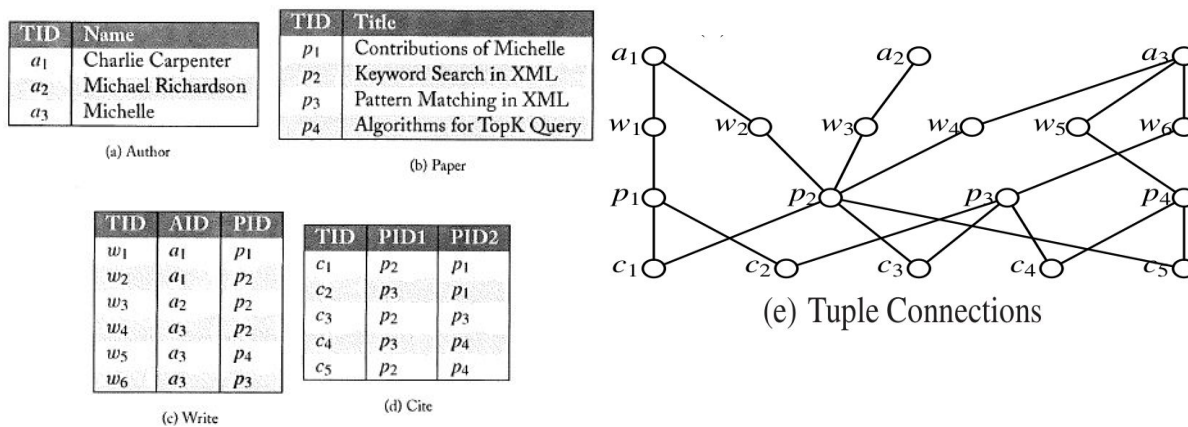


Task 1: Minimal Total Joining Network of Tuples (MTJNTs)

Given are the following database, its database graph, the query K and the size control parameter T_{max} (maximum number of tuples in MTJNT) as follows.



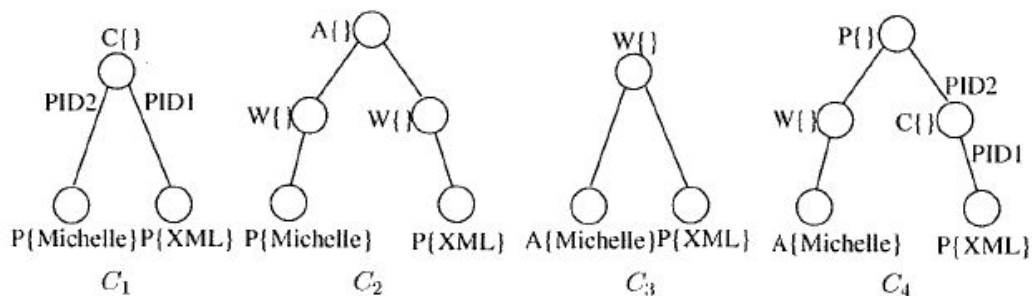
$K = \{Michelle, XML\}$

$T_{max} = 5$

Find all MTJNTs for query K .

Task 2: Candidate Networks (CN)

Given are the following CNs:



Write SQL query expressions to generate C_1, \dots, C_4 .

You can also try your queries online here: <https://sqliteonline.com>. First, load the database file linked on the lecture's website (<https://www2.kbs.uni-hannover.de/399.html>). When you execute your query online, use "a LIKE %b%" instead of "contains(a,b)".

Task 3: CN generation algorithm

Given are the CN generation algorithm, a schema graph and the query keyword relations as follows.

CN generation algorithm (BFS-based):

Algorithm 1 Discover-CNGen (Q, T_{max}, G_S)

Input: an l -keyword query $Q = \{k_1, k_2, \dots, k_l\}$, the size control parameter T_{max} , the schema graph G_S .

Output: the set of CNs $C = \{C_1, C_2, \dots\}$.

```

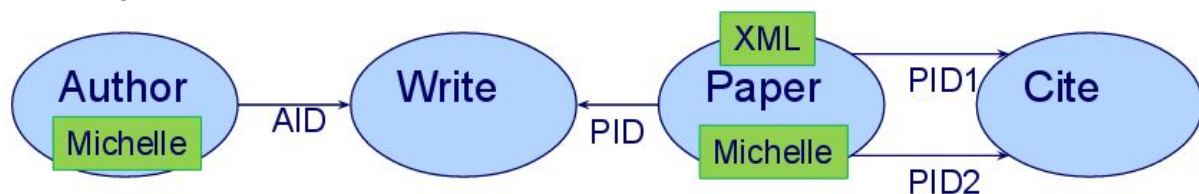
1:  $Q \leftarrow \emptyset; C \leftarrow \emptyset$ 
2: for all  $R_i \in V(G_S), K' \subseteq Q$  do
3:    $Q.enqueue(R_i\{K'\})$ 
4: while  $Q \neq \emptyset$  do
5:    $T \leftarrow Q.dequeue()$ 
6:   if  $T$  is minimal and total and  $T$  does not satisfy Rule-1 then
7:      $C \leftarrow C \cup \{T\}$ ; continue
8:   if the size of  $T < T_{max}$  then
9:     for all  $R_i \in T$  do
10:      for all  $(R_i, R_j) \in E(G_S)$  or  $(R_j, R_i) \in E(G_S)$  do
11:         $T' \leftarrow T \cup (R_i, R_j)$ 
12:        if  $T'$  does not satisfy Rule-2 or Rule-3 then
13:           $Q.enqueue(T')$ 
14: return  $C$ ;
```

Rule 1: There are no duplicates in C .

Rule 2: The CN is minimal.

Rule 3: The CN does not contain cycles.

Schema graph:



Keyword relations:

$A\{Michelle\}, P\{XML\}, P\{Michelle\}$

Write down the essential steps of of the algorithm until the first valid (i.e. total and minimal) CN is generated.