

NAME:

NEPTUN CODE:

CIRCLE YOUR INSTRUCTORS' NAME PLEASE:

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FINAL EXAM

DATABASE SYSTEMS

TOTAL POINTS ARE 40
GOOD LUCK!!

1. In the instance of the relation $R(A,B,C,D,E)$ shown below, which of the following functional dependencies hold?

A	B	C	D	E
1	2	3	4	5
1	4	3	4	5
1	2	4	4	1

- I. $AB \rightarrow C$ II. $B \rightarrow D$ III. $DE \rightarrow A$
(A) I only
(B) II only
(C) I and III only
(D) II and III only

Write your answer here:

Briefly explain your answer:

(2 p)

2. Consider relation $S(A, B, C, D, E)$ with the FD's:
 $AB \rightarrow C, B \rightarrow D, DE \rightarrow A$. What are all the keys of S ?

- (A) $\{A, B, D, E\}$
(B) $\{A, B\}$ and $\{D, E\}$
(C) $\{B, E\}$
(D) $\{A, B, E\}$ and $\{B, D, E\}$

Write your answer here:

Briefly explain your answer:

List at least 2 Armstrong axioms and use them in order to derive new functional dependencies! (4 p)

3. We would like to design a database to maintain information about the World-Wide Web. The following information needs to be captured :

- Hosts on the web, which are characterized by their IP address, location, names and the server software running on them ,
- Associated with the hosts are directories . Each directory has a name(dname) which is unique on a given host. Thus a directory is essentially identified by the host machine on which it resides and its name(dname). We also need to store the last date of modification of the directory and the filenames under the directory. Directories can be classified as either root or non-root. While a root directory has no parent, non-root directories have a parent which is also a directory. Also, a non-root directory has associated with it access permissions.
- We also store information about clients which access a host machine. The client is characterized by an IP address, client name(cname) and each access to a host machine is associated with a timestamp.

The diagram shown in Fig 1 below represents the above information using the entity relationship model, except for the grayed text. Complete the diagram with this information (3 points), and give also a well-fit relational model (3 points).

4. Suppose we have a database for an investment firm, consisting of the following attributes:
DB (Broker, Office_of_broker, Inventor, Stock, Quantity, Dividend)

Quantity=quantity of stock owned by an investor

Dividend=dividend paid by a stock

Abbreviating by the first letters, the overall schema is $R(B, O, I, S, Q, D)$. Assume the following functional dependencies are required to hold on this database:

$F := \{I \rightarrow B, IS \rightarrow Q, B \rightarrow O, S \rightarrow D\}$

Tegyük fel, hogy egy befektetési iroda adatbázisa a következő sémájú:

DB (Bróker, Bróker_irodája, Befektető, Részvény, Mennyiség, Osztalék.) A megoldásban az angol megfelelőket KELL használni. Rövidítve:

Bróker=B, Bróker_irodája=O, Befektető=I, Részvény=S, Mennyiség=Q, Osztalék=D.

4.1 List and explain what anomalies can be observed in this relation. Sorolja fel, milyen anomáliákat talál ebben a relációban? (3 p)

4.2 List all candidate keys for R . Adja meg az összes kucsjelöltet. (3 p)

4.3 Decide, what normal form is obeyed by R ? Hányadik normálformában van R ? (3 p)

Is there a violator FD, contradicting 2 NF? If yes, write it here:

Is there a violator FD, contradicting 3 NF? If yes, write it here:

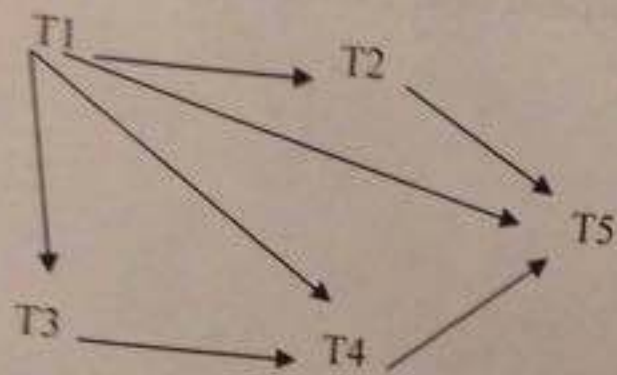
Is there a violator FD, contradicting BCNF? If yes, write it here:

4.3 Give a lossless decomposition of R into Boyce-Codd Normal Form. You are supposed to follow the algorithm we learnt. Explain using one part of your decomposition process, how losslessness is ensured. A tanult algoritmust használva adj meg a DB reláció egy veszteségmentes BCNF felbontását. A felbontás **egy lépését felhasználva** magyarázza el, mi biztosítja a veszteségmentességet? (4 p)

5.. Suppose that a relation schema is $R(ABCDEFGHI)$, with
 $F := \{ H \rightarrow GD, E \rightarrow D, HD \rightarrow CE, BD \rightarrow A \}$ (the same as in 2.1). A decomposition of R is given: $R_1(HGCE), R_2(ED), R_3(BDA), R_4(HBI)$. Is this decomposition is lossless?

Tegyük fel, hogy az $R(ABCDEFGHI)$ egy dekompozíciója az F függőségi halmaz szerint $R_1(HGCE), R_2(ED), R_3(BDA), R_4(HBI)$. Veszteségmentes-e ez a felbontás? (4 p)

6. A precedence graph is given in the figure below. Is this schedule conflict serializable? If yes, give 2 possible equivalent schedules. (1 points)



7. Someone tried to model a timestamp based protocol, and wrote that imagined schedule below. Valaki az időbélyegzés technikát próbálta modellezni, és az alábbi ütemezést írta le.

TIME UNITS	T1 TIMESTAMP=1	T2 TIMESTAMP=2	T3 TIMESTAMP=3	T4 TIMESTAMP=4	T5 TIMESTAMP=5
1		READ(X)			
2					
3	READ(X)				WRITE(Z)
4				READ(Y)	
5			READ(X)		
6					READ(X)
7	WRITE(X)	WRITE(Y)			
8					
9		READ(Z)			
10			READ(Y)		
11				WRITE(Y)	
12			WRITE(Y)		
13					READ(Y)

7.1 Is it possible in real? Why, or why not? Lehetséges-e ez a valóságban? Miért? (1p)

7.2 Can you make this schedule possible by dropping one or more transaction(s) completely? Would it make a difference if you apply Thomas write rule? Néhány tranzakció teljes kiiktatásával az ütemezés kivitelezhető ütemezéssé tehető-e? Ha Thomas írási szabályt is alkalmazza, más lenne-e a helyzet? (4 p)

7.3 Using any of your modified schedule in 7.2, give the timestamps of the given data elements X, Y, Z. A 7.2-ben megadott bármelyik VÉGREHAJTHATÓ (de csak egy) ütemezés alapján adja meg a szereplő X, Y, Z adatelemek időbélyegeit! (3 p)

8.

(7 points) Consider the concurrent transaction processing log shown below:

Step	Log Entry
1	<CHECKPOINT, L1>
2	<T1, START>
3	<T1, X, 0, 1>
4	<T2, START>
5	<T2, X, 1, 2>
6	<CHECKPOINT, L2>
7	<T1, COMMIT>
8	<T3, START>
9	<T4, START>
10	<T4, X, 2, 3>
11	<T3, Y, 5, 6>
12	<T2, COMMIT>
13	<T3, X, 3, 4>
14	<T4, Y, 6, 8>
15	<CHECKPOINT, L3>
16	<T4, COMMIT>
17	<T3, COMMIT>
18	<T5, START>
19	<T5, X, 4, 5>
20	<T5, COMMIT>

a.) Specify the following lists:

L1:

L2:

L3:

b.) Give recovery actions (IN EXECUTION ORDER) and log entries used for following failure events:
Crash between 11 and 12:

Recovery actions:

Values for X and Y in the database after the recovery:

Now suppose that the above failure has not occurred. But another crash is between 19 and 20:

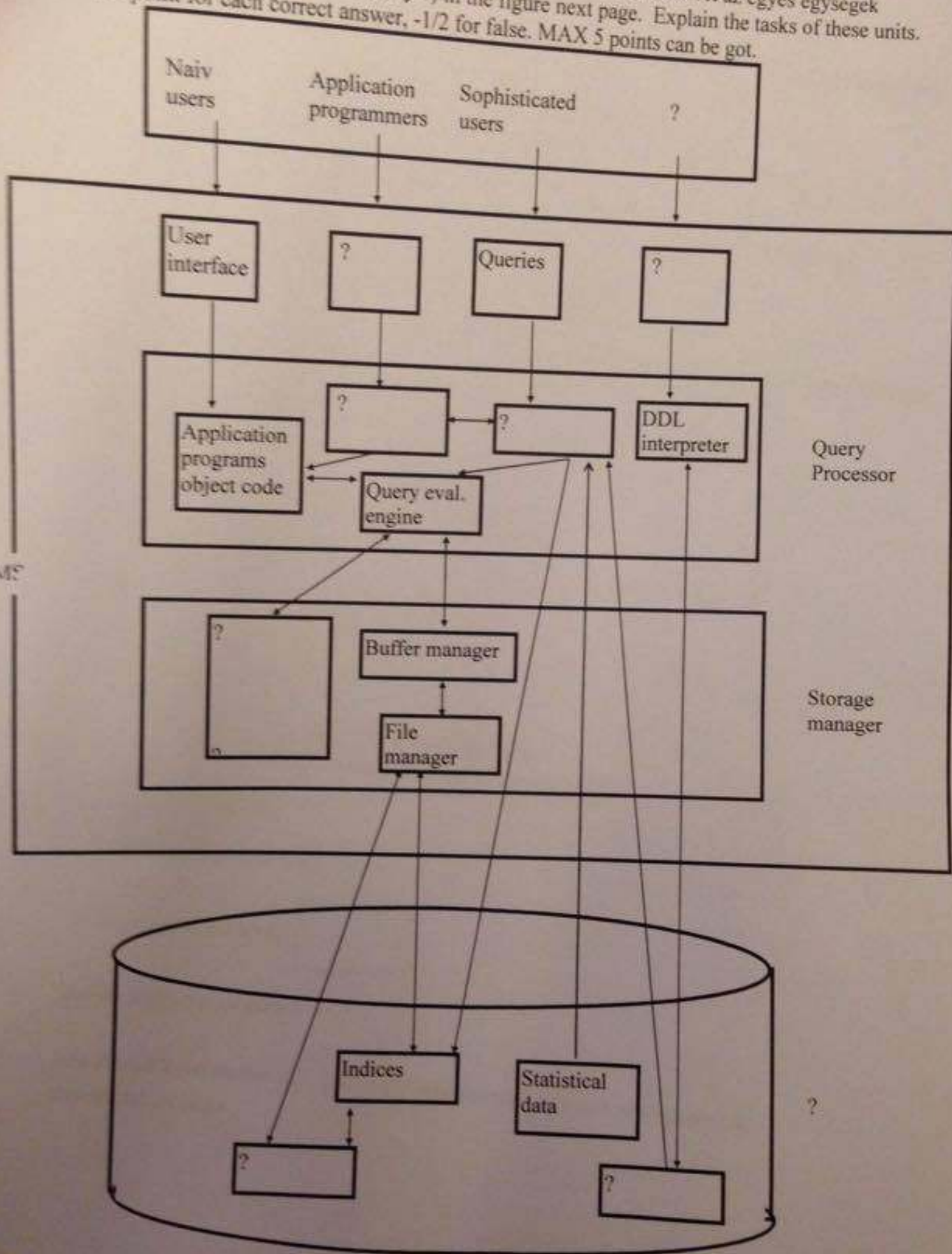
Recovery actions:

Values for X and Y in the database after the recovery:

(3 p)

9. Töltse ki az ábrán szereplő kérdőjeleket, és röviden magyarázza el az egyes egységek feladatát! Fill the gaps (denoted by ?) in the figure next page. Explain the tasks of these units. 1/2 point for each correct answer, -1/2 for false. MAX 5 points can be got.

3M



9.1.

What are the relational algebraic ALA Pműveletek, és mit jelentenek? (3 p)
What are RA basic operations and what are their meaning?

There are several measurement points where the air pressure, ambient temperature, and rain level data are collected. The locations are stored in MEASUREMENT_SITE relation, the type of data are stored in MEASUREMENT_TYPE relation and the values are in the MEASUREMENTS relation.

Az alábbi mérési pontok, ahol légnyomást, hőmérsékletet illetve csapadékmennyiséget mérünk. A mérési pontok a MEASUREMENT_SITE reláció, a mérési értékek típusait a MEASUREMENT_TYPE, továbbá a mérési értékeket a MEASUREMENTS relációk tartalmazza.

MEASUREMENT_SITE(M_ID, CITY)
MEASUREMENT_TYPE(T_ID, SENSOR_TYPE)
MEASUREMENTS(M_ID, T_ID, TIME, DATE, VALUE)

Sample data:

MEASUREMENT_SITE

01, Budapest
02, Esztergom
03, Pécs
04, Debrecen
05, Szombathely

MEASUREMENT_TYPE

T01, Pressure
T02, Temperature
T03, Fallen rain
T04, Hours of sunlight

MEASUREMENTS

01, 02, 12.00, 14-06-30, 35
01, 02, 12.00, 14-06-30, 1025
01, 02, 16.00, 14-06-30, 38
01, 02, 16.00, 14-06-30, 1020
02, 02, 12.00, 14-05-30, 22
02, 02, 12.00, 14-04-30, 1025
05, 02, 16.00, 14-07-12, 26
05, 02, 16.00, 14-06-14, 1020

Write a relational algebra AND SQL query for finding the greatest Temperature value from the RA és egy SQL kifejezés a legmagasabb Hőmérséklet érték megtalálására! (2p + 2p)

Select the maximal measurement values for every measurement type! (2 p)
Keresd az átlagos mérési értékeket, mérési értéktípusonként.

In which city has been the maximal average temperature measured.

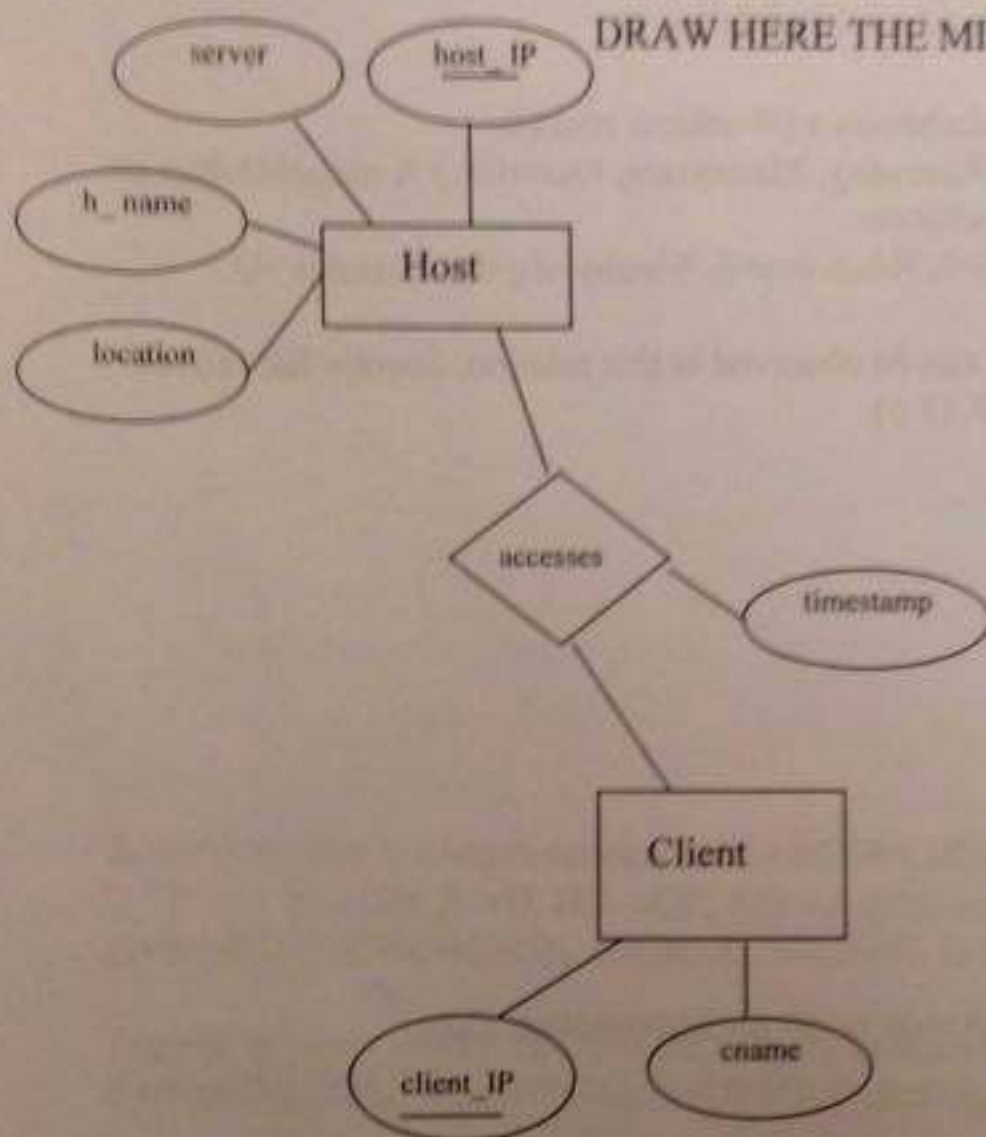
Melyik városban van a legmagasabb átlagos hőmérsékleti értéket. (2 p)

List the cities where the average temperature values is higher than the average temperature of all cities.

Keressük azt a városokat, ahol az átlagos hőmérsékleti érték nagyobb mint a teljes átlagos hőmérséklet. (2 p)

Determine the cities where the maximal air pressure or the maximal temperature value has been recorded.

Keressük azokat a városokat, ahol a légnyomás (pressure) vagy a hőmérséklet maximumot mérték. (2p)



RELATIONAL MODEL: