BigData – Spark
Hands-On : File IO

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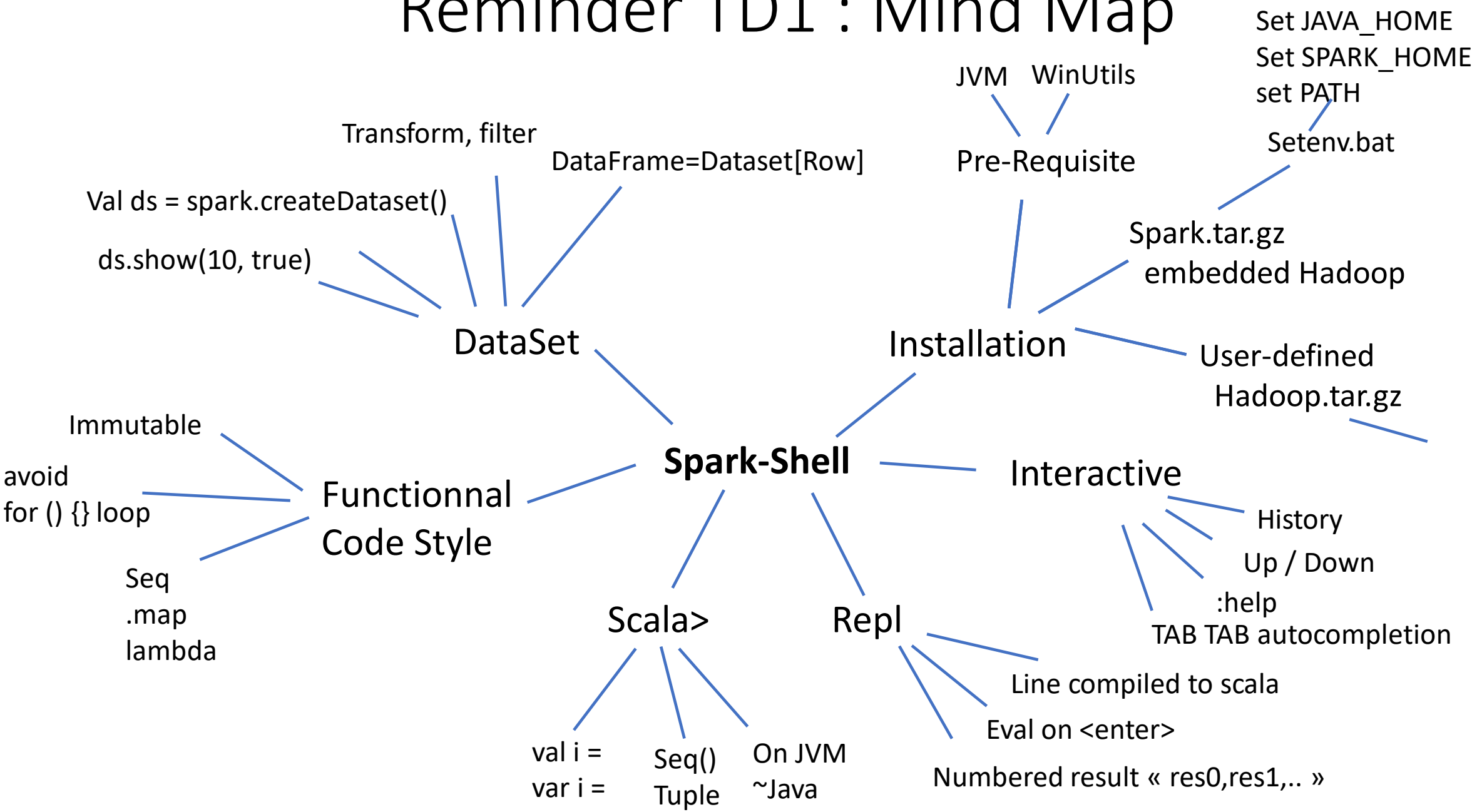
Outline

Reminder on TD1
Questions ? Problems on TD1 ?

Objective of TD2: mostly Files Input-Output

Pre-requisistes: same as TD1: « spark-shell »

Reminder TD1 : Mind Map



Objectives of Hands-On

1/ read CSV files, convert options

2/ read combine several files

3/ others file format: json, nd-json, xml, text

4/ write to PARQUET files dir
repartitionning

5/ Discover PARQUET format optimisations

Exercise 1: edit a csv file with few lines + Header

Edit a CSV file, with columns « id, text, boolean, date, doubleValue, .. »

Use either a text editor: Notepad++, SublimeText, IntelliJ / Eclipse, …

First line should be « header » : columns names
All other lines = values, separated by « ; »
Strings may contain special ‘;’ character, but should be wrapped with double quotes

Save as file « c:\data\sample-data1.csv »

Exercise 1..

```
id;text;boolean;date;doubleValue
1;hello 1;true;2020/01/24;3.1415926
2;hello 2;false;2020/01/25;2.71828
3;hello 3;true;2020/01/26;1.4142135
4;"hello multi-lines\n line 2..\n line 3";false;2020/01/27;0.0
5;"hello line containing ;;; chars";false;2020/01/28;1.0
```

Exercise 2 : Read CSV file from spark-shell

val **sample1Ds** = spark.read. ….

use
  spark**.read .option**(…) **.format**(« csv ») **.load** (path)
OR equivalent
  spark**.read .option**(…) **.csv**(path)

CHECK :
1/ correct path
2/ option to set the field delimiter
3/ option to interpret the first header line correctly
4/ cast or interpret types correctly
5/ use sample1Ds.show(20, false) to check lines
6/ use sample1Ds.printSchema to check types
  … string,boolean,int should be OK
  for date .. Cf Exercise 3 or 5 !

Exercise 3: use .schema(« col1 type1, ..»)

Add

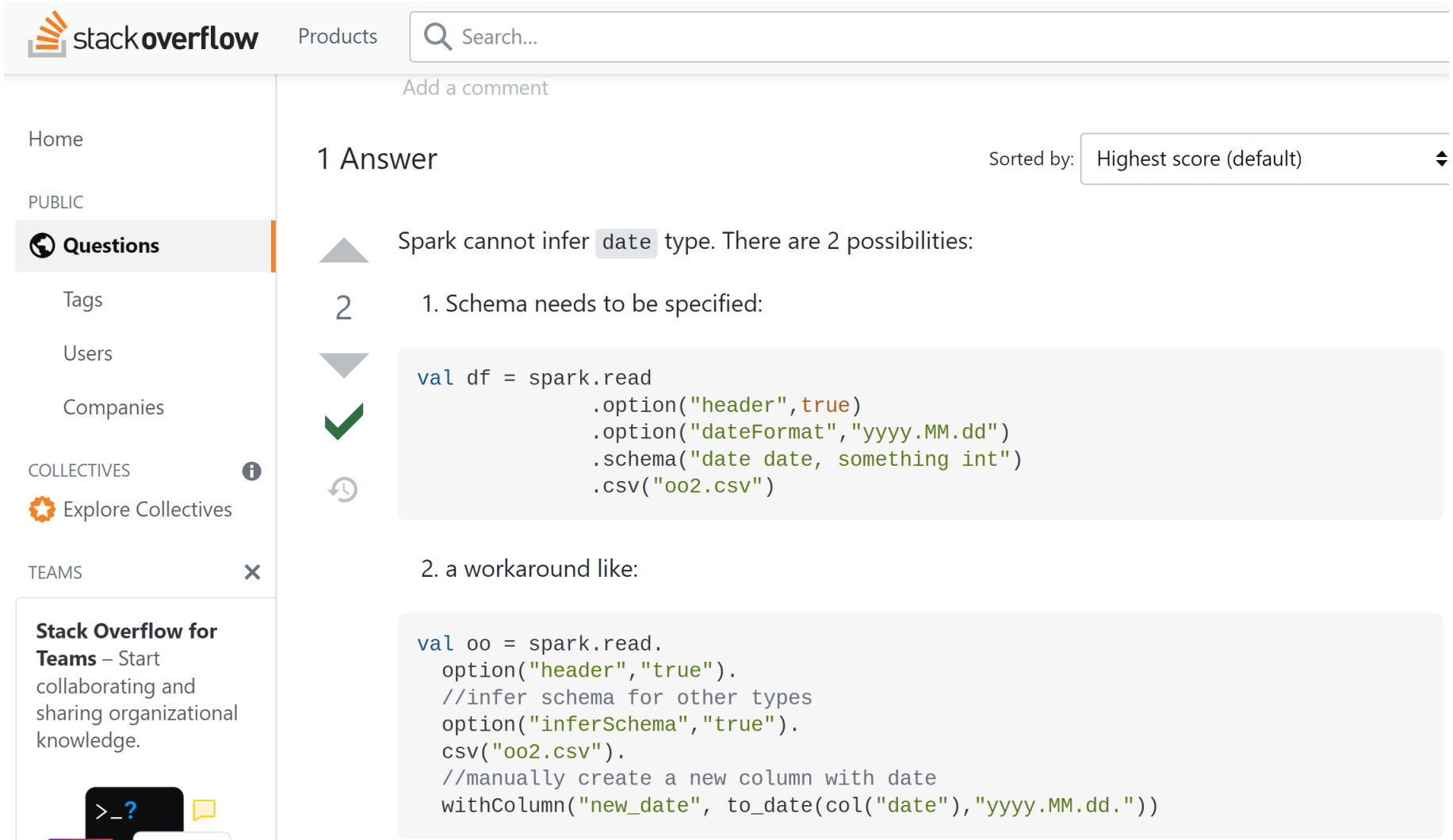
spark.read .. **.schema(** « name1 type1, name2 type2….. »**)**

to force column types

(but maybe not date columns that may need explicit parsing .. cf next !)

Exercise 3: Spark can not inferSchema for date …

https://stackoverflow.com/questions/66935214/spark-reading-csv-with-specified-date-format



Exercise 4: use schema for file with no Header line

copy file « sample-data1.csv » without the header line
save as « sample-data1-no-header.csv »

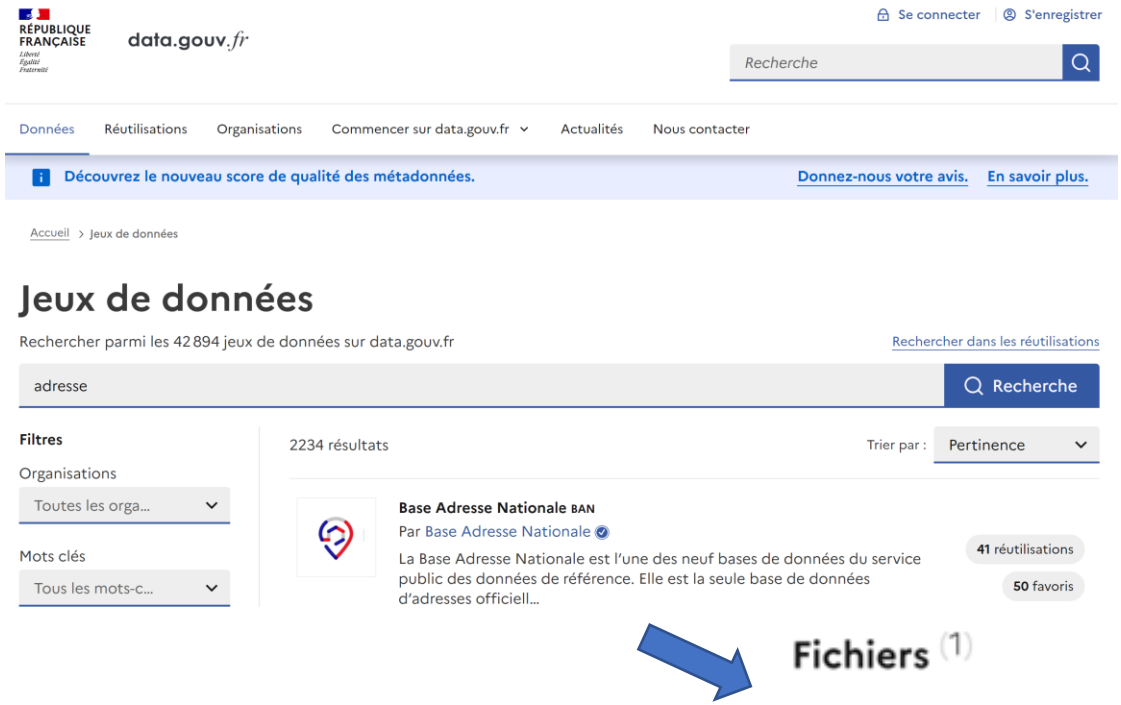
Read CSV file using option(« schema », « ….. »)

Exercise 5: post processing conversion String->Date

From Dataset sample1Ds (from exercise3/)
… with date as String

Define new column « parsed_date » with typed date,
then drop previous « date » text column,
then rename column

Exercise 6: real CSV Files, example of Open Data



https://www.data.gouv.fr

https://www.data.gouv.fr/fr/datasets/base-adresse-nationale/

Base Addresse Nationale:
number, street, city, zipCode, latitude, longitude …

1 CSV file 3.3 Go
.. Or split by 990 files x 33 Ko

Exercise 6 … download + uncompress files

https://adresse.data.gouv.fr/data/ban/adresses/latest/csv-bal/

Index of /data/ban/adresses/latest/csv-bal/

../		
adresses-01.csv.gz	26-Sep-2022 07:46	6788728
adresses-02.csv.gz	26-Sep-2022 07:46	6264425
adresses-03.csv.gz	26-Sep-2022 07:46	4671417
adresses-04.csv.gz	26-Sep-2022 07:45	2596804
adresses-05.csv.gz	26-Sep-2022 07:45	2303802
adresses-06.csv.gz	26-Sep-2022 07:46	5746570
adresses-07.csv.gz	26-Sep-2022 07:46	5274174
adresses-08.csv.gz	26-Sep-2022 07:46	3186529
adresses-09.csv.gz	26-Sep-2022 07:46	3306036
adresses-10.csv.gz	26-Sep-2022 07:36	3723847
adresses-11.csv.gz	26-Sep-2022 07:36	6426680
adresses-12.csv.gz	26-Sep-2022 07:36	3896309
adresses-13.csv.gz	26-Sep-2022 07:38	13520343
…	…	…
adresses-977.csv.gz	26-Sep-2022 07:44	20
adresses-978.csv.gz	26-Sep-2022 07:44	20
adresses-984.csv.gz	26-Sep-2022 07:44	20
adresses-986.csv.gz	26-Sep-2022 07:44	20
adresses-987.csv.gz	26-Sep-2022 07:44	80482
adresses-988.csv.gz	26-Sep-2022 07:45	734636
adresses-989.csv.gz	26-Sep-2022 07:44	20
adresses-france.csv.gz	26-Sep-2022 07:51	676109377

Exercise: Download few files
01, 02, … 04

990 x small csv.gz files

ALL in ONE = 1 x Big csv.gz files

Exercise 6: load individual CSV files, then do union of DataSets

a/ load files:
address-01.csv -> in dataset01
address-02.csv -> in dataset02
..
address-03 .csv -> in dataset03

b/ do union of datasets: dataset01**.union**(dataset02) .. **.union**(dataset04)

c/ check that count of union = sum of count of individual files

Exercise 7: load multiple CSV files from 1 directory

a/ create an empty directory, for example « C:\data\OpenData-gouv.fr\bal\bal-split-files »

b/ put your few address files in it (adress-01.csv, -02, ..-03, -04)
ensure you have NO other csv files in it

c/ read all files using 1 command: spark.read … taking path of directory (instead of path of file)

d/ check that count is similar to exercise 7/

Exercise 8 … repeat query before/after .cache() explain which query a/b/c/.. perform IO reads

scala> spark.read. … « infer »true

scala> allAdressCsvDs.count

scala> allAdressCsvDs.count

scala> allAdressCsvDs.cache

scala> allAdressCsvDs.count

scala> allAdressCsvDs.count

scala> allAdressCsvDs.count

a/ Read? … for schema/statistics, but data not retained in memory

b/ Read ?

c/ Read ?

d/ Read ?

e/ Read ?

f/ Read ?

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repartitionning

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10 mn pause

APPENDIX …
If you have finished exercises 1-8, but your friends are still struggling ?

Idea 1 / help your struggling friends

Idea 2/ imagine processing queries on OpenData addresses
(see next)

APPENDIX 1: Exercise 6 was loading « addresses » …

What could you process out of this ?

Suggestions:

1. Extract all city names with zipCode, average latitude/longitude
2. Extract all distinct street names
3. Extract number of addresses and number of streets per city
4. Detect all street named to a person « firstname Lastname » given a list of known firstname
5. Count how many times « Victor Hugo » is present
6. Count cities having neither « Victor Hugo », nor « Balzac », or « Picasso »
7. Detect cities having one of « Leningrad », « Stalingrad », « Maurice Thorez »
8. …

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6/ Discover Spark UI

Exercise 9: save as json, load json file

a/ write addresses Dataset (from CSV) to JSON

b/ look at written files

is it a valid « .json » file, containing 1 array of objects ?

Or ND-json = New-lines Delimited Json

compare file size of csv and nd-json

c/ load dataset from ND-json file

Exercise 10 : analyze written json files

Repeat the same operation twice, and notice that

1/ you can not specify the file names .. Only an empty directory name !

2/ the file names are generated with a unique UUID
part-00{partNumber}-{UUID}-c000.json

3/ during write time… spark write to « _temporary » sub dir, then rename at the end

4/ spark has written several files …
If using the full dataset of 3Giga .. Spark write 26 json files

(Optional) Exercise 11 : convert ND-json to valid JSON array File
… then load from spark

To convert … you need to

1. add a START_ARRAY delimiter at line 1 : char « **[**«
2. finish all lines with char « **,** » … except the last line !!
3. finish END_ARRAY at last line : char « **]** »

a/ edit manually a little file (~10 lines) / use regexp / or write a program(?)

b/ load this real json « multiline » file from spark

Exercise 12 : Read plain « Text » lines from file

a/ edit a file containing many lines of text

b/ load this text file from spark

c/ count number of lines

d/ what is the difference between spark.read.textFile() and spark.read.text() ?

Exercise 13 : What about xml format ?

Questions

a/ do you see a « xml() » method in spark.read. ?

b/ why ?

c/ suppose you want to extract known <element>..</element> from a <root>..</root>
… How would you convert to a Dataset ?

Exercise 13 … Example of « Big » Xml dump files

https://dumps.wikimedia.org/enwiki/20220901/

More than 100 Gigas of Xml files

2022-09-02 04:32:53 **done** Articles, templates, media/file descriptions, and primary meta-pages, in multiple bz2 streams, 100 pages per stream

enwiki-20220901-pages-articles-multistream1.xml-p1p41242.bz2 251.2 MB
enwiki-20220901-pages-articles-multistream-index1.txt-p1p41242.bz2 221 KB
enwiki-20220901-pages-articles-multistream2.xml-p41243p151573.bz2 336.5 MB
enwiki-20220901-pages-articles-multistream-index2.txt-p41243p151573.bz2 638 KB
enwiki-20220901-pages-articles-multistream3.xml-p151574p311329.bz2 364.6 MB
enwiki-20220901-pages-articles-multistream-index3.txt-p151574p311329.bz2 820 KB
enwiki-20220901-pages-articles-multistream4.xml-p311330p558391.bz2 406.4 MB
enwiki-20220901-pages-articles-multistream-index4.txt-p311330p558391.bz2 1.3 MB
enwiki-20220901-pages-articles-multistream5.xml-p558392p958045.bz2 436.6 MB

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Idea 1 / help your struggling friends

Idea 2/ bonus exercise 14 on textFile

Exercise 14 : the « World Count » Hello-World standard program of BigData

From dataset of text lines from exercise 12/

split all lines into words
… For this, start by « map() » replacing all punctuation marks by a single space
… Then replace 2 successive spaces by a single space
… Then split by space

… then use « flatMap() » instead of « map() »

Finally extract words count

10 mn pause

Continue…

Please open next document: Part2
TD2-Part2 (PARQUET)