}

C) BCNF DECOMPOSITION:
   AFFECTS ONLY BedBookings \text{(FD patient_cpr→from_date,to_date)}
   BedBookings_1 (patient_cpr, from_date, to_date) 5 P}
   BedBookings_2 (patient_cpr, room_id, bed_number) \text{CORRECT RELATIVE TO B}}

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 \text{(to_date). I BELIEVE...}

\text{1+2: SET TRANSACTION READ WRITE ISOLATION LEVEL READ COMMITTED)}
\text{GUESSSING?}

3: SERIALIZABLE.

KNOWS ISOLATION LEVELS: 1 P
PROBLEM 4

A) SELECT SUM(capacity) AS Total-Capacity
FROM Rooms
WHERE type = 'T'; 6 P

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 'OCC'.

(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. OK, NOT VERY CONCISE. 5 P

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

E) a) T sum(capacity) (σ type='T' (Rooms)) ✓ 3+0 P

b) T type, sum(room_ids) (σ buy_date < '1990' (Rooms)
GROUP BY type) ??
A) FACTS: ABOUT VEHICLES ARE PASSED OR NOT UNCL E A R.
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:

[Diagram of a star schema with tables connected by arrows showing relationships]
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)
   \(\checkmark\) \(5\) \(p\)

B) DOC NOW HAS THE FOLLOWING PRIVILEGES:
   - CAN UPDATE 'to_date' AND PASS ON THIS PRIVILEGE
   \(3\) \(p\)

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;

   COULD BE THOUGHTLESS, OR A SERIOUS MISUNDERSTANDING

TOTAL: 52 POINTS
GRADE: 6
EXAMPLE EXAM ANSWER 2

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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 HAVING NULLS):

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

THE REST OF THE CONVERSION IS:

Doctors (dcept, name)
Treats (pccr, dcept)
Illnesses (family, type)
Speciality (dcept, family, type, since)
Has (pccr, family, type)

REdundant (? ) ÷ 1 p

D O E S N O T
F O L L O W G O M
M E T H O D ÷ 2 p

7 p
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.

% 2P
PROBLEM 2

B) Since \((\text{room-id}, \text{bed-number})\) is a key, \text{bed-number} does not determine \text{room-id}. Avoidable FPs in beds:

\[
\begin{align*}
\text{buy-date} & \rightarrow \text{type} \\
\text{room-id} & \rightarrow \text{type} \quad \text{MISSING}
\end{align*}
\]

In rooms neither type nor capacity nor the two together can determine \text{room-id} on each other. Hence there is no avoidable FD.

In bed bookings there is also no avoidable FD.  

3 p

C) Beds is decomposed into:

\[
\begin{align*}
\text{Beds}(\text{room-id}, \text{bed-number}, \text{buy-date}) \\
\text{Type}(\text{buy-date}, \text{type}) & \checkmark \text{(relative to B)}
\end{align*}
\]

5 p

PROBLEM 3

A) 1) Here I would choose isolation level \text{serializable} to avoid that several attempts to book the same bed.

2) Isolation level \text{read committed} - it is very unlikely that two people will discharge the same patient at the same time.

3) \text{read committed here too}. Argument missing (52 p)

8 p
A) \[ \text{SELECT} \ \text{SUM(capacity)} \ \text{AS totalCapacity} \]
\[ \text{FROM Rooms} \]
\[ \text{WHERE type = 'L'} \]
\[ 6 \text{p} \]

B) \[ \text{SELECT Rooms.room_id, Rooms.type} \]
\[ \text{FROM Rooms, Beds} \]
\[ \text{WHERE Rooms.room_id = Beds.room_id AND buy_date < '1990'} \]
\[ 6 \text{p} \]

C) \[ \text{THE STATEMENT SETS room_id AND bed_number IN} \]
\[ \text{BEDBOOKINGS TO NULL FOR ALL BEDS OF TYPE 'LW'} \] 
\[ 6 \text{p} \]

D) \[ \text{UPDATE Rooms} \]
\[ \text{SET capacity = SELECT COUNT(Beds.room_id) AS numbeds} \]
\[ \text{FROM Beds, Rooms} \]
\[ \text{WHERE Beds.room_id = Rooms.room_id} \]
\[ 4 \text{p} \]

E) \[ \text{totalCapacity (C_{type='L'} (\sum \text{capacity} \rightarrow \text{totalCapacity (Rooms)}))} \]

\[ \text{NOT REL. ALGEBRA NOTATION} \]
\[ 2 \text{p} \]
PROBLEM 5

**TUPLES OF THE FORM**

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

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. % 3 P

B) DOC CANNOT SELECT FROM BedBookings.
   DOC CAN ONLY UPDATE to-date IN BedBookings.
   DOC MAY DELETE TUPLES IN BedBookings. % (RELATE TO A) 3 P

C) CREATE VIEW N_BEDBOOKINGS AS
   SELECT room_id, bed_number, from_date, to_date
   FROM BedBookings
   WHERE (patientID % 62 = 0)

GRANT SELECT ON N_BEDBOOKINGS TO public. ✓ 5 P

TOTAL POINTS: 73
GRADE: 9