Task 5 (3 marks)

An objective of this task is to find the best distribution of relational tables over the persistent storage devices.

Assume, that to avoid the conflicts with the accesses to the relational tables of TPC-HR sample database we would like to distribute the relational tables over two different persistent storage devices. Then the relational tables that are joined together can be simultaneously read from two or more persistent storage devices. Do not worry if your system does not have persistent storage devices. We shall simulate the drives through two different tablespaces DRIVE_C and DRIVE_D. You do not have to create the tablespaces. To find out, which relational tables should be located on each device we shall consider the following queries.

(i) *Find the total quantity of parts ordered by the customers living in a given city (attribute C_ADDRESS).*
(ii) *Find the names of parts included in the orders that have a given shipment date (attribute L_SHIPDATE).*
(iii) *Find the names of parts shipped by the suppliers from a given city (attribute S_ADDRESS).*
(iv) *Find the names of suppliers who live in a given country (attribute N_NAME).*

Note, that the prefixes of the column names indicate the relational tables the columns are located at. For example, R_NAME denotes a column in a relational table REGION.

Analyze the queries listed above and find which relational tables are used by each query and distribute the relational tables over the hard drives simulated by the tablespaces DRIVE_C and DRIVE_D such, that the relational tables used by the same query are located on the different hard drives. Such approach reduces the total number of conflicts when accessing the persistent storage devices and it speeds up the query processing. If it is impossible to distribute the relational tables used by the same application on the different hard drives then try to minimize the total number of conflicts. You do not need to worry about distribution of indexes used for processing of the queries.

Create a document solution5.pdf that contains the following information.

(1) For each one of the queries listed above find what relational tables are used by a query and draw an undirected hypergraph such that each one of its hyperedges contains the names of tables used by one query. The names of tables are the nodes of the hypergraph.

(2) Use the hypergraph created in the previous step to find distribution of the relational tables over the persistent storage devices DRIVE_C and DRIVE_D such, that the relational tables used by the same query are located on the different persistent storage devices. If it is impossible to do it locate smaller relational tables on the same device and larger relational tables on different devices. Include information which relational table assigned to which device in a document solution5.pdf.

Hint
You can find a definition and visualization of an undirected hypergraph at:
`https://en.wikipedia.org/wiki/Hypergraph`

Deliverables
A file `solution5.pdf` that contains a hypergraph created in step (1) and information about relational tables assigned to the persistent storage devices. You are allowed to use any line drawing tool to draw a hypergraph. A scanned/photographed copy of a neat hand drawing is also acceptable.

Solution

(i)

```
SELECT SUM(L_QUANTITY)
FROM LINEITEM JOIN ORDERS
              ON L_ORDERKEY = O_ORDERKEY
              JOIN CUSTOMER
              ON O_CUSTKEY = C_CUSTKEY
WHERE C_ADDRESS LIKE '%city%';
```

(ii)

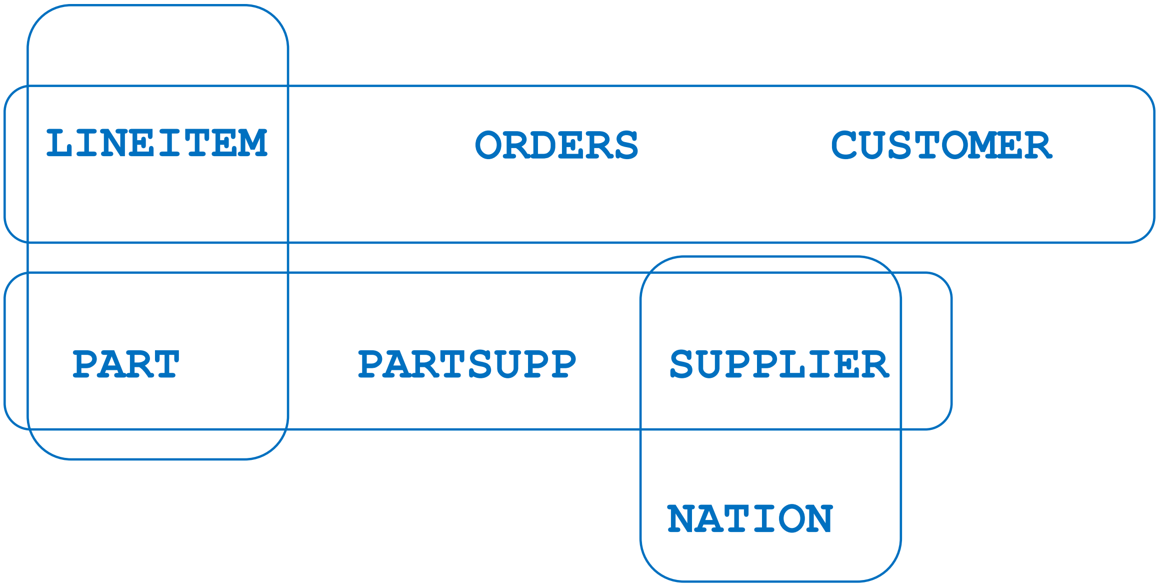
```
SELECT PNAME
FROM PART JOIN LINEITEM
          ON P_PARTKEY = L_PARTKEY
WHERE L_SHIPDATE = 'date'
```

(iii)

```
SELECT PNAME
FROM PART JOIN PARTSUPP
          ON P_PARTKEY = PS_PARTKEY
          JOIN SUPPLIER
          ON PS_SUPPKEY = S_SUPPKEY
WHERE S_ADDRESS LIKE '%city%'
```

(iv)

```
SELECT S_NAME
FROM SUPPLIER JOIN NATION
              ON S_NATIONKEY = N_NTIONKEY
WHERE N_ NAME = 'country_name';
```



```
DRIVE_C:LINEITEM, PARTSUPP, NATION,

DRIVE_D:PART, ORDERS,  SUPPLIER, CUSTOMER
```

End of sample solution