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:

<table>
<thead>
<tr>
<th>Question</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>10</td>
</tr>
<tr>
<td>1B</td>
<td>10</td>
</tr>
<tr>
<td>2A</td>
<td>4</td>
</tr>
<tr>
<td>2B</td>
<td>6</td>
</tr>
<tr>
<td>2C</td>
<td>5</td>
</tr>
<tr>
<td>3A</td>
<td>10</td>
</tr>
<tr>
<td>3B</td>
<td>6</td>
</tr>
<tr>
<td>3C</td>
<td>8</td>
</tr>
<tr>
<td>4A</td>
<td>6</td>
</tr>
<tr>
<td>4B</td>
<td>6</td>
</tr>
<tr>
<td>4C</td>
<td>6</td>
</tr>
<tr>
<td>4D</td>
<td>6</td>
</tr>
<tr>
<td>4E</td>
<td>5</td>
</tr>
<tr>
<td>5A</td>
<td>5</td>
</tr>
<tr>
<td>5B</td>
<td>5</td>
</tr>
<tr>
<td>5C</td>
<td>5</td>
</tr>
<tr>
<td>5D</td>
<td>5</td>
</tr>
</tbody>
</table>

The grading scale for the exam was:

<table>
<thead>
<tr>
<th>Points</th>
<th>Grade</th>
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<tbody>
<tr>
<td>≥ 15</td>
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</tr>
<tr>
<td>30</td>
<td>5</td>
</tr>
<tr>
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<td>6</td>
</tr>
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<td>80</td>
<td>10</td>
</tr>
<tr>
<td>88</td>
<td>11</td>
</tr>
</tbody>
</table>

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.
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 BENS & OCCUP, E.G.

Beds (room, number, type, cpr)

PROBLEM 2

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

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 COMMITTED

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 'CP'.

   (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)  TT(sum(capacity) (σtype='T' (Rooms))

   b)  TT(type, sum(room_id) (σbuy-date < '1990' (Rooms)
       GROUP BY type)
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:

```
VEHICLE
  speed

WEATHER

OLAP INFORMATION
```

A) Doc has the following privileges on BedBookings:
   - Can see the data (SELECT)
   - Can update from date AND to date AND can 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_cpn%2 = 0);

   GRANT SELECT ON BedBookings TO public;
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 PAIRED WITH NULLS):

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

THE REST OF THE CONVERSION IS:

Doctors (dcpn, name)
Treats (pcpr, dcpn)
Illnesses (family, type)
Speciality (dcpn, family, type, since)
Has (pcpr, family, type)
**PROBLEM 1**

B) [Diagram of a database schema showing entities such as Patients, Doctors, Illness, Rooms, Beds, and Booked with relationships and attributes like room_id, type, ocup, room_id, and bed_number.]

**PROBLEM 2**

A) **REDUNDANCY**: TYPE IN BEDS WOULD BE THE SAME FOR MORE BERS, 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 BED BOOKINGS 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) \[ \text{SELECT SUM(capacity) AS totalCapacity FROM Rooms WHERE type='t'} \]

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

C) The statement sets room_id and bed_number in bedbookings to NULL for all beds of type 'old'.

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

E) \[ \text{TT totalCapacity (O_type='t' (O \text{SUM(capacity) \rightarrow totalcapacity (Rooms)))} \]

\[ \text{TT Rooms.room_id, Rooms.type (O \text{Rooms.room_id = Beds.room_id AND buy_date < '1990' (Rooms and Beds)})} \]
**PROBLEM 5**

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

```
  DIMENSION
  FACT TABLE
  DIMENSION
```

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 (patientOpn%2 = 0)
```

GRANT SELECT ON N_BEDBOOKINGS TO public.