Big data: architectures and data analytics

Spark - Exercises

Exercise #30

- Log filtering
  - Input: a simplified log of a web server (i.e., a textual file)
    - Each line of the file is associated with a URL request
  - Output: the lines containing the word "google"
    - Store the output in an HDFS folder

Exercise #30 - Example

- Input file

```
66.249.69.97 - - [24/Sep/2014:22:25:44 +0000] "GET http://www.google.com/bot.html"
66.249.69.97 - - [24/Sep/2014:22:26:44 +0000] "GET http://www.google.com/how.html"
66.249.69.97 - - [24/Sep/2014:22:28:44 +0000] "GET http://dbdmg.polito.it/course.html"
71.19.157.179 - - [24/Sep/2014:22:30:12 +0000] "GET http://www.google.com/faq.html"
66.249.69.97 - - [24/Sep/2014:31:28:44 +0000] "GET http://dbdmg.polito.it/thesis.html"
```

- Output

```
66.249.69.97 - - [24/Sep/2014:22:25:44 +0000] "GET http://www.google.com/bot.html"
66.249.69.97 - - [24/Sep/2014:22:26:44 +0000] "GET http://www.google.com/how.html"
71.19.157.179 - - [24/Sep/2014:22:30:12 +0000] "GET http://www.google.com/faq.html"
```


Exercise #31

- Log analysis
  - Input: log of a web server (i.e., a textual file)
    - Each line of the file is associated with a URL request
  - Output: the list of distinct IP addresses associated with the connections to a google page (i.e., connections to URLs containing the term "www.google.com")
    - Store the output in an HDFS folder

Exercise #31 - Example

- Input file

```
66.249.69.97 - - [24/Sep/2014:22:25:44 +0000] "GET http://www.google.com/bot.html"
66.249.69.97 - - [24/Sep/2014:22:26:44 +0000] "GET http://www.google.com/how.html"
66.249.69.97 - - [24/Sep/2014:22:28:44 +0000] "GET http://dbdmg.polito.it/course.html"
71.19.157.179 - - [24/Sep/2014:22:30:12 +0000] "GET http://www.google.com/faq.html"
66.249.69.95 - - [24/Sep/2014:31:28:44 +0000] "GET http://dbdmg.polito.it/thesis.html"
66.249.69.97 - - [24/Sep/2014:56:26:44 +0000] "GET http://www.google.com/how.html"
56.249.69.97 - - [24/Sep/2014:56:26:44 +0000] "GET http://www.google.com/how.html"
```

- Output

```
66.249.69.97
71.19.157.179
56.249.69.97
```

Exercise #32

- Maximum value
  - Input: a collection of (structured) textual csv files containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format
      sensorId,date,PM10 value (µg/m³)\n
  - Output: report the maximum value of PM10
    - Print the result on the standard output

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Exercise #32 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,55.5
s2,2016-01-03,52.5
```

- Output

```
60.2
```

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Exercise #33

- Top-k maximum values
  - Input: a collection of (structured) textual csv files containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format
      sensorId,date,PM10 value (µg/m³)\n
  - Output: report the top-3 maximum values of PM10
    - Print the result on the standard output

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Exercise #33 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,55.5
s2,2016-01-03,52.5
```

- Output

```
60.2
55.5
52.5
```

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Exercise #34

- Readings associated with the maximum value
  - Input: a collection of (structured) textual csv files containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format
      sensorId,date,PM10 value (µg/m³)\n
  - Output: the line(s) associated with the maximum value of PM10
    - Store the result in an HDFS folder

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Exercise #34 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,60.2
s2,2016-01-03,52.5
```

- Output

```
s1,2016-01-02,60.2
s1,2016-01-03,60.2
```

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Exercise #35

- Dates associated with the maximum value
  - Input: a collection of (structured) textual csv files containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format
      sensorId,date,PM10 value (μg/m³)\n
  - Output: the date(s) associated with the maximum value of PM10
    - Store the result in an HDFS folder

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Exercise #35 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,60.2
s2,2016-01-03,52.5
```

- Output

```
2016-01-02
2016-01-03
```

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Exercise #36

- Average value
  - Input: a collection of (structured) textual csv files containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format
      sensorId,date,PM10 value (μg/m³)\n
  - Output: compute the average PM10 value
    - Print the result on the standard output

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Exercise #36 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,55.5
s2,2016-01-03,52.5
```

- Output

```
39.86
```

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Exercise #31

- Log analysis
  - Input: log of a web server (i.e., a textual file)
    - Each line of the file is associated with a URL request
  - Output: the list of distinct IP addresses associated with the connections to a google page (i.e., connections to URLs containing the term "www.google.com")
    - Store the output in an HDFS folder

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Exercise #31 - Example

- Input file

```
66.249.69.97 - - [24/Sep/2014:22:25:44 +0000] "GET http://www.google.com/bot.html"
66.249.69.97 - - [24/Sep/2014:22:26:44 +0000] "GET http://www.google.com/how.html"
66.249.69.97 - - [24/Sep/2014:22:28:44 +0000] "GET http://dbdmg.polito.it/course.html"
71.19.157.179 - - [24/Sep/2014:22:30:12 +0000] "GET http://www.google.com/faq.html"
66.249.69.95 - - [24/Sep/2014:31:28:44 +0000] "GET http://dbdmg.polito.it/thesis.html"
66.249.69.97 - - [24/Sep/2014:56:26:44 +0000] "GET http://www.google.com/how.html"
56.249.69.97 - - [24/Sep/2014:56:26:44 +0000] "GET http://www.google.com/how.html"
```

- Output

```
66.249.69.97
71.19.157.179
56.249.69.97
```

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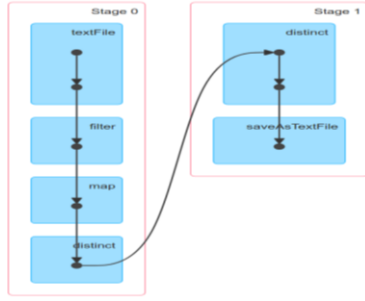
Exercise #31 - DAG



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Exercise #31 - Simulation

- Suppose that Sparks splits the RDD associated with the input file in two partitions
- Part. #1

```
66.249.69.97 - - [24/Sep/2014:22:25:44 +0000] "GET http://www.google.com/bot.html"
66.249.69.97 - - [24/Sep/2014:22:26:44 +0000] "GET http://www.google.com/how.html"
66.249.69.97 - - [24/Sep/2014:22:28:44 +0000] "GET http://dbdmg.polito.it/course.html"
```

- Part. #2

```
71.19.157.179 - - [24/Sep/2014:22:30:12 +0000] "GET http://www.google.com/faq.html"
66.249.69.95 - - [24/Sep/2014:31:28:44 +0000] "GET http://dbdmg.polito.it/thesis.html"
66.249.69.97 - - [24/Sep/2014:56:26:44 +0000] "GET http://www.google.com/how.html"
56.249.69.97 - - [24/Sep/2014:56:26:44 +0000] "GET http://www.google.com/how.html"
```

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Exercise #31 - Simulation

Part. #1

```
66.249.69.97 - - [24/Sep/2014:22:25:44 +0000]
"GET http://www.google.com/bot.html"
66.249.69.97 - - [24/Sep/2014:22:26:44 +0000]
"GET http://www.google.com/how.html"
66.249.69.97 - - [24/Sep/2014:22:28:44 +0000]
"GET http://dbdmg.polito.it/course.html"
```

Part. #2

```
71.19.157.179 - - [24/Sep/2014:22:30:12 +0000]
"GET http://www.google.com/faq.html"
66.249.69.95 - - [24/Sep/2014:31:28:44 +0000]
"GET http://dbdmg.polito.it/thesis.html"
66.249.69.97 - - [24/Sep/2014:56:26:44 +0000]
"GET http://www.google.com/how.html"
56.249.69.97 - - [24/Sep/2014:56:26:44 +0000]
"GET http://www.google.com/how.html"
```

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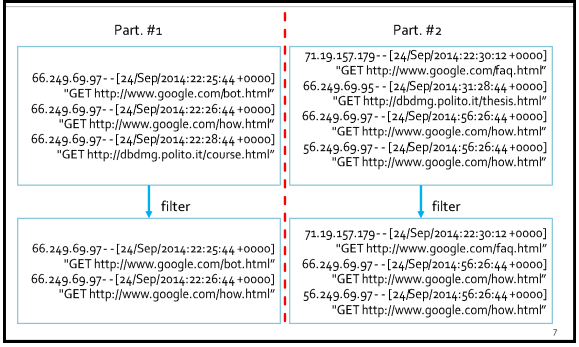
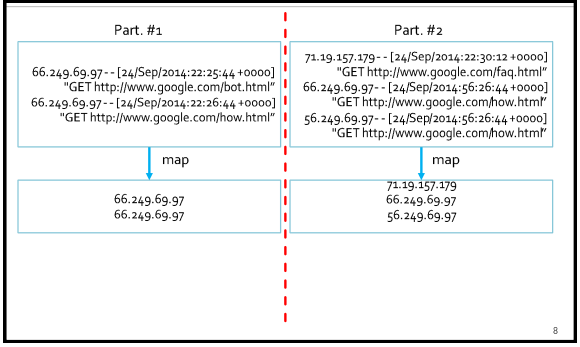
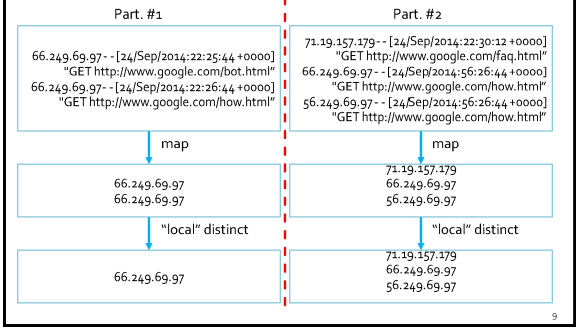
Exercise #31 - Simulation



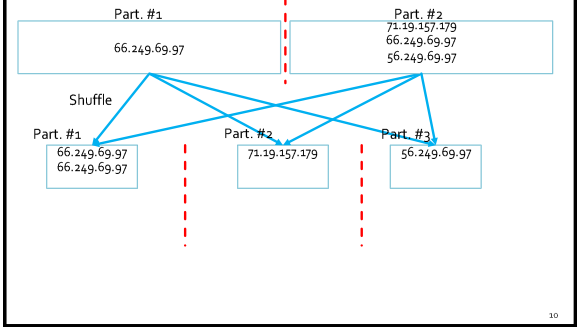
Exercise #31 - Simulation



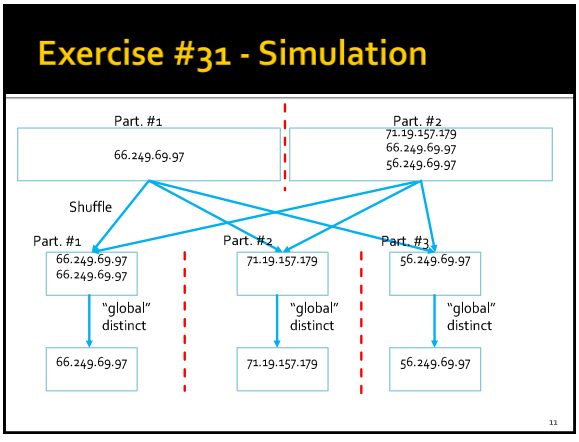
Exercise #31 - Simulation



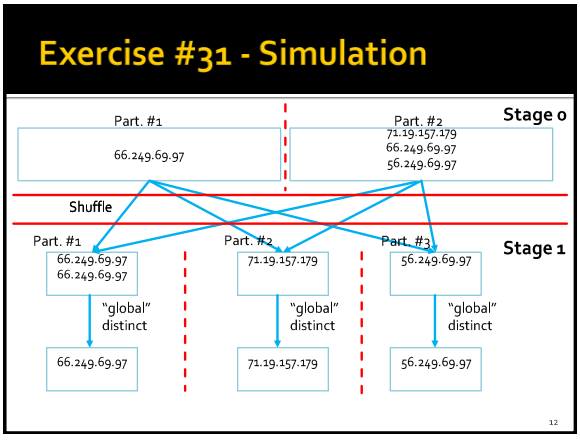
Exercise #31 - Simulation



Exercise #31 - Simulation



Exercise #31 - Simulation



Big data: architectures and data analytics

Spark - Exercises

Exercise #37

- Maximum values
  - Input: a textual csv file containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format

      sensorId,date,PM10 value (µg/m^3)\n
  - Output: the maximum value of PM10 for each sensor
    - Store the result in an HDFS file

Exercise #37 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,55.5
s2,2016-01-03,52.5
```

- Output

```
(s1,60.2)
(s2,52.5)
```


Exercise #38

- Pollution analysis
  - Input: a textual csv file containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format

      sensorId,date,PM10 value (µg/m^3)\n
  - Output: the sensors with at least 2 readings with a PM10 value greater than the critical threshold 50
    - Store in an HDFS file the sensorIds of the selected sensors and also the number of times each of those sensors is associated with a PM10 value greater than 50

Exercise #38 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,55.5
s2,2016-01-03,52.5
```

- Output

```
(s1,2)
```

Exercise #39

- Critical dates analysis
  - Input: a textual csv file containing the daily value of PM10 for a set of sensors
    - Each line of the files has the following format

      sensorId,date,PM10 value (µg/m^3)\n
  - Output: an HDFS file containing one line for each sensor
    - Each line contains a sensorId and the list of dates with a PM10 values greater than 50 for that sensor

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Exercise #39 - Example

- Input file

```
s1,2016-01-01,20.5
s2,2016-01-01,30.1
s1,2016-01-02,60.2
s2,2016-01-02,20.4
s1,2016-01-03,55.5
s2,2016-01-03,52.5
```

- Output

```
(s1,[2016-01-02, 2016-01-03])
(s2,[2016-01-03])
```

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