Summary

Introduction of the two solutions

To improve the performance, we have tried following two solutions:

1. Solution 1 – reducing shuffle partition number
    a) Rewrite the source data to 4 parquet files using bucketing
    b) set "spark.sql.shuffle.partitions" to 4 and driver number to 4

    As a result, there is reduced shuffle/write. Also we gain good performance at the scenario when broadcast join is disabled

2. Solution 2 – using bucketing

    a) Rewrite the source data to 4 parquet files using bucketing
    b) Read the data to DataFrame as tables
    c) set "spark.sql.shuffle.partitions" to 4 and driver number to 4

As a result, there is NO shuffle read/write in the execution plan. Also we gain good performance when broadcast join is disabled

The above two solutions are similar. Maybe the only difference is that, solution 2 reads the data as a table and solution 1 reads the data not as table. But the results are quite different. For solution 2 , 'bucketing' is achieved, which means, there is no shuffle in the execution plan However one thing worth mentioning, strangely, the performance of solution 2 is slightly worse than solution 1

Performance comparison

As these two tables are both small, the Broadcast join is automatically used for the query by Spark. So we also do experiments on the scenarios that Broadcast join can not be used. This will happen when the two tables are large, say, bigger than 10Mb (the default value "spark.sql.autoBroadcastJoinThreshold').

	With broadcast Join	With broadcast Join Disabled
Original query	3.45 3.17	19.48 18.13
Solution 1	2.17 2.15	2.30 2.22
Solution 2	3.08 3.08	3.23 3.27

The experiments also show:

- For solution 1, there is reduced shuffle;
- For solution 2 . there is no shuffle

Conclusion

The experiment results have confirmed that:

- Our solutions have better performance than the original query.

- More importantly, our solutions are stable – even when broadcast join can not be used, they still gain good performance

Implementation Details

1. Environment

We set up Spark on a local machine (Windows 10) and ran the experiments on it.

2. Scripts

Here are the scripts we used. Note:

1. We slightly changed the original script by adding timing measurement logic
2. For user cases where 'broadcast join' is disabled, we basically using the same script and just adding one line:

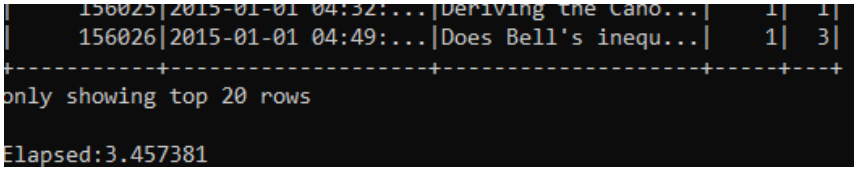
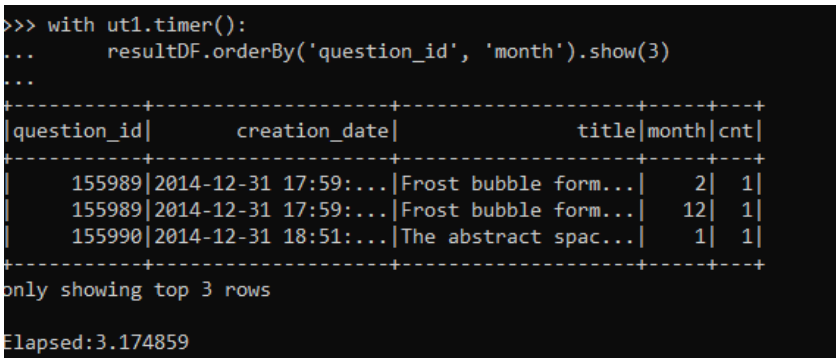
```
spark.conf.set("spark.sql.autoBroadcastJoinThreshold",-1)
```

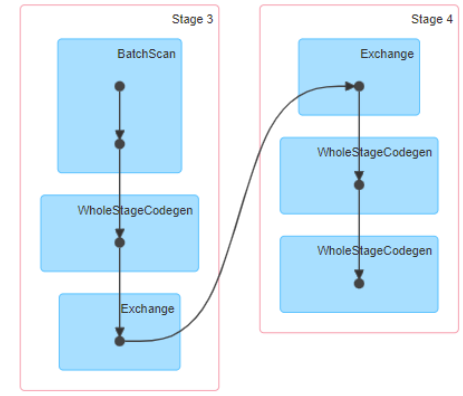
Original query	p20_optim_10.py
Solution 1	p20_write1.py: re-write the source data to 4 files p20_optim_21.py: improved solutio
Solution 2	p20_write2.py: re-write the source data to 4 files p20_optim_31.py: improved solution
Other file	Ut_spr.py: we are using a decorator method 'timer()' from this module to measure the time.

Experiment Details

1. Original Query

1.1 With BroadcastJoin used (by default)

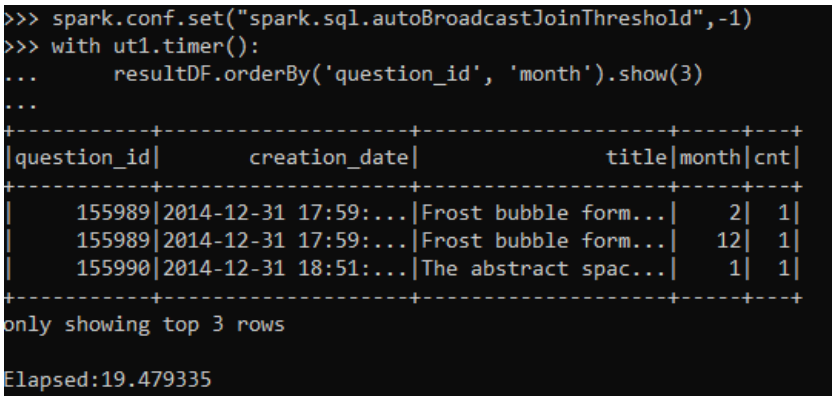
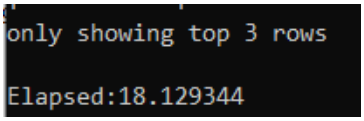
Note	It is noticed: 1. BroadcastJoin has been used as the two dataset are small (less than 10Mb) and 'spark.sql.autoBroadcastJoinThreshold' is default to 10M. So the performance is not bad 2. 200 partitions are used for shuffle
Run time	Run 1: 3.45 Run 2: 3:17 Run 1: 3.45 sec  Run 2: 3.17 sec 
Explain plan	>>> resultDF.orderBy('question_id', 'month').explain() == Physical Plan == *(4) Sort [question_id#44L ASC NULLS FIRST, month#60 ASC NULLS FIRST], true, 0 +- Exchange rangepartitioning(question_id#44L ASC NULLS FIRST, month#60 ASC NULLS FIRST, 200), true, [id=#222] +- *(3) Project [question_id#44L, creation_date#46, title#47, month#60, cnt#76L] +- *(3) BroadcastHashJoin [question_id#44L], [question_id#32L], Inner, BuildRight :- *(3) Project [question_id#44L, creation_date#46, title#47] : +- *(3) Filter isnotnull(question_id#44L) : +- *(3) ColumnarToRow : +- BatchScan[question_id#44L, creation_date#46, title#47] ParquetScan Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/questions], ReadSchema: struct<question_id:bigint,creation_date:timestamp,title:string>, PushedFilters: [IsNotNull(question_id)] +- BroadcastExchange HashedRelationBroadcastMode(List(input[0, bigint, true])), [id=#217] +- *(2) HashAggregate(keys=[question_id#32L, month#60], functions=[count(1)])

	+- Exchange hashpartitioning(question_id#32L, month#60, 200), true, [id=#213] +- *(1) HashAggregate(keys=[question_id#32L, month#60], functions=[partial_count(1)]) +- *(1) Project [question_id#32L, month(cast(creation_date#34 as date)) AS month#60] +- *(1) Filter isnotnull(question_id#32L) +- *(1) ColumnarToRow +- BatchScan[question_id#32L, creation_date#34] ParquetScan Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/answers], ReadSchema: struct<question_id:bigint,creation_date:timestamp>, PushedFilters: [IsNotNull(question_id)]
	 ▾ Completed Stages (2) Page: 1 1 Pages. Jump to 1 . Show 100 items in a page. Go Stage Id ▾ | Description | Submitted | Duration | Tasks: Succeeded/Total | Input | Output | Shuffle Read | Shuffle Write 4 | broadcast exchange (runId 649e2f81-9454-4d6f-8d2f-c7ed27954aef) call at <unknown>:0 +details | 2022/03/07 07:45:40 | 0.5 s | 200/200 | | | 1084.2 KiB | 3 | broadcast exchange (runId 649e2f81-9454-4d6f-8d2f-c7ed27954aef) call at <unknown>:0 +details | 2022/03/07 07:45:38 | 1 s | 4/4 | | | | 1084.2 KiB

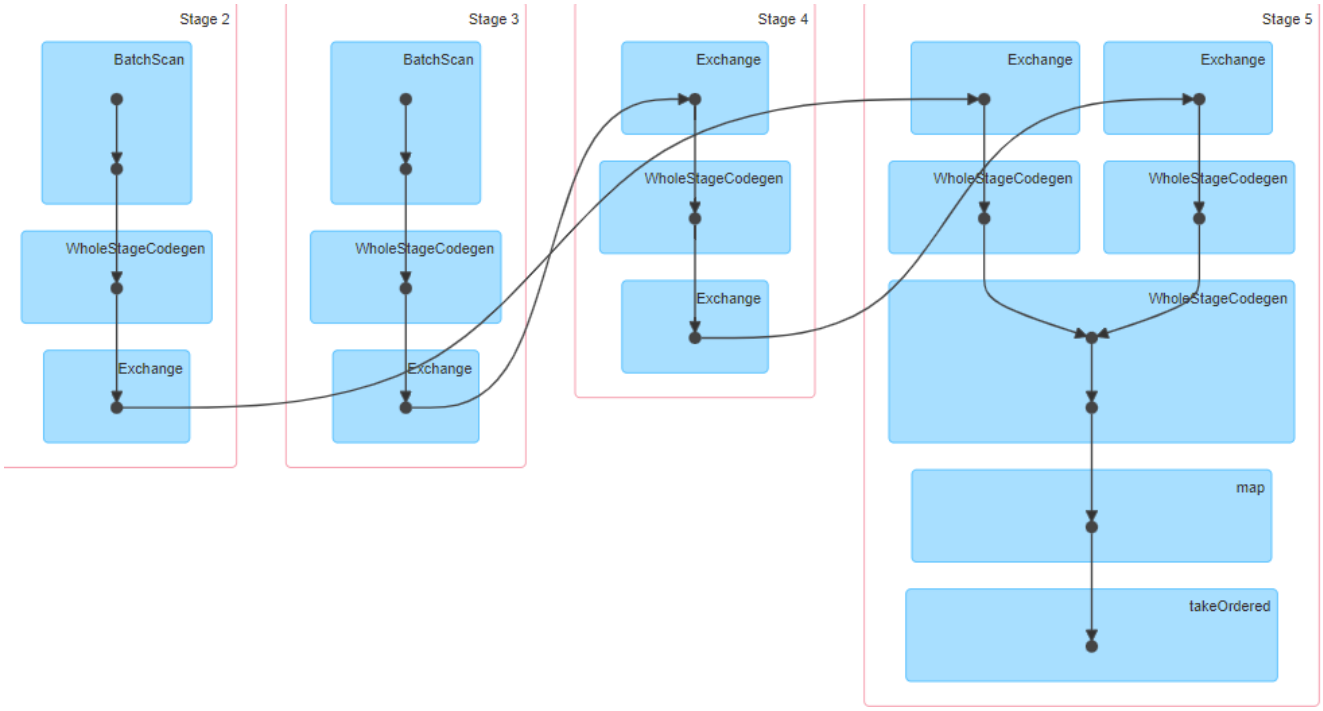
1.2. original query with BroadcastJoin distabled

We added ‘‘spark.conf.set("spark.sql.autoBroadcastJoinThreshold",-1)’ to the script so the Broadcast Join was disabled

Observation	• 200 partitions took part in shuffle process • There are shuffles. Shuffle read/write data size is large (each 9.5 M in total) • Worst performance – running time is 6 times of when broadcast is used

	Run time: 19.48 sec 18.13 sec. Run 1  Run 2: 
Plan	>>> resultDF.orderBy('question_id', 'month').explain() == Physical Plan == *(7) Sort [question_id#44L ASC NULLS FIRST, month#60 ASC NULLS FIRST], true, 0 +- **Exchange rangepartitioning**(question_id#44L ASC NULLS FIRST, month#60 ASC NULLS FIRST, 200), true, [id=#407] +- *(6) Project [question_id#44L, creation_date#46, title#47, month#60, cnt#76L] +- *(6) SortMergeJoin [question_id#44L], [question_id#32L], Inner :- *(2) Sort [question_id#44L ASC NULLS FIRST], false, 0 : +- **Exchange hashpartitioning**(question_id#44L, 200), true, [id=#384] : +- *(1) Project [question_id#44L, creation_date#46, title#47] : +- *(1) Filter isnotnull(question_id#44L) : +- *(1) ColumnarToRow : +- BatchScan[question_id#44L, creation_date#46, title#47] ParquetScan Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/questions], ReadSchema: struct<question_id:bigint,creation_date:timestamp,title:string>, PushedFilters: [IsNotNull(question_id)] +- *(5) Sort [question_id#32L ASC NULLS FIRST], false, 0 +- **Exchange hashpartitioning**(question_id#32L, 200), true, [id=#399] +- *(4) HashAggregate(keys=[question_id#32L, month#60], functions=[count(1)]) +- **Exchange hashpartitioning**(question_id#32L, month#60, 200), true, [id=#395] +- *(3) HashAggregate(keys=[question_id#32L, month#60], functions=[partial_count(1)]) +- *(3) Project [question_id#32L, month(cast(creation_date#34 as date)) AS month#60] +- *(3) Filter isnotnull(question_id#32L) +- *(3) ColumnarToRow +- BatchScan[question_id#32L, creation_date#34] ParquetScan Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/answers], ReadSchema:

struct<question_id:bigint,creation_date:timestamp>, PushedFilters: [IsNotNull(question_id)]]



1 Pages. Jump to 1 . Show 100 items in a page. Go

Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
showString at <unknown>:0 +details	2022/03/07 11:50:43	3 s	200/200			8.4 MiB	
showString at <unknown>:0 +details	2022/03/07 11:50:30	12 s	200/200			1084.2 KiB	2.9 MiB
showString at <unknown>:0 +details	2022/03/07 11:50:29	1 s	4/4				1084.2 KiB
showString at <unknown>:0 +details	2022/03/07 11:50:29	1 s	4/4				5.4 MiB

2. Solution 1 – rewrite source data and set sjuffle partition numbe

We made following improvements:

1) Rewrite the source data to 4 parquet files using bucketing

```
questionsDF\
.coalesce(1)\
.write\
.mode('overwrite')\
.bucketBy(4, 'question_id')\
.sortBy("question_id")\
.option("path","data/questions_n")\
.saveAsTable('questions',format='parquet')
```

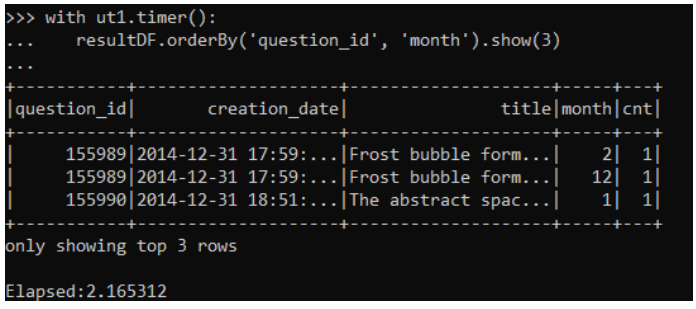
```
answersDF\
.coalesce(1)\
.write\
.mode('overwrite')\
.bucketBy(4, 'question_id')\
.sortBy("question_id")\
.option("path","data/answers_n")\
.saveAsTable('answers',format='parquet')
```

2) Set spark.sql.shuffle.partitions to 4 and set number of drivers to 4 (master("local[4])

```
spark.conf.set ("spark.sql.shuffle.partitions",4)
```

```
spark = SparkSession.builder.appName('Optimize I')\
   .master("local[4]") \
```

2.1 When ' Broadcast join' used by default

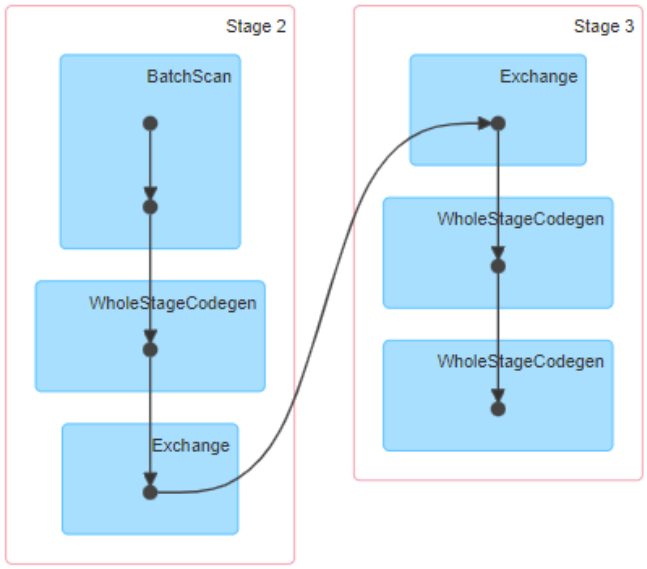
Note	• There are shuffle read/write, but shuffle data size is reduced((575k) • 4 partitions are used for shuffle • Gained best performance (shortest time of running query)
	Run 1: 2.17 sec  Run 2: 2.15 sec

```
>>> with ut1.timer():
...     resultDF.orderBy('question_id', 'month').show(3)
...
+-----------+--------------------+--------------------+-----+---+
|question_id|       creation_date|               title|month|cnt|
+-----------+--------------------+--------------------+-----+---+
|     155989|2014-12-31 17:59:...|Frost bubble form...|    2|  1|
|     155989|2014-12-31 17:59:...|Frost bubble form...|   12|  1|
|     155990|2014-12-31 18:51:...|The abstract spac...|    1|  1|
+-----------+--------------------+--------------------+-----+---+
only showing top 3 rows

Elapsed:2.165312
```

```
>>>
>>> with ut1.timer():
...     resultDF.orderBy('question_id', 'month').show(3)
...
+-----------+-------------------+--------------------+-----+---+
|question_id|      creation_date|               title|month|cnt|
+-----------+-------------------+--------------------+-----+---+
|     155989|2014-12-31 17:59:...|Frost bubble form...|    2|  1|
|     155989|2014-12-31 17:59:...|Frost bubble form...|   12|  1|
|     155990|2014-12-31 18:51:...|The abstract spac...|    1|  1|
+-----------+-------------------+--------------------+-----+---+
only showing top 3 rows

Elapsed:2.146522
```

Execution plan:

```
>>> resultDF.orderBy('question_id', 'month').explain()
== Physical Plan ==
*(4) Sort [question_id#12L ASC NULLS FIRST, month#28 ASC NULLS FIRST], true, 0
+- Exchange rangepartitioning(question_id#12L ASC NULLS FIRST, month#28 ASC NULLS FIRST, 4), true, [id=#149]
   +- *(3) Project [question_id#12L, creation_date#14, title#15, month#28, cnt#44L]
      +- *(3) BroadcastHashJoin [question_id#12L], [question_id#0L], Inner, BuildRight
         :- *(3) Project [question_id#12L, creation_date#14, title#15]
         :  +- *(3) Filter isnotnull(question_id#12L)
         :     +- *(3) ColumnarToRow
         :        +- BatchScan[question_id#12L, creation_date#14, title#15] ParquetScan Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/questions_n], ReadSchema: struct<question_id:bigint,creation_date:timestamp,title:string>, PushedFilters: [IsNotNull(question_id)]
         +- BroadcastExchange HashedRelationBroadcastMode(List(input[0, bigint, true])), [id=#144]
            +- *(2) HashAggregate(keys=[question_id#0L, month#28], functions=[count(1)])
               +- Exchange hashpartitioning(question_id#0L, month#28, 4), true, [id=#140]
                  +- *(1) HashAggregate(keys=[question_id#0L, month#28], functions=[partial_count(1)])
                     +- *(1) Project [question_id#0L, month(cast(creation_date#2 as date)) AS month#28]
                        +- *(1) Filter isnotnull(question_id#0L)
                           +- *(1) ColumnarToRow
                              +- BatchScan[question_id#0L, creation_date#2] ParquetScan Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/answers_n], ReadSchema: struct<question_id:bigint,creation_date:timestamp>, PushedFilters: [IsNotNull(question_id)]
```



▾ Completed Stages (2)

Page: 1 1 Pages. Jump to 1 . Show 100 items in a page. Go

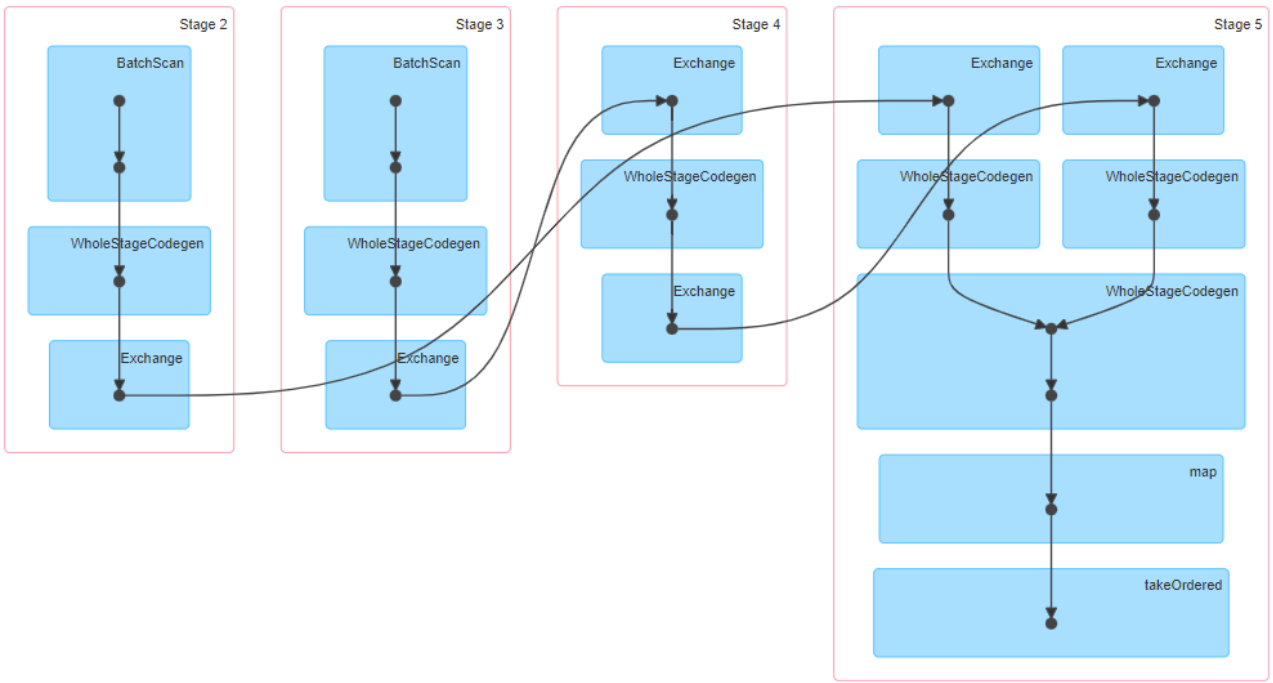
Stage Id ▾	Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
8	broadcast exchange (runId 950951b4-1605-4558-8777-4f392faf1fbc) call at <unknown>:0 +details	2022/03/07 09:27:08	39 ms	4/4			575.4 KiB	
7	broadcast exchange (runId 950951b4-1605-4558-8777-4f392faf1fbc) call at <unknown>:0 +details	2022/03/07 09:27:08	71 ms	4/4				575.4 KiB

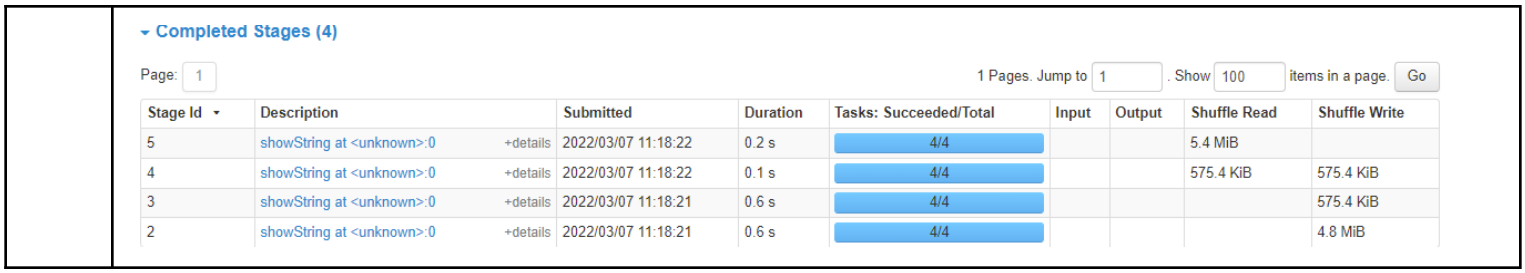
2.2 When Broadcast is disabled

Observations	• The execution plan is very similar to the original query when broadcast join is disable • 4 partitions are used and shuffle data size is reduced • With our improvement, the performance is comparable to when broadcast join is used, which means performance is stable

	Run time:
	2.30 sec,
	2.22 sec
	
	Run 1:
	`only showing top 3 rows`
	`Elapsed:2.297134`
	
	Run 2:
	`Elapsed:2.222535`

```
>>> resultDF2.explain()
== Physical Plan ==
*(7) Sort [question_id#12L ASC NULLS FIRST, month#28 ASC NULLS FIRST], true, 0
+- Exchange rangepartitioning(question_id#12L ASC NULLS FIRST, month#28 ASC NULLS FIRST, 4),
true, [id=#181]
   +- *(6) Project [question_id#12L, creation_date#14, title#15, month#28, cnt#44L]
      +- *(6) SortMergeJoin [question_id#12L], [question_id#0L], Inner
         :- *(2) Sort [question_id#12L ASC NULLS FIRST], false, 0
         :  +- Exchange hashpartitioning(question_id#12L, 4), true, [id=#158]
         :     +- *(1) Project [question_id#12L, creation_date#14, title#15]
         :        +- *(1) Filter isnotnull(question_id#12L)
         :           +- *(1) ColumnarToRow
         :              +- BatchScan[question_id#12L, creation_date#14, title#15] ParquetScan Location:
InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/questions_n],
ReadSchema: struct<question_id:bigint,creation_date:timestamp,title:string>, PushedFilters:
[IsNotNull(question_id)]
         +- *(5) Sort [question_id#0L ASC NULLS FIRST], false, 0
            +- Exchange hashpartitioning(question_id#0L, 4), true, [id=#173]
               +- *(4) HashAggregate(keys=[question_id#0L, month#28], functions=[count(1)])
                  +- Exchange hashpartitioning(question_id#0L, month#28, 4), true, [id=#169]
                     +- *(3) HashAggregate(keys=[question_id#0L, month#28], functions=[partial_count(1)])
                        +- *(3) Project [question_id#0L, month(cast(creation_date#2 as date)) AS month#28]
                           +- *(3) Filter isnotnull(question_id#0L)
                              +- *(3) ColumnarToRow
                                 +- BatchScan[question_id#0L, creation_date#2] ParquetScan Location:
InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/answers_n],
ReadSchema: struct<question_id:bigint,creation_date:timestamp>, PushedFilters: [IsNotNull(question_id)]
```





▾ Completed Stages (4)

Page: 1 — 1 Pages. Jump to 1 . Show 100 items in a page. Go

Stage Id ▾	Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
5	showString at <unknown>:0 +details	2022/03/07 11:18:22	0.2 s	4/4			5.4 MiB	
4	showString at <unknown>:0 +details	2022/03/07 11:18:22	0.1 s	4/4			575.4 KiB	575.4 KiB
3	showString at <unknown>:0 +details	2022/03/07 11:18:21	0.6 s	4/4				575.4 KiB
2	showString at <unknown>:0 +details	2022/03/07 11:18:21	0.6 s	4/4				4.8 MiB

3. Solution 2 – using bucketing

With this solution, we are using 'Bucketing' technology :

1) Rewrite the source data to 4 parquet files using bucketing by specifying following

```
answersDF\
    .coalesce(1)\
    .write \
    .bucketBy(4, 'question_id') \
    .mode('overwrite')\
    .sortBy('question_id') \
    .option("path","data/tb_answer")\
    .saveAsTable('tb_answer', format='parquet')


questionsDF\
    .coalesce(1)\
    .write\
    .bucketBy(4, 'question_id') \
    .mode('overwrite')\
    .sortBy('question_id') \
    .option("path","data/tb_question")\
    .saveAsTable('tb_question', format='parquet')
```

2) Also set "spark.sql.shuffle.partitions" to 4 and driver number to 4, similar to solution 1

3) Read the data to DataFrame as tables

```
df_ans =spark.read.table('tb_answer')
df_que = spark.read.table('tb_question')
```

As a result, there is no shuffle in the execution plan

3.1 With ‘broadcast join’ enable by default

<table>
<tr><td>observations</td><td>

- There is broadcast join but no shuffle read/write (from the execution plan)
- The performance is slightly better than original query but is worse than solution 1

</td></tr>
<tr><td></td><td>

Run 1: 3.08 sec

```
>>> with ut1.timer():
...     resultDF.orderBy('question_id', 'month').show(3)
...
+-----------+-------------------+--------------------+-----+---+
|question_id|       creation_date|               title|month|cnt|
+-----------+-------------------+--------------------+-----+---+
|     155989|2014-12-31 17:59:...|Frost bubble form...|    2|  1|
|     155989|2014-12-31 17:59:...|Frost bubble form...|   12|  1|
|     155990|2014-12-31 18:51:...|The abstract spac...|    1|  1|
+-----------+-------------------+--------------------+-----+---+
only showing top 3 rows

Elapsed:3.078451
```

Run 2: 3.08 sec

```
>> with ut1.timer():
..     resultDF.orderBy('question_id', 'month').show(3)
..
+-----------+-------------------+--------------------+-----+---+
|question_id|       creation_date|               title|month|cnt|
+-----------+-------------------+--------------------+-----+---+
|     155989|2014-12-31 17:59:...|Frost bubble form...|    2|  1|
|     155989|2014-12-31 17:59:...|Frost bubble form...|   12|  1|
|     155990|2014-12-31 18:51:...|The abstract spac...|    1|  1|
+-----------+-------------------+--------------------+-----+---+
only showing top 3 rows

Elapsed:3.084175
```

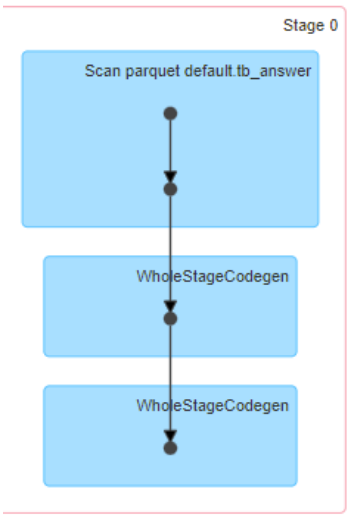
</td></tr>
<tr><td></td><td>

```
>>> resultDF.orderBy('question_id', 'month').explain()
== Physical Plan ==
*(3) Sort [question_id#0L ASC NULLS FIRST, month#28 ASC NULLS FIRST], true, 0
+- Exchange rangepartitioning(question_id#0L ASC NULLS FIRST, month#28 ASC NULLS FIRST, 4), true, [id=#135]
   +- *(2) Project [question_id#0L, creation_date#2, title#3, month#28, cnt#44L]
      +- *(2) BroadcastHashJoin [question_id#0L], [question_id#16L], Inner, BuildRight
         :- *(2) Project [question_id#0L, creation_date#2, title#3]
         :  +- *(2) Filter isnotnull(question_id#0L)
         :     +- *(2) ColumnarToRow
         :        +- FileScan parquet default.tb_question[question_id#0L,creation_date#2,title#3] Batched: true, DataFilters: [isnotnull(question_id#0L)], Format: Parquet, Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/tb_question], PartitionFilters: [], PushedFilters: [IsNotNull(question_id)], ReadSchema: struct<question_id:bigint,creation_date:timestamp,title:string>, SelectedBucketsCount: 4 out of 4
         +- BroadcastExchange HashedRelationBroadcastMode(List(input[0, bigint, true])), [id=#130]
            +- *(1) HashAggregate(keys=[question_id#16L, month#28], functions=[count(1)])
               +- *(1) HashAggregate(keys=[question_id#16L, month#28], functions=[partial_count(1)])
                  +- *(1) Project [question_id#16L, month(cast(creation_date#18 as date)) AS month#28]
```

</td></tr>
</table>

+- *(1) Filter isnotnull(question_id#16L)
+- *(1) ColumnarToRow
+- FileScan parquet default.tb_answer[question_id#16L,creation_date#18] Batched: true, DataFilters: [isnotnull(question_id#16L)], Format: Parquet, Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/tb_answer], PartitionFilters: [], PushedFilters: [IsNotNull(question_id)], ReadSchema: struct<question_id:bigint,creation_date:timestamp>, SelectedBucketsCount: 4 out of 4

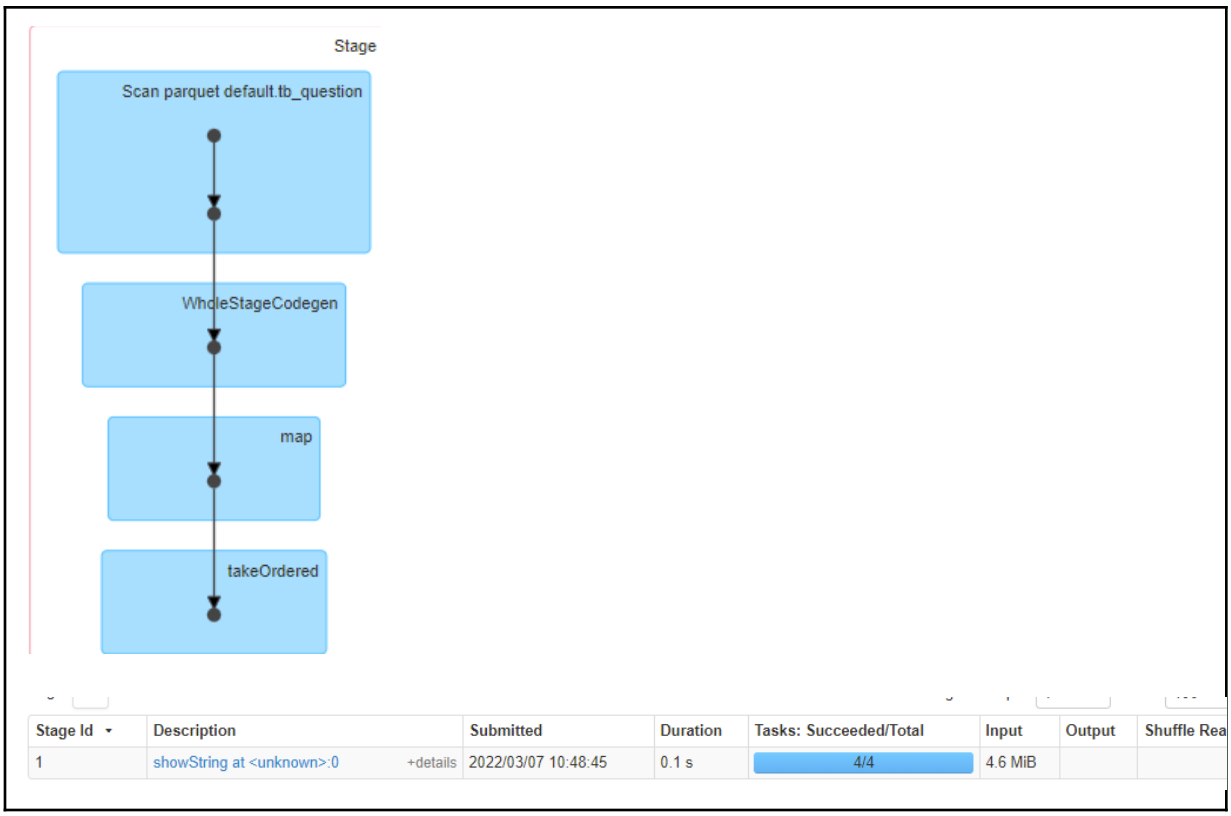
Job 0 – read 'question' data; there is broadcastExchange; no shuffle



Page: 1 1 Pages. Jump to 1 . Show 100 items

Stage Id	Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read
0	broadcast exchange (runId b60ff2dc-a301-4cd0-9ea3-e38840733dc9) call at <unknown>:0 +details	2022/03/07 10:48:43	1 s	4/4	1598.8 KiB		

Job 1: read 'answer' data, no shuffle



3. 2. With ‘broadcast join’ disabled:

- There is no shuffle read/write (from the execution plan)
- The performance is slightly slower than using this solution when broadcast join is used, and a lot better than original query when broadcast join is disabled

Running time:

Run 1: 3.23 sec

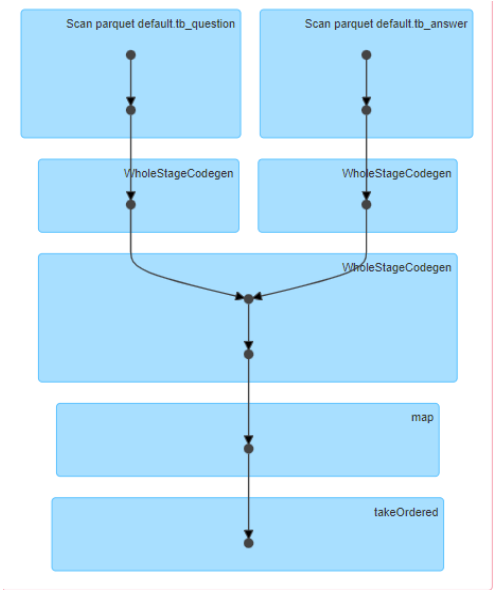
```
----- resultDF2.show -----
>>> with ut1.timer():
...     resultDF.orderBy('question_id', 'month').show(3)
...
+-----------+-------------------+--------------------+-----+---+
|question_id|      creation_date|               title|month|cnt|
+-----------+-------------------+--------------------+-----+---+
|     155989|2014-12-31 17:59:...|Frost bubble form...|    2|  1|
|     155989|2014-12-31 17:59:...|Frost bubble form...|   12|  1|
|     155990|2014-12-31 18:51:...|The abstract spac...|    1|  1|
+-----------+-------------------+--------------------+-----+---+
only showing top 3 rows

Elapsed:3.226743
```

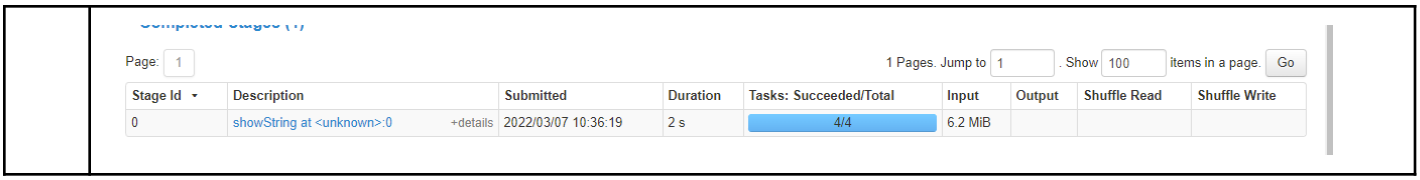
Run 2: 3.27 sec

```
+----------+-------------
only showing top 3 rows

Elapsed:3.274235
```

```
>>> resultDF.orderBy('question_id', 'month').explain()
== Physical Plan ==
*(4) Sort [question_id#0L ASC NULLS FIRST, month#28 ASC NULLS FIRST], true, 0
+- Exchange rangepartitioning(question_id#0L ASC NULLS FIRST, month#28 ASC NULLS FIRST, 4), true, [id=#147]
   +- *(3) Project [question_id#0L, creation_date#2, title#3, month#28, cnt#44L]
      +- *(3) SortMergeJoin [question_id#0L], [question_id#16L], Inner
         :- *(1) Sort [question_id#0L ASC NULLS FIRST], false, 0
         :  +- *(1) Project [question_id#0L, creation_date#2, title#3]
         :     +- *(1) Filter isnotnull(question_id#0L)
         :        +- *(1) ColumnarToRow
         :           +- FileScan parquet default.tb_question[question_id#0L,creation_date#2,title#3] Batched: true, DataFilters: [isnotnull(question_id#0L)], Format: Parquet, Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/tb_question], PartitionFilters: [], PushedFilters: [IsNotNull(question_id)], ReadSchema: struct<question_id:bigint,creation_date:timestamp,title:string>, SelectedBucketsCount: 4 out of 4
         +- *(2) Sort [question_id#16L ASC NULLS FIRST], false, 0
            +- *(2) HashAggregate(keys=[question_id#16L, month#28], functions=[count(1)])
               +- *(2) HashAggregate(keys=[question_id#16L, month#28], functions=[partial_count(1)])
                  +- *(2) Project [question_id#16L, month(cast(creation_date#18 as date)) AS month#28]
                     +- *(2) Filter isnotnull(question_id#16L)
                        +- *(2) ColumnarToRow
                           +- FileScan parquet default.tb_answer[question_id#16L,creation_date#18] Batched: true, DataFilters: [isnotnull(question_id#16L)], Format: Parquet, Location: InMemoryFileIndex[file:/C:/demo/c17-spark-ex1/01-HelloSpark-and-other-app/data/tb_answer], PartitionFilters: [], PushedFilters: [IsNotNull(question_id)], ReadSchema: struct<question_id:bigint,creation_date:timestamp>, SelectedBucketsCount: 4 out of 4
```

It has only one job:




Page: 1
1 Pages. Jump to 1 . Show 100 items in a page. Go
Stage Id
Description
Submitted
Duration
Tasks: Succeeded/Total
Input
Output
Shuffle Read
Shuffle Write
0
showString at <unknown>:0 +details
2022/03/07 10:36:19
2 s
4/4
6.2 MiB