CentraleSupelec, 2017-2018

Programming languages and platforms

Group : Yuan ZHANG, Zhenyu ZOU

CentraleSupélec

Task Distribution

Question 2.7 :

- Code : Zhenyu ZOU
- Report : Zhenyu ZOU

Question 2.8 :

- Code : Yuan ZHANG
- Report : Zhenyu ZOU

Question 5.1 :

- Code : Yuan ZHANG
- Report : Yuan ZHANG, Zhenyu ZOU

Question 5.2 :

- Code : Yuan ZHANG
- Report : Yuan ZHANG, Zhenyu ZOU

Question 5.3 :

- Code : Zhenyu ZOU
- Report : Yuan ZHANG, Zhenyu ZOU

Question 2.7

```
ANNEE PLANTATION,  HAUTEUR
1935,  13.0
1854,  20.0
1862,  22.0
1906,  16.0
1784,  30.0
1860,  45.0
1840,  40.0
...
```

Result of question 2.7

Question 2.8

```
USAF Code: 999999,  Station's name: SAN ANGELO GOODFELLOW AFB    ,  FIPS Country ID: US,  Altitude: +0573.0
USAF Code: 999999,  Station's name: BIGGS AFB                    ,  FIPS Country ID: US,  Altitude: +1196.0
USAF Code: 999999,  Station's name: AURORA BUCKLEY FIELD ANGB    ,  FIPS Country ID: US,  Altitude: +1725.8
USAF Code: 999999,  Station's name: LUBBOCK WEST TEXAS AIR TERMIN,  FIPS Country ID: US,  Altitude: +0987.9
USAF Code: 999999,  Station's name: ROSWELL MUNI AP              ,  FIPS Country ID: US,  Altitude: +1106.1
USAF Code: 999999,  Station's name: EL PASO MUNICIPAL ARPT       ,  FIPS Country ID: US,  Altitude: +1193.6
USAF Code: 999999,  Station's name: TUCUMCARI FAA AP             ,  FIPS Country ID: US,  Altitude: +1231.1
USAF Code: 999999,  Station's name: ALBUQUERQUE MUNICIPAL ARPT   ,  FIPS Country ID: US,  Altitude: +1619.7
USAF Code: 999999,  Station's name: CLAYTON MUNICIPAL AIRPARK    ,  FIPS Country ID: US,  Altitude: +1515.5
USAF Code: 999999,  Station's name: RATON MUNICIPAL CREWS FIELD A,  FIPS Country ID: US,  Altitude: +1935.2
USAF Code: 999999,  Station's name: PAMPA                        ,  FIPS Country ID: US,  Altitude: +0985.1
USAF Code: 999999,  Station's name: GUADALUPE PASS               ,  FIPS Country ID: US,  Altitude: +1663.0
USAF Code: 999999,  Station's name: OTTO FAA AP                  ,  FIPS Country ID: US,  Altitude: +1900.1
USAF Code: 999999,  Station's name: ACOMITA FAA AP               ,  FIPS Country ID: US,  Altitude: +2007.1
USAF Code: 999999,  Station's name: COLUMBUS                     ,  FIPS Country ID: US,  Altitude: +1239.0
USAF Code: 999999,  Station's name: SALT FLAT                    ,  FIPS Country ID: US,  Altitude: +1132.9
USAF Code: 999999,  Station's name: EL MORRO CAA AP              ,  FIPS Country ID: US,  Altitude: +2171.1
USAF Code: 999999,  Station's name: ALAMOSA ARPT                 ,  FIPS Country ID: US,  Altitude: +2298.5
USAF Code: 999999,  Station's name: DENVER STAPLETON AIRFIELD    ,  FIPS Country ID: US,  Altitude: +1626.1
USAF Code: 999999,  Station's name: EAGLE COUNTY AP              ,  FIPS Country ID: US,  Altitude: +1991.9
USAF Code: 999999,  Station's name: GOODLAND RENNER FIELD        ,  FIPS Country ID: US,  Altitude: +1124.1
USAF Code: 999999,  Station's name: GRAND JUNCTION WALKER FIELD  ,  FIPS Country ID: US,  Altitude: +1474.9
```

Result of question 2.8

Question 5.1 : TF-IDF

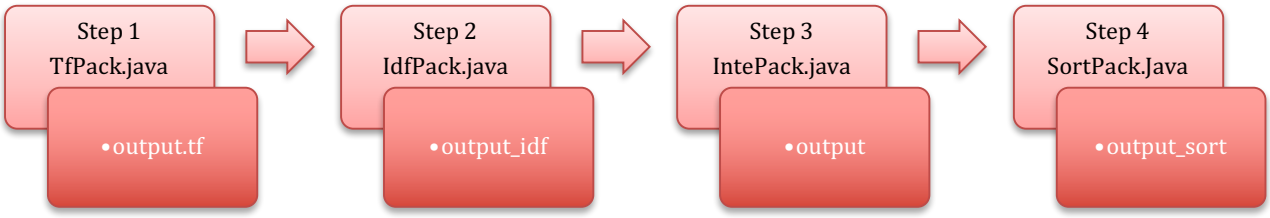
TF-IDF measures how important a word to a document or a groupe of documents. TF shows the frequency of a term in a document and IDF describes how much of information that this term provides.

This program includes :

1) java files
   - Tfidf_Driver.java : main program
   - TfPack.java : TF calculation
   - IdfPack.java : IDF calculation
   - IntePack.java : combine the result of TF&IDF and calculate TF-IDF
   - SortPack.java : results sorting

2) 2 input files
   - callwild
   - defoe-robinson-103.txt

3) 4 output files
   - output_tf
   - output_idf
   - output
   - output_sort

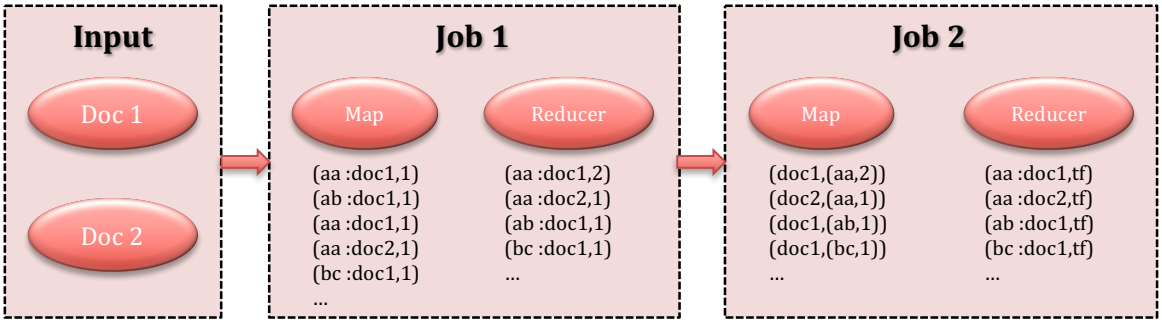


- **Step 1 (TfPack.java)**

This step aims to calculate : $tf_{wrd} = \frac{wordCount}{wordsPerDoc}$. We define two jobs, let's denote job 1 and job 2.

Job 1
- Mapper result: (word :docName, 1)
- Reducer result: (word :docName, wordCount)

Job 2
- Mapper result: (docName, (word, wordCount)), (produced by remapping the result of the output of Job 1)
- Reducer result: Generates the pair (word :docName, tf)



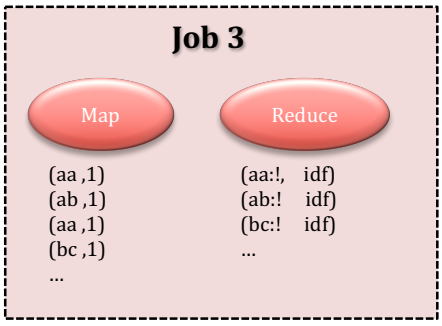
This step generates an output file of tf as the below screenshot shows (tf :2nd column) :

```
perches:callwild        3.096838128271035E-5
hysteria:callwild       3.096838128271035E-5
attended:callwild       3.096838128271035E-5
yukon:callwild  2.1677866897897247E-4
holding:callwild        6.19367625654207E-5
advances:callwild       1.238735251308414E-4
discharged:callwild     6.19367625654207E-5
answered:callwild       9.290514384813106E-5
pleading:callwild       3.096838128271035E-5
solleks:callwild        3.096838128271035E-5
slope:callwild  9.290514384813106E-5
advanced:callwild       6.19367625654207E-5
...
```

- **Step 2 (IdfPack.java)**

This step aims to calculate : $idf_{wrd} = \log\left(\frac{totalDocs}{DocsPerWord}\right)$. Let's denote job 3 that helps us to generate the result based on the output of the step 1.

Job 3
- Mapper result: (word : 1) (produced by remapping the result of the output of Job 2)
- Reducer result: (word :! idf), which is the idf of the doc 1 or doc 2. (here, ":!"is for easy combination of TF & IDF in IntePack)



This step generates an output file of idf as the below screenshot shows (idf :2nd column) :

```
a:!       0.0
aback:!  0.3010299956639812
abandoned:!       0.3010299956639812
abandoning:!      0.3010299956639812
abandonment:!     0.3010299956639812
abate:!  0.3010299956639812
abated:!          0.3010299956639812
abatement:!       0.3010299956639812
abating:!         0.3010299956639812
abed:!   0.3010299956639812
abhor:!  0.3010299956639812
abhorrence:!      0.3010299956639812
abide:!  0.0
abiding:!         0.3010299956639812
ability:!         0.3010299956639812
abjectly:!        0.3010299956639812
able:!   0.0
…
```

- **Step 3 (IntePack.java)**

This procedure combines the results of step 1 and step 2. Then we could generate an output file of tf-idf as the below screenshot shows (tf-idf :2nd column) :

```
a:callwild      0.0
a:defoe-robinson-103.txt        0.0
aback:callwild  9.3224116832548l5E-6
abandoned:defoe-robinson-103.txt        9.882796968861396E-6
abandoning:defoe-robinson-103.txt       2.470699242153496-6
abandonment:callwild    9.3224116832548l5E-6
abate:defoe-robinson-103.txt    2.9648390905841877E-5
abated:defoe-robinson-103.txt   2.4706992421534895E-5
abatement:defoe-robinson-103.txt        2.470699242153496-6
abating:defoe-robinson-103.txt  2.470699242153496-6
abed:defoe-robinson-103.txt     2.470699242153496-6
abhor:defoe-robinson-103.txt    2.470699242153496-6
abhorrence:defoe-robinson-103.txt       1.4824195452920939E-5
abide:callwild  0.0
abide:defoe-robinson-103.txt    0.0
abiding:callwild        9.3224116832548l5E-6
ability:callwild        1.8644823366509636-5
abjectly:callwild       9.3224116832548l5E-6
able:callwild   0.0
able:defoe-robinson-103.txt     0.0
abode:defoe-robinson-103.txt    7.412097726460469E-6
abominable:defoe-robinson-103.txt       4.941398484306986-6
abortive:defoe-robinson-103.txt 2.470699242153496-6
about:callwild  0.0
```

- **Step 4 (SortPack.java)**

This step sorts the result of td-idf as a descending order.

```
buck:callwild   0.003356068205971733
dogs:callwild   0.001100044578624068
thornton:callwild       9.50885991691991E-4
myself:defoe-robinson-103.txt   7.21444178708819E-4
spitz:callwild  6.059567594115629E-4
sled:callwild   5.873119360450533E-4
francois:callwild       5.593447009952889E-4
friday:defoe-robinson-103.txt   4.570793597983956E-4
trail:callwild  3.822188790134474E-4
john:callwild   3.7289646733019256E-4
perrault:callwild       3.635740556469377E-4
hal:callwild    3.4492923228042813E-4
team:callwild   3.1696199723066372-4
thoughts:defoe-robinson-103.txt 2.7424761587903736E-4
sol:callwild    2.7034993881438964E-4
traces:callwild 2.610275271311348E-4
leks:callwild   2.610275271311348E-4
ice:callwild    2.610275271311348E-4
around:callwild 2.4238270376462516E-4
dave:callwild   2.3306029208137037E-4
mates:callwild  2.0509305703160592E-4
mercedes:callwild       1.957706453483511E-4
```

Question 5.2 : PageRank

PageRank is an algorithm to measure the importance of website pages.
In our project, we apply the Efficient Computation of PageRank. [1]

This program includes :

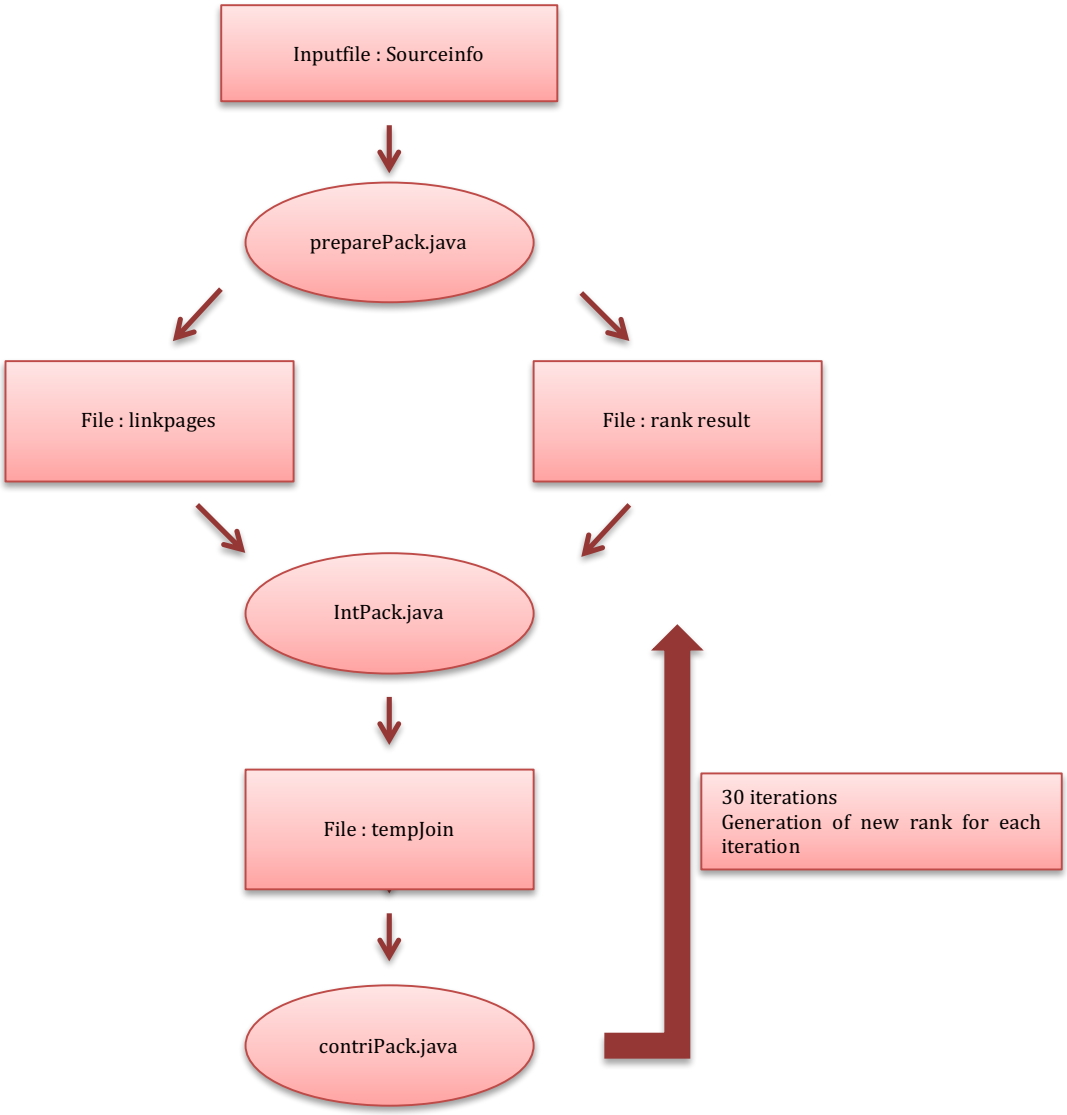
1) java files
   - PageRank_Driver.java : main program
   - preparePack.java : adjust the input file data (preprocessing)
   - IntePack.java : integrates the "linkpages" file with the new rank results
   - contriPack.java : applys the algorithm to calculate the new rank results
   - SortPack.java : results sorting after the 30th iteration

2) input file
   - sourceinfo

3) output file
   - rank i, i=1,…30: the rank result for each iteration
   - rans sort : results sorting

4) other files
   - linkpages : one result of preprocessing
   - rank 0 : the other result of preprocessing, the initial rankings
   - tempJoin : the joined file of « linkpages » and « rank » for each time

[1] reference :http://infolab.stanford.edu/~ullman/mmds/ch5.pdf, page 178



procedure of question 5.2

- **Step 1 (preparePack.java)**

Firstly, we regroup the data file and get the result named « linkpages », let's take an example as below :

FromNodeID	ToNodeID
0	(1,3)
1	2
2	(1,2)
3	(2,3)

- key =FromNodeID
- value = all the ToNodeID which are connected to this FromNodeID .

We initialize the rankings as below :

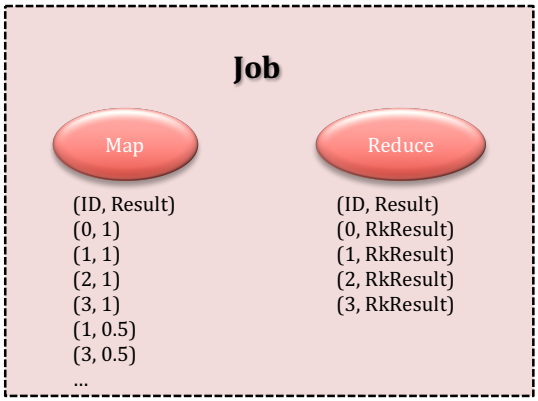
NodeID	Rank Result
0	1
1	1
2	1
3	1

- **Step 2 (IntePack.java and contriPack.java)**

IntePack.java will integrate the data we obtained in the Step 1 and the linkpages, it generates a new « joint data ».
For example, the result of the IntePack for the first time:

FromNodeID	Rank Result
0	(1,3)@1@[2]
1	@1@(2)
2	(1,2)@1@
3	(2,3)@1@

And then calculate the contributions of « ToNodeID » :
contriPack.java will use the new « joint data » of the previous IntePack job, and then generate a new rank result (rank i, with i=1,…30),
which is shown in the graph below:



For example, this is the mapper result of the contriPack for the first time:

[2] we use @ in order to identify the rank result

NodeID	Rank Result
1	0.5
3	0.5
2	1
1	0.5
2	0.5
2	0.5
3	0.5

We run many times IntePack and contriPack and we will get new rank result for each time, which is like this:

NodeID	Rank Result
0	Rk Result ith iteration
1	Rk Result ith iteration
2	Rk Result of ith iteration
3	Rk Result of ith iteration

We obtain the final result of the 30th time :

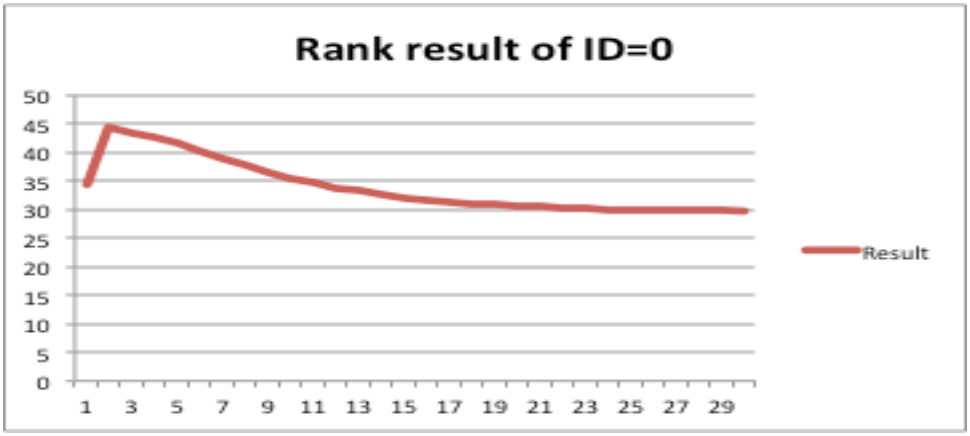
```
0       @29.679081056999532@
1       @36.265688675189 99@
10      @14.253779288194396@
100     @15.6797943197851 56@
1000    @1.3541512829318476@
10000   @0.42618724678253 93@
10001   @0.76394114717533 07@
10002   @4.350148557117924@
10003   @2.238645649459073@
1001    @1.9638216058153528@
10010   @0.1963673013153758@
10011   @0.2025987497150164@
10013   @0.18644887218346895@
…
```

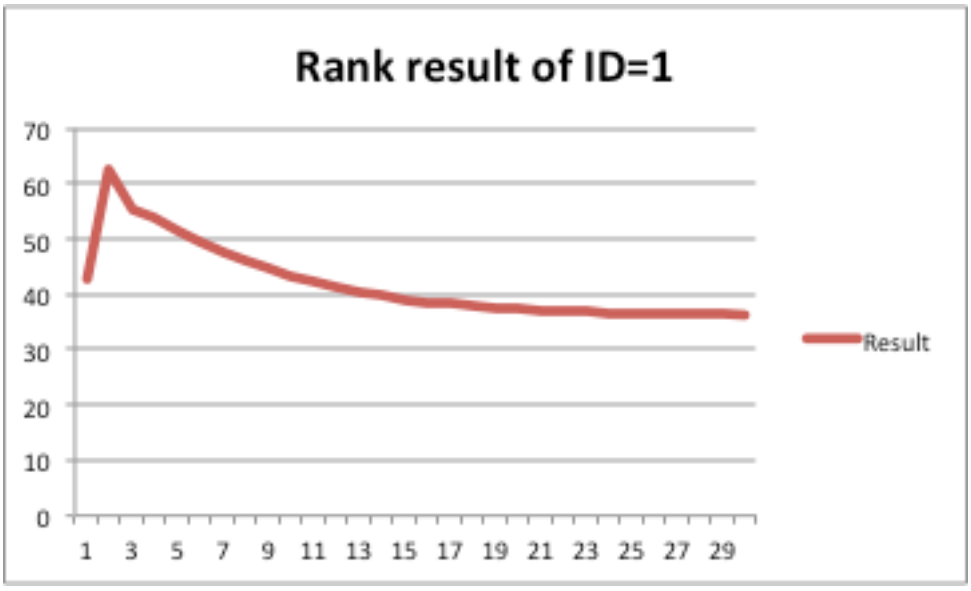
- **Step 3 (SortPack.java)**

Sorting the result :

```
18      141.1780450766438
737     94.8014137571071
1719    67.07283922696732
118     66.03677822420498
143     64.12731657831327
136     62.19629634407251
790     62.020526926539944
40      58.00436331347216
1619    47.140209572422386
725     46.905038131331885
1179    45.83121246574543
401     45.44736683379003
849     44.809715309030615
27      44.75970975500976
77      43.94857127887023
```

The below graphs show the convergence of the results while the iteration times increase.

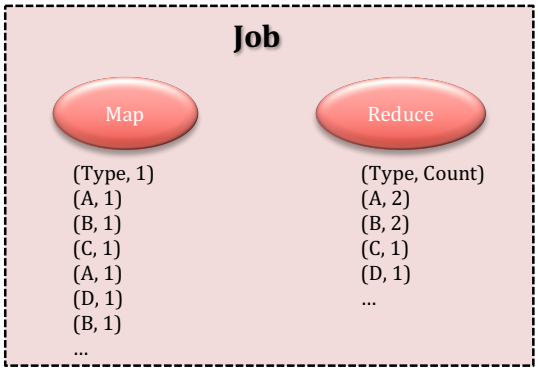

Rank result of ID=0
50
45
40
35
30
25
20
15
10
5
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Result


Rank result of ID=1
70
60
50
40
30
20
10
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Result

Question 5.3 : Trees of Paris

- **Compute the number of trees per type**

Job

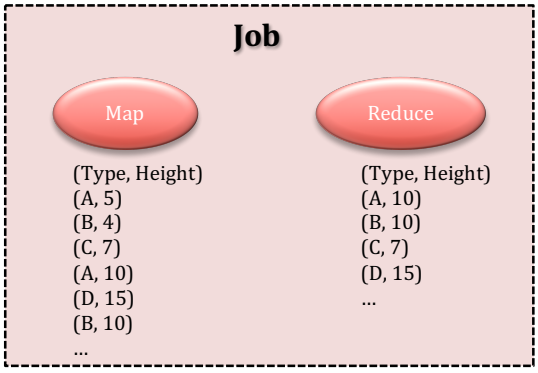


Output

```
Acer    3
Aesculus        3
Ailanthus       1
Alnus   1
Araucaria       1
Broussonetia    1
Calocedrus      1
Catalpa 1
Cedrus  4
Celtis  1
Corylus 3
Davidia 1
Diospyros       4
Eucommia        1
Fagus   8
```

- **Compute the highest tree of each type**

Job

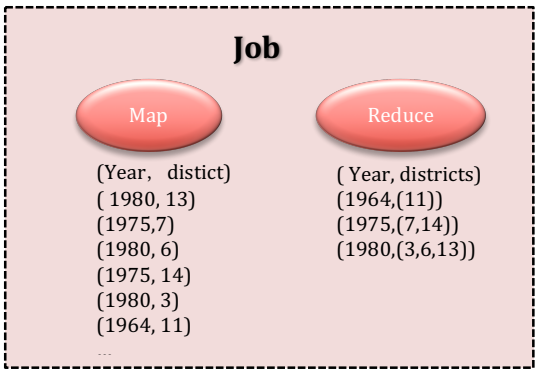


Output

```
Acer     16.0
Aesculus          30.0
Ailanthus         35.0
Alnus    16.0
Araucaria         9.0
Broussonetia      12.0
Calocedrus        20.0
Catalpa  15.0
Cedrus   30.0
Celtis   16.0
Corylus  20.0
Davidia  12.0
Diospyros         14.0
Eucommia          12.0
Fagus    30.0
Fraxinus          30.0
Ginkgo   33.0
Gymnocladus       10.0
Juglans  28.0
```

- **Find the distict of the oldest tree of Paris ("reduce" will sort the result automatically according to keys)**

Job



Output

```
1601    5,
1772    16,
1782    16,
1784    12,
1814    8,7,
1815    12,
1829    12,
1833    20,
1840    17,14,
1843    16,
1845    12,
1847    16,
1850    8,16,16,
1852    16,16,
1854    8,
```