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ФАКУЛЬТЕТ ИНФОРМАТИКА И СИСТЕМЫ УПРАВЛЕНИЯ

КАФЕДРА КОМПЬЮТЕРНЫЕ СИСТЕМЫ И СЕТИ (ИУ6)

НАПРАВЛЕНИЕ ПОДГОТОВКИ 09.04.01 Информатика и вычислительная техника

МАГИСТЕРСКАЯ ПРОГРАММА 09.04.01/07 Интеллектуальные системы анализа, обработки и интерпретации больших данных

ОТЧЕТ

по лабораторной работе № 10

Вариант № 6

Название лабораторной работы: Spark

Дисциплина: Языки программирования для работы с большими данными

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Введение

Целью лабораторной работы является приобретение навыков работы со Spark на языке программирования Java.

Практическая часть

Задание 1

- 1) Выбрать любой датасет на kaggle.com
- 2) Сделать 10 выборок данных по выбранной предметной области Код написанной программы представлен в листинге 1.

Листинг 1 – Программа для первого задания

```
package org.example;
import org.apache.spark.sql.Dataset;
import org.apache.spark.sql.Row;
import org.apache.spark.sql.SparkSession;
public class Main {
    public static void main(String[] args) {
        SparkSession spark = SparkSession.builder()
                .appName("Lab10")
                .master("local")
                .getOrCreate();
        Dataset<Row> flights = spark.read()
                .option("header", true)
                .option("inferSchema", true)
.csv("/Users/ivangorshkov/Documents/BMSTU/BigDataJava/Java-IU6-
12M/Lab10/russian air service CARGO AND PARCELS.csv");
        flights.createOrReplaceTempView("flights");
        spark.sql("SELECT * FROM flights").show();
        spark.sql("select * from flights where Year = '2020'").show();
        spark.sql("select * from flights where Year = '2010'").show();
        spark.sql("select * from flights where May <</pre>
September").show();
        spark.sql("select * from flights where AirportName =
'Trip'").show();
        spark.sql("select AirportName, Year from flights order by
February desc").show();
        spark.sql("select AirportName, Year, March from flights where
January > 150.0 order by November desc").show();
        spark.sql("select AirportName, Year, April from flights order
by May desc").show();
        spark.sql("select AirportName, Year, May, June from flights
where Year = '2014' and AirportName = 'Trip' order by May
desc").show();
        spark.sql("select avg(January) from flights").show();
        spark.stop();
```

Результат выполнения программы показан на рисунке 1.

	January	 February Mar	++ ch April Ma	+ ay June July	August Se	ptember O	+ ctober No	+- vember D	+ ecember Wh	ole year	+ Airport coordinates	
+				.0 0.0 0.0		0.01	0.01	0.01	8.81		Decimal('91.3997	
Aikhal 202	9.9	0.0 0	.0 0.0 0.	.0 0.0 0.0	0.0	0.01	0.0	0.0	0.0	0.01(Decimal('111.543	
Loss 202 Amderma 202				0.0 0.0 0.0 0.0 0.0 0.		0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0		Decimal('125.398 Decimal('61.5774	
Anadyr (Carbon) 2020 Anapa (Vitiazevo) 2020				0.0 0.0 0.0 0.0 0.0 0.0		0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0		Decimal('177.738 Decimal('37.3415	
Apatite (Khibiny) 2020	9.9		.0 0.0 0.	.0 0.0 0.0		0.01	0.0	0.01	8.8	0.01(Decimal('33.5819	
Arkhangelsk (Vask 2020 Arkhangelsk (Talagy) 2020		0.0 8 0.0 8		0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0		Decimal('40.7067 Decimal('40.7148	
Astrakhan (Narima 202	53.55	0.0 0	.0 0.0 0.	.0 0.0 6.0	0.0	0.0	0.0	0.0	0.0	0.01(Decimal('47.9998	
Trip 2020 Baykit 2020		0.0 0 0.0 0		0.0 0.0 0.0 0.0 0.0 0.	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0		Decimal('138.042 Decimal('96.3667	
Barnaul (Titov Name) 2020		0.0 8 0.0 8		0.8 0.0 0. 0.8 0.0 0.	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0		Decimal('83.5477 Decimal('130.399	
white Mountain 202	0.0	0.0 0	.0 0.0 0.	.0 0.0 0.0	0.0	0.01	0.0	0.01	0.0	0.01(Decimal('146.228	
Belgorod 2020 Novy Urengoy 2020		0.0 0 0.0 0		0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0		Decimal('36.5705 Decimal('66.6945	
Belushi 202	9.91	0.0 6	.0 0.0 0.	.0 0.0 0.0	0.0	8.81	0.0	0.0	0.0	0.01(Decimal('47.6234	
Usinsk 2020 Beringovskiy 2020		0.0 8 0.0 8		.0 0.0 6.0 .0 0.0 6.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0		Decimal('65.0461 Decimal('179.293	
only showing top 20 rows												
+												
AirportName Year	January F +-	ebruary March	April Ma	ay June Ju1 +	.y August ++	September +	October M	lovember	December W +-	hole year +-	Airport coordinates	
Abakan 2018 Aikhal 2018			108.7 118 0.8 8	.8 69.3 87. .0 0.0 0		181.4 8.0	88.5 0.0	83.3 0.8	110.6		Decimal('91.3997 Decimal('111.543	
Loss 2010	0.0	0.0 0.0	0.8 8	.0 0.0 0	6 6.0	8.0	0.0	0.8	0.8	0.0 (Decimal('125.398	
Amderma 2018 Anadyr 2018			0.8 0 277.8 213	.0 0.0 0.		8.0 138.0	0.0 191.0	0.8 147.8	0.8 352.8		Decimal('61.5774 Decimal('177.738	
Anapa (Vitjazevo) 2016 Antypayuta 2018	14.62	21.43 25.1	25.25 34.	66 59.19 89.1		62.42	47.53	31.6	29.72		Decimal('37.3415 Not found	
Apatite (Khibiny) 2010	0.0	0.0 0.6	0.8 8	.0 0.0 0	81 8.01	8.0	0.0	0.8	0.8	0.01(Decimal('33.5819	
Arkhangelsk (Vask 2016 Arkhangelsk (Talagy) 2016				.0 0.0 0. .2 191.7 263		8.0 200.22	0.0 191.3	0.8 353.9	0.8 479.2	3015.52 (Decimal('48.7067 Decimal('48.7148	
Astrakhan (Narima 2018 Achinsk 2018		41.91 52.75 8.0 0.6		71 58.99 68.1 .0 0.0 0.		76.19 8.0	71.23 0.0	63.54 0.8	71.06 0.0		Decimal('47.9998 Decimal('98.5664	
Trip 2018	0.0	0.0 0.6	0.81 8	.0 0.0 0	61 6.01	8.01	0.01	0.81	0.81	8.01(Decimal('138.042	
Auctions 2016 Baykit 2016		0.0 0.6 0.0 0.6		.0 0.0 0. .0 0.0 0.	6 6.0 6 6.0	8.0 8.0	0.0 0.0	0.8 0.8	0.8 0.8	0.0 (Decimal('113.479 Decimal('96.3667	
Barnaul (Titov Name) 2018 In Salah 2018		8.0 0.6 8.0 0.6		.0 9.0 0.		8.0 8.0	0.0 0.0	0.8 0.8	0.8		Decimal('83.5477 Decimal('130.399	
white Mountain 2018	0.0	0.0 0.6	0.8 6	.0 0.0 0	61 6.01	8.01	0.01	0.8	0.81	0.010	Decimal('146.228	
Belgorod 2010 Novy Urengoy 2010				.0 0.0 0.		8.0 57.0	0.0 54.8	0.0 85.8	0.8 55.1		Decimal('36.5705 Decimal('66.6945	
ttt												
	+		-+	-++								
AirportName Year		ebruary Marc		/ June July /	lugust Sep	tember Oct	ober Nov	ember Dec	ember Who		rport coordinates	
Abakan 2626	43.58		0 0.0 0.6	0.0 0.0	0.0	0.8	0.0	0.0	0.0	0.0 (De	cimal('91.3997	
Aikhal 2020 Loss 2020		0.0 0. 0.0 0.		0.0 0.0 3 0.0 0.0	0.0 0.0	0.8 0.8	0.0 0.0	0.0 0.0	0.0 0.0		cimal('111.543 cimal('125.398	
Amderma 2020	0.0	0.0 0.	0.0 0.6	0.6 0.6	0.0	0.8	8.0	0.0	0.0	0.0 (De	cimal('61.5774	
Anadyr (Carbon) 2020 Anapa (Vitjazevo) 2020		0.0 0. 0.0 0.			0.0 0.0	0.8 0.8	0.0 0.0	0.0 0.0	0.0 0.0		cimal('177.738 cimal('37.3415	
Apatite (Khibiny) 2020 Arkhangelsk (Vask 2020		0.0 0. 0.0 0.			0.0 0.0	0.8 0.8	0.0 0.0	0.0 0.0	0.0 0.0		cimal('33.5819 cimal('40.7067	
Arkhangelsk (Talagy) 2828		0.0 0.		0.0 0.0	0.01	0.8	0.0	0.0	0.0		cimal('40.7148	
Arkhangetsk (Tatagy) 2026 Astrakhan (Narima 2026 Trip 2026	53.55	0.0 0. 0.0 0. 0.0 0.	0 0.0 0.0		0.0 0.0 0.0	0.8 0.8 0.8	0.0 0.0 0.0		0.8 0.8 0.8	0.0 (De		
Astrakhan (Narima 2020 Trip 2020 Baykit 2020	53.55 1.5 0.0	0.0 0. 0.0 0. 0.0 0.	0 0.0 0.0 0 0.0 0.0 0 0.0 0.0	3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0	0.0 9.0 0.0	0.8 0.8 0.8	0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0 0.0 0.0	0.0 (De 0.0 (De 0.0 (De	cimal('40.7148 cimal('47.9998 cimal('138.042 cimal('96.3667	
Astrakhan (Narima 2026 Trip 2026 Baykit 2026 Barnaul (Titov Name) 2026 In Salah 2026	53.55 1.5 0.0 163.4 0.0	0.0 0. 0.0 0. 0.0 0. 0.0 0. 0.0 0.	0 9.0 0.6 0 9.0 0.6 0 9.0 0.6 0 9.0 0.6	3 0.6 9.0 3 0.6 9.0 3 0.6 9.0 3 0.6 9.0 3 0.6 9.0	0.0 0.0 0.0 0.0 0.0	0.8 6.8 6.8 6.8	8.8 8.8 8.8 8.8 8.8	9.0 9.0 9.0 9.0 9.0 9.0	0.8 0.8 0.8 0.8 0.8	8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De	cimal('40.7148 cimal('47.9998 cimal('138.842 cimal('96.3667 cimal('83.5477 cimal('130.399	
Astrakhan (Narima 2026 Trip 2026 Baykit 2026 Barnaul (Titov Name) 2026	53.55 1.5 8.0 163.4 8.0 9.0	0.0 0. 0.0 0. 0.0 0. 0.0 0.	0 0.0 0.6 0 0.0 0.6 0 0.0 0.6 0 0.0 0.6 0 0.0 0.6	3 0.6 9.0 3 0.6 9.0 3 0.6 9.0 3 0.6 9.0 3 0.6 9.0	9.0 9.0 9.0 9.0	0.8 0.8 0.8 0.8	6.8 6.8 6.8 6.8	8.0 8.0 8.0 8.0 8.0	0.0 0.0 0.0 0.0	9.0 (De 9.0 (De 9.0 (De 9.0 (De 9.0 (De 9.0 (De	cimal('40.7148 cimal('47.9998 cimal('138.042 cimal('96.3667 cimal('83.5477	
Astrakhan (Narima]2820 Tripl2820 Baykit]2820 Barnaul (Titov Name)]2820 In Salah]2820 white Mountain]2820 Belgorod]2828 Novy Urengoy]2820	53.55 1.5 8.0 163.4 8.0 8.0 5.24	9.0 9. 9.0 9. 9.0 9. 9.0 9. 9.0 9. 9.0 9. 9.0 9.	0	3 0.0 0.0 3 0.0 0.0	9.0 9.0 9.0 9.0 9.0 9.0 9.0	0.81 0.81 0.81 0.81 0.81 0.81	6.0 6.0 6.0 6.0 6.0 6.0 6.0	9.0 9.0 9.0 9.0 9.0 9.0 9.0	0.01 0.01 0.01 0.01 0.01 0.01	8.0 (De 9.0 (De 9.0 (De 9.0 (De 9.0 (De 9.0 (De 9.0 (De	cimal('40.7148 cimal('47.9998 cimal('138.042 cimal('93.5477 cimal('83.5477 cimal('139.399 cimal('146.228 cimal('66.6945	
Astrakhan (Marima 2026 Trip 282 Baykst 2026 Barnaul (Titov Name) 2026 In Salah 2026 White Mountain 2026 Belgorod 2026 Rovy Urengoy 2026 Belush 2026 Usinsk 2026	53.55 1.5 0.0 163.4 0.0 0.0 5.24 5.5 0.0	9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9.	0 0 0 0 0 0 0 0 0 0	0.0 0.0	9.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	8.8 6.8 6.8 6.8 6.8 6.8 6.8 6.8	8.9 8.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0	0.81 0.61 0.61 0.61 0.61 0.61 0.61 0.61	8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De	cimal('48.7148 cimal('47.9998 cimal('138.042 cimal('138.3647 cimal('138.3477 cimal('138.399 cimal('36.5785 cimal('36.5785 cimal('66.6945 cimal('65.04461 cimal('65.04461	
Astrakhan (Narima 2826 Trip 2826 Baykit 2826 Barnaul (Titov Name) 2826 In Salah 2826 white Mountain 2826 Belgorod 2828 Novy Urengoy 2826 Belushi 2826	53.55 1.5 8.0 163.4 8.0 8.0 5.24 5.5 8.0 6.0	9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9.	0 0 0 0 0 0 0 0 0 0	31 0.01 0.01 31 0.01 0.01	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	6.6 6.6 6.6 6.6 6.6 6.6 6.6 6.6	6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0	8.9 8.0 9.0 9.0 9.0 9.0 9.0 9.0	0.81 0.61 0.61 0.61 0.61 0.61 0.61	8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De	cimal('48.7148 cimal('47.9998 cimal('38.642 cimal('38.647 cimal('36.3667 cimal('36.5477 cimal('36.599 cimal('36.5785 cimal('36.5785 cimal('66.6945	
Astrakhan (Narima)2026 Trial 2026 Bayikil 12026 Barnaul (Titov Name) 12026 White Mountain 12026 White Mountain 12026 Belganod 12026 Novy Urengoy 12026 Belushi 12026 Usinski 2026 Beringoviski 12026	53.55 1.5 8.0 163.4 8.0 8.0 5.24 5.5 8.0 6.0	9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9. 9.6 9.	0 0.	3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0 3 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	6.6 6.6 6.6 6.6 6.6 6.6 6.6 6.6	8.8 6.8 6.8 6.8 6.8 6.8 6.8 6.8	8.9 8.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0	0.81 0.61 0.61 0.61 0.61 0.61 0.61 0.61	8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De 8.0 (De	cimal('48.7148 cimal('47.9998 cimal('138.042 cimal('138.3647 cimal('138.3477 cimal('138.399 cimal('36.5785 cimal('36.5785 cimal('66.6945 cimal('65.04461 cimal('65.04461	
Astrakhan (Narisa . 1226 Bayiti 1226 Bayiti 1226 Barnaul (Titov Mane) 1296 In Salah 1286 White Mountain 1292 White Mountain 1292 Novy Unengoy 1202 Belugni 1202 Usinski 1206 Beringovskiy 12026	53.55 1.5 0.0 163.4 0.0 0.0 5.24 5.5 0.0 0.0	9.9 9. 9.9 9. 9.9 9. 9.9 9. 9.9 9. 9.9 9. 9.9 9. 9.9 9. 9.9 9. 9.9 9.	9	10.01 0.01 0.01 0.01 0.01 0.01 0.01 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	9.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0 	8.8 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9	9.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9	0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.9 (De 8.9 (De 8.9 (De 8.9 (De 8.9 (De 8.9 (De 8.9 (De 8.9 (De 8.9 (De	cimal('46.7148 cimal('47.998 cimal('47.998 cimal('138.842 cimal('93.867 cimal('18.5477 cimal('138.599 cimal('16.6.8745 cimal('16.6.8745 cimal('16.6.8745 cimal('16.834 cimal('17.9233 cimal('17.9233	+ :es
Astrakhan (Narima . 1226 Bayiti 1226 Barnaul (Titov Name) 1206 In Salah) 1226 white Mountain 1226 white Mountain 1226 Rouy Urengov 1226 Betuani 1226 Usinski 1226 Beringovskiy 1206 willy showing top 28 rows	53.55 1.5 0.0 163.4 0.0 0.0 5.24 5.5 0.0 0.0 0.0	9.9 0. 9.0 0. 9.0 0. 9.0 0. 9.0 0. 9.0 0. 9.0 0. 9.0 0. 9.0 0.	9 9.0 9.	91 6.61 8.61 91 6.01 9.01 91 6.01 9.01	9.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9	6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0	8.8 8.8 8.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9	9.9 9.9 9.9 9.9 9.9 9.9 9.9 9.9	0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	8.9 (De 9.9 (De 9.9 (De 9.9 (De 9.9 (De 9.9 (De 9.9 (De 9.9 (De	cimal('46.7148 cimal('47.998 cimal('47.998 cimal('43.842 cimal('98.5667 cimal('18.5497 cimal('18.599 cimal('16.228 cimal('16.6.6945 cimal('16.6.6945 cimal('176.634 cimal('179.293	
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AirportName|Year|
|Moscow (Sheremety...|2012|
|Moscow (Sheremety...|2019|
|Moscow (Sheremety...|2018|
|Moscow (Sheremety...|2017|
|Moscow (Sheremety...|2011|
|Moscow (Sheremety...|2016|
|Moscow (Sheremety...|2013|
|Moscow (Sheremety...|2014|
|Moscow (Sheremety...|2008|
| Moscow (Domodedovo)|2013|
|Moscow (Sheremety...|2010|
| Moscow (Domodedovo)|2011|
|Moscow (Sheremety...|2007|
| Moscow (Domodedovo)|2014|
| Moscow (Domodedovo)|2012|
|Moscow (Sheremety...|2015|
| Moscow (Domodedovo)|2018|
| Moscow (Domodedovo)|2008|
| Moscow (Domodedovo)|2015|
|Moscow (Sheremety...|2009|
only showing top 20 rows
        AirportName|Year| March|
|Moscow (Sheremety...|2019| 26703.6|
|Moscow (Sheremety...|2017| 25153.5|
|Moscow (Sheremety...|2016| 17486.6|
| Moscow (Domodedovo)|2012| 13593.3|
| Moscow (Domodedovo)|2013|14225.51|
| Moscow (Domodedovo)|2014|14015.58|
| Moscow (Domodedovo)|2010|11290.43|
only showing top 20 rows
|Moscow (Sheremety...|2012| 25820.2|
|Moscow (Sheremety...|2019| 28634.2|
|Moscow (Sheremety...|2018| 24709.4|
|Moscow (Sheremety...|2014| 16924.1|
|Moscow (Sheremety...|2015| 15826.4|
| Moscow (Domodedovo)|2013|13922.46|
| Moscow (Domodedovo)|2011|13999.56|
| Moscow (Domodedovo)|2014|14121.12|
| Moscow (Domodedovo)|2008|11837.18|
| Moscow (Domodedovo)|2018| 9397.39|
|Moscow (Sheremety...|2009| 11585.2|
only showing top 20 rows
|AirportName|Year|May|June|
        . - - - - - + - - - + - - - + - - - +
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Trip|2014|0.0| 0.0|

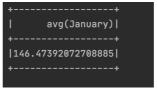


Рисунок 1 – Результат выполнения программы

Вывод: В результате выполнения лабораторной работы были приобретены навыки работы со Spark на языке программирования Java.

Репозитории по ссылке https://github.com/IvanGorshkov/Java-IU6-12M.