

Please write on each separate paper your name, date of birth (if you have not registered, please give your personal number), the name of the course and the examiner, the date of the exam, and your signature.

1. Let us examine the relation $A(\underline{a}, b, c)$ (size $n > 0$ rows), $B(\underline{a} \rightarrow A, \underline{d}, e)$ (size $m > 0$ rows) and $C(\underline{a} \rightarrow A, \underline{d}, e)$ (size $p > 0$ rows). Annotations : π projection, \times cross product, $|\times|$ join, σ selection and $*$ natural join.
 - a) What is the join condition in the operation $B * C$?
 - b) May $\pi_d(B)$ be empty?
 - c) If, in relation A and B , there are the same amount of rows, $n = m$, then is $\pi_a(A) = \pi_a(B)$?
 - d) If $\pi_a(B) - \pi_a(C)$ is empty, is $B - C$ also empty?
 - e) Which conditions have to be filled to make $A \cup B$ possible? (10p)

Problems 2 – 4 refer to the following tables on medical prescriptions

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doctor(id, name)
patient(personal_number, name, year_of_birth)
prescription(prescription_number, date_of_issue, issuer->doctor,
             receiver->patient)
medication(prescription_number->prescription, medicine_id->medicine, dosage,
           instructions)
medicine(medicine_id, name, main_purpose, under_observation)
observation_list(doctor->doctor, medicine->medicine, date)
```

The domain of the column *under_observation* is { 'yes', 'no' } and it tells us whether the use of the medicine is under observation. The column *dosage* in the table *medication* expresses the amount of prescribed medicine in units. The function *sysdate* gives us today's date.

2. Give the following SQL queries. Specify an appropriate order for the answers.
 - a) The names of medicines against high blood pressure.
 - b) The names of patients who have been prescribed Burana 600 during June 2001.
 - c) The doctors' strike started on March 12th 2001 and ended on August 19th 2001. Give the names of the doctors who did not write any prescriptions during the strike. (12p)
3. Give the following SQL queries. Specify an appropriate order for the answers.
 - a) How many prescriptions with Viagra have been issued this year?
 - b) The names of doctors who have prescribed over 20,000 units of anti-depressants (main purpose depression) during this year, and the total amount of anti-depressants that each of these doctors has prescribed?
 - c) Which medicine has been prescribed the most in terms of units? (12p)
4. A doctor is placed on the observation list if s/he has prescribed a medicine that is under observation over 200 times during one month. The observation is dated according to the last day of the month and stays on the list for a year. The observation list is updated on the 15th of each month, when the previous month's situation is considered. Which database operations have to be done at that point and how are they presented with SQL? Assume that the functions to deal with dates are *LastOfMonth(date)* – which provides the last day of the month containing the date that has been given as parameter, and *FirstOfMonth* respectively. *Sysdate* gives the present date. [The date one year ago can be computed as *sysdate - 365*]. (8p)
5. Describe briefly the concepts functional dependency and Boyce-Codd normal form (8p)