BIG DATA HADOOP AND SPARK DEVLOPMENT

ASSIGNMENT 7

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BIG DATA HADOOPAND SPARK DEVELOPMENT

1. Introduction

In this assignment, the given tasks are performed and Output of the tasks are recorded in the form of Screenshots.

2. Objective

This Assignment consolidates the deeper understanding of the Session – 7 Introduction to APACHE PIG

3. Problem Statement

- Task 1
  - Write a program to implement wordcount using Pig

- Task 2
  - We have employee_details and employee_expenses files. Use local mode while running Pig and write Pig Latin script to get below results:

    employee_details (EmpID, Name, Salary, DepartmentID)
    https://github.com/prateekATacadgild/DatasetsForCognizant/blob/master/employee_details.txt

    employee_expenses (EmpID, Expense)
    https://github.com/prateekATacadgild/DatasetsForCognizant/blob/master/employee_expense s.txt

    - (a) Top 5 employees (employee id and employee name) with highest rating. (In case two employees have same rating, employee with name coming first in dictionary should get preference)

    - (b) Top 3 employees (employee id and employee name) with highest salary, whose employee id is an odd number. (In case two employees have same salary, employee with name coming first in dictionary should get preference)

- (c) Employee (employee id and employee name) with maximum expense (In case two employees have same expense, employee with name coming first in dictionary should get preference)

- (d) List of employees (employee id and employee name) having entries in employee_expenses file.

- (e) List of employees (employee id and employee name) having no entry in employee_expenses file.

- Task 3

  - Implement the use case present in below blog link and share the complete steps along with screenshot(s) from your end.

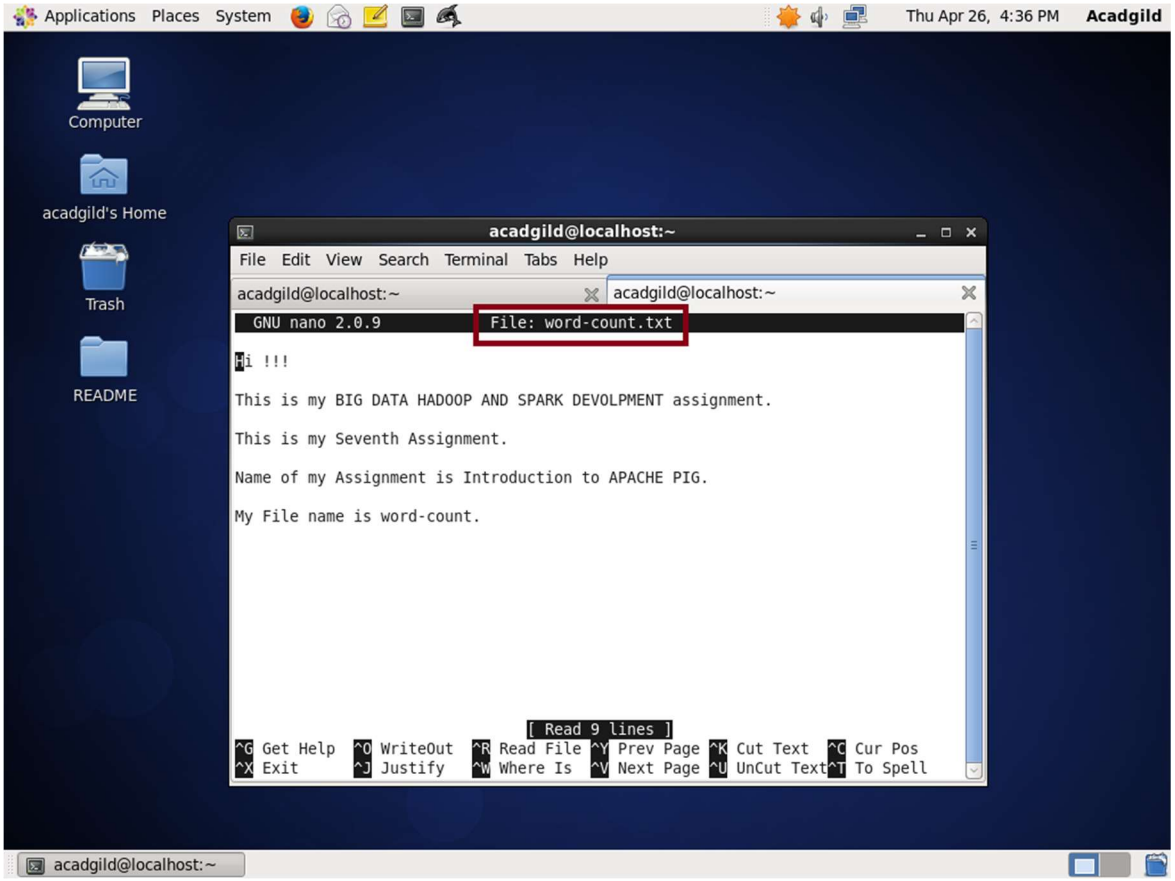
    https://acadgild.com/blog/aviation-data-analysis-using-apache-pig

4. Expected Output

- Task 1

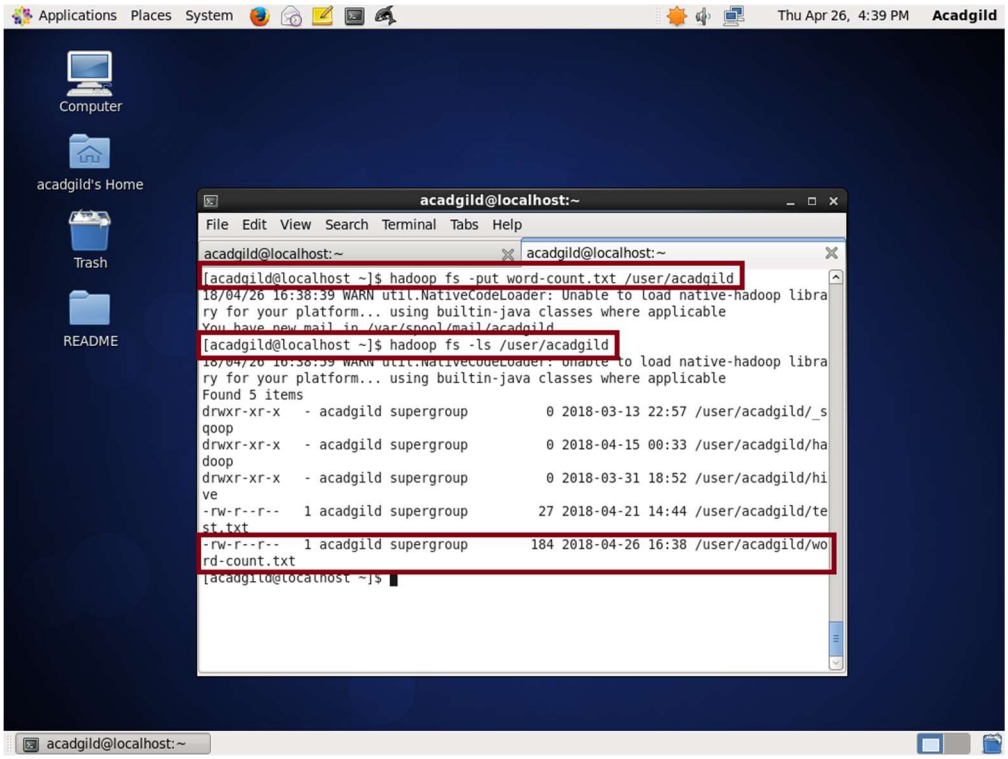
i. Write a program to implement wordcount using Pig

Create the word-count.txt file using, nano word-count.txt command and save the text file with some text data.



Save the text file and copy the text file to Hadoop file system by using –put command. By using the following command, the word-count.txt is copied from local to Hadoop file system.

hadoop fs –put word-count.txt /user/acadgild



By using hadoop fs –ls /

We can list down the directories and files by using the –ls / command

We check the text file is copied or not by following command.

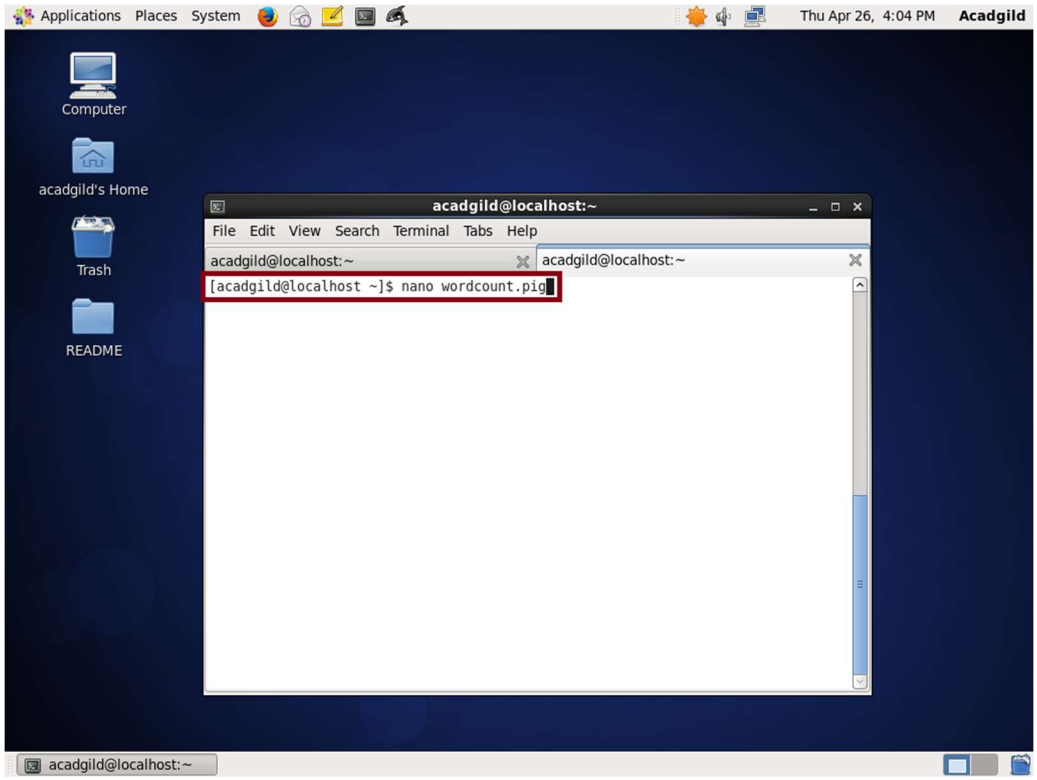
hadoop fs –ls /user/acadgild/word-count.txt

Creating a pig file:

Pig file is created with the extension of .pig , Pig file is created by using following command,

nano wordcount.pig

Create the wordcount.pig file using, nano wordcount.pig command and save the pig file with word count program codes to implement the wordcount using Pig.



Add the following codes to the pig file to implement the word count of the text input file

```
Lines = LOAD '/user/acadgild/word-count.txt' AS (line:chararray);

words = FOREACH Lines GENERATE FLATTEN(TOKENIZE(line)) as word;

grouped = GROUP words BY word;

wordcount = FOREACH grouped GENERATE group, COUNT(words);

DUMP wordcount;
```

- **TOKENIZE operator:**

The above pig script, first splits each line in the text file into words using the TOKENIZE operator. The tokenize function creates a bag of words.

- **FOREACH Operator:**

Use the FOREACH operator to work with columns of data.

- **GROUP Operator:**

Use the GROUP operator to group data in a single relation.

- **DUMP Operator:**

Use the DUMP operator to display results to a screen.

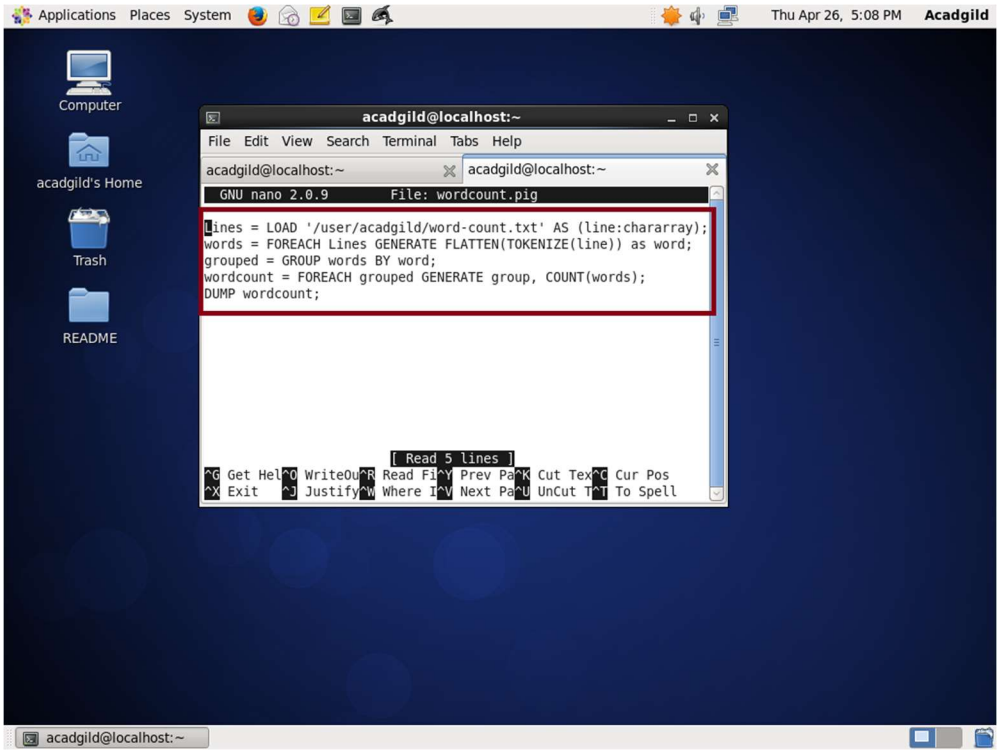
- **FLATTEN function:**

Using the **FLATTEN** function, the bag is converted into a tuple.

- **COUNT function:**

The **COUNT** function of **Pig** Latin is used to get the number of elements in a bag.

In the third statement, the words are grouped together so that the count can be computed in fourth statement.



In order to run or execute the pig script in local, the pig file has to be copied to the Hadoop distributed file system. By copying the pig file to Hadoop, the file can be executed from the grunt shell directly as pig local is situated top of the Hadoop.

By using,

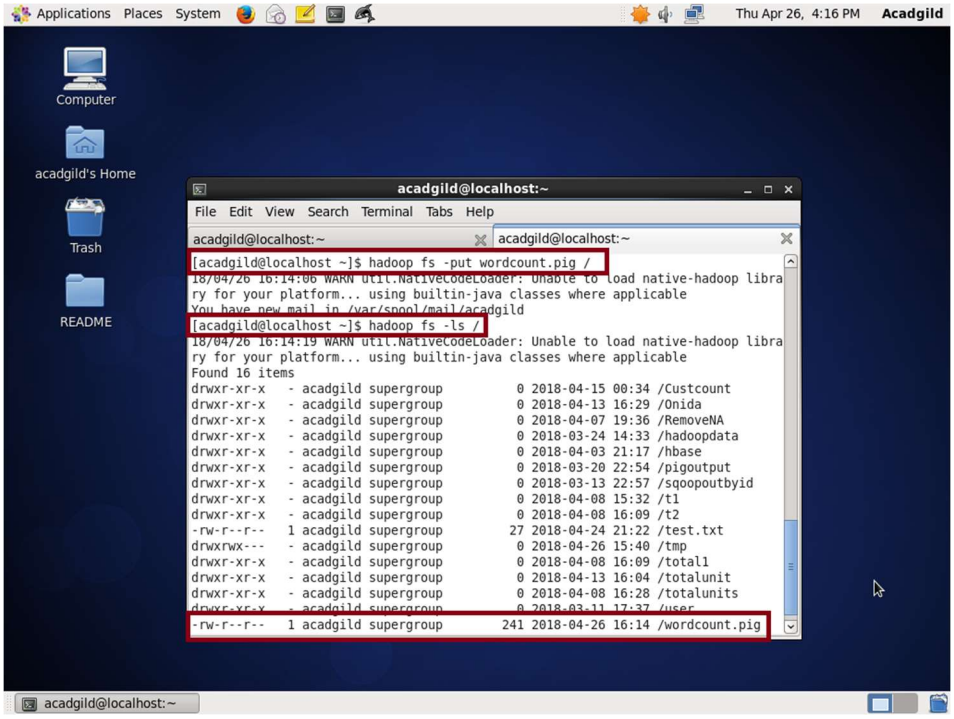
hadoop fs –put wordcount.pig /

The wordcount.pig is copied from local to Hadoop.

By using,

hadoop fs –ls /

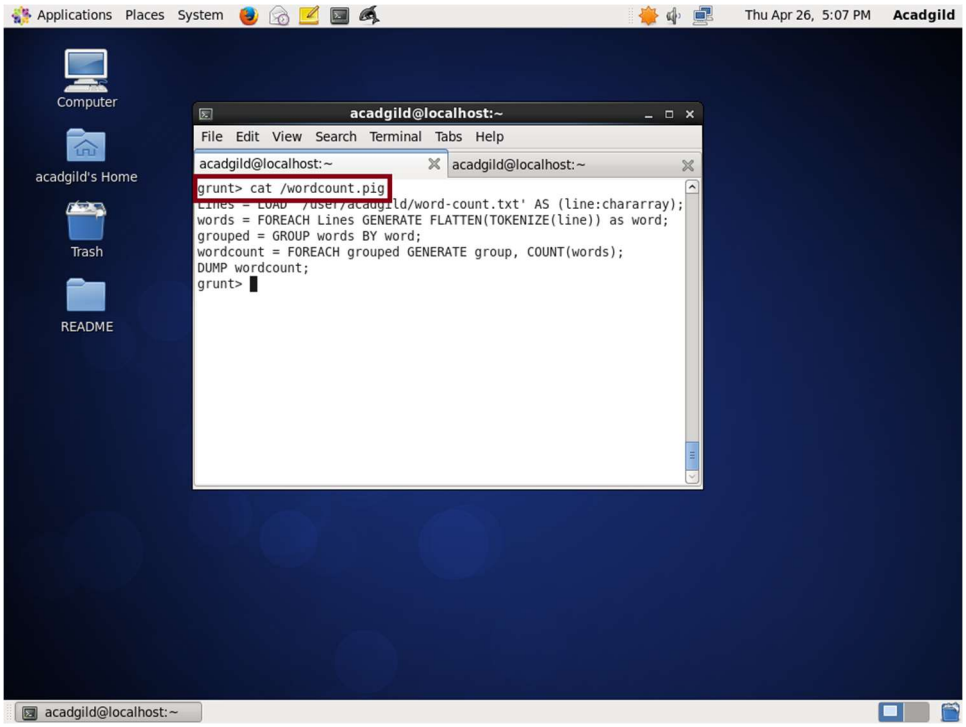
The wordcount.pig is listed in the Hadoop.



Grunt Mode or Interactive Mode:

The grunt mode can also be called as interactive mode. Grunt is pig's interactive shell. It is started when no file is specified for pig to run.

Using cat location path of pig file name, the file contents are shown in the grunt console. Below is the screenshot of the cat function shown in the grunt shell.



You can also run pig scripts from grunt using run and exec commands.

```
grunt> run scriptfile.pig

grunt> exec scriptfile.pig
```

Utility Commands

exec - Run a Pig script.

Syntax

exec [–param param_name = param_value] [–param_file file_name] [script]

Terms

–param param_name = param_value

See Parameter Substitution.

–param_file file_name

See Parameter Substitution.

Script

The name of a Pig script.

Usage

Use the exec command to run a Pig script with no interaction between the script and the Grunt shell (batch mode).

Aliases defined in the script are not available to the shell. However, the files produced as the output of the script and stored on the system are visible after the script is run.

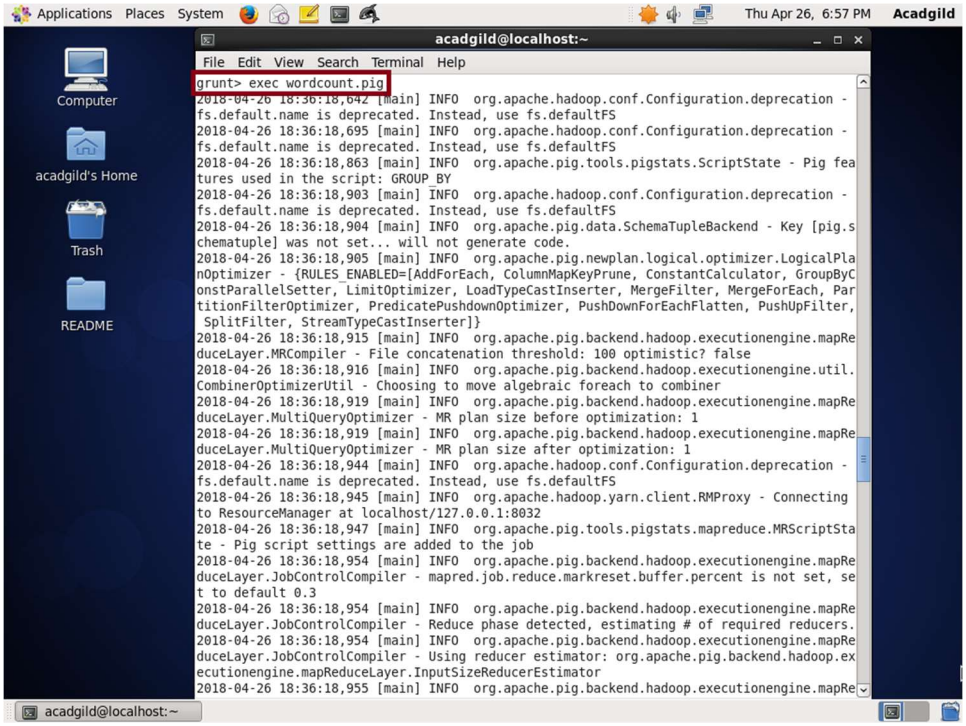
Aliases defined via the shell are not available to the script.

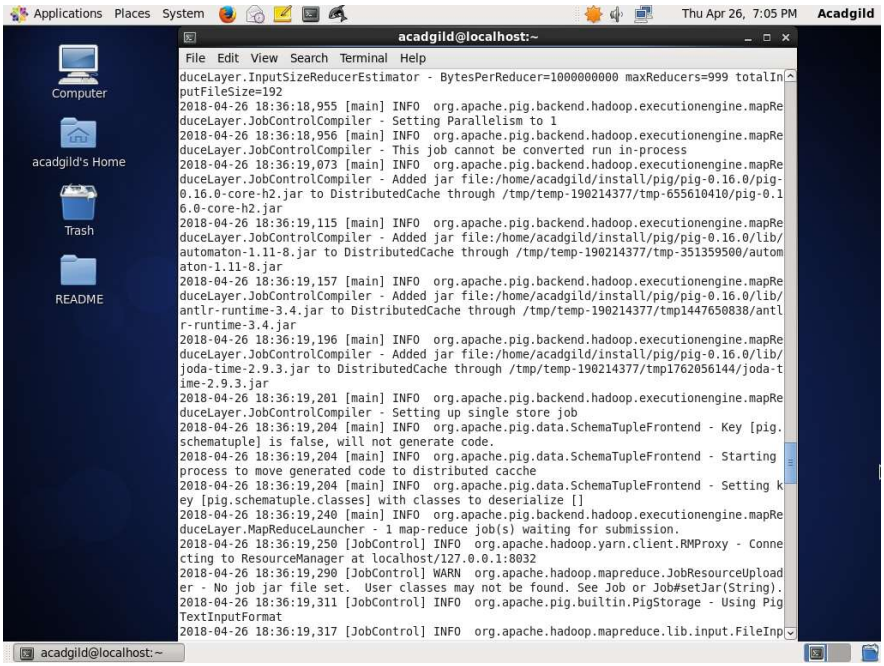
With the exec command, store statements will not trigger execution; rather, the entire script is parsed before execution starts.

Unlike the run command, exec does not change the command history or remembers the handles used inside the script.

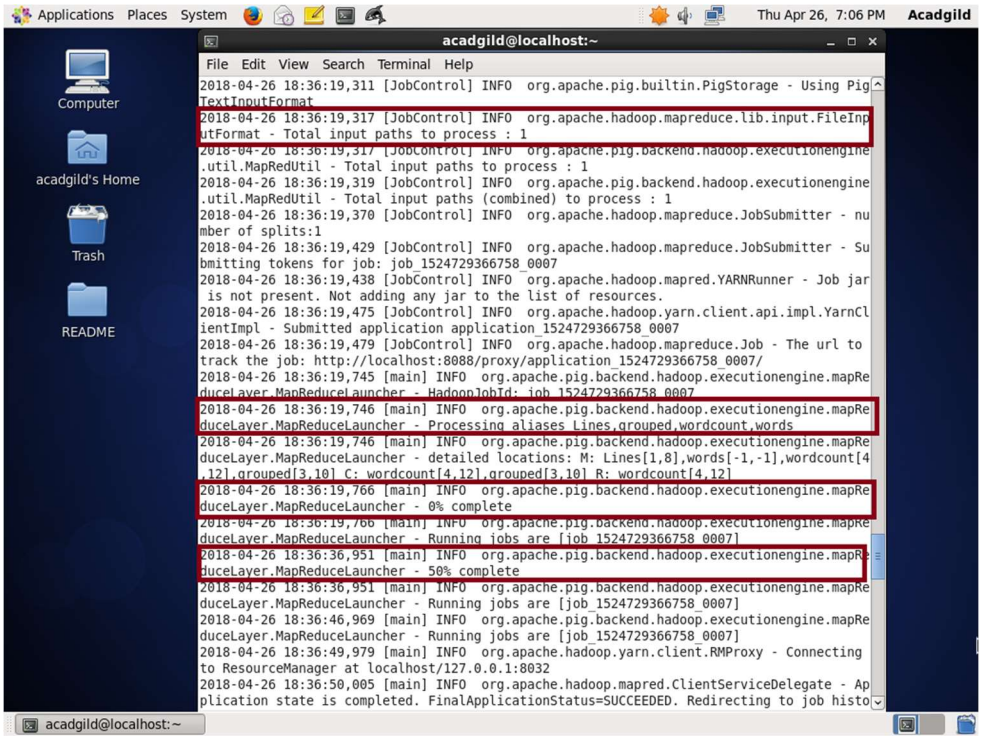
Exec without any parameters can be used in scripts to force execution up to the point in the script where the exec occurs.

grunt> exec wordcount.pig

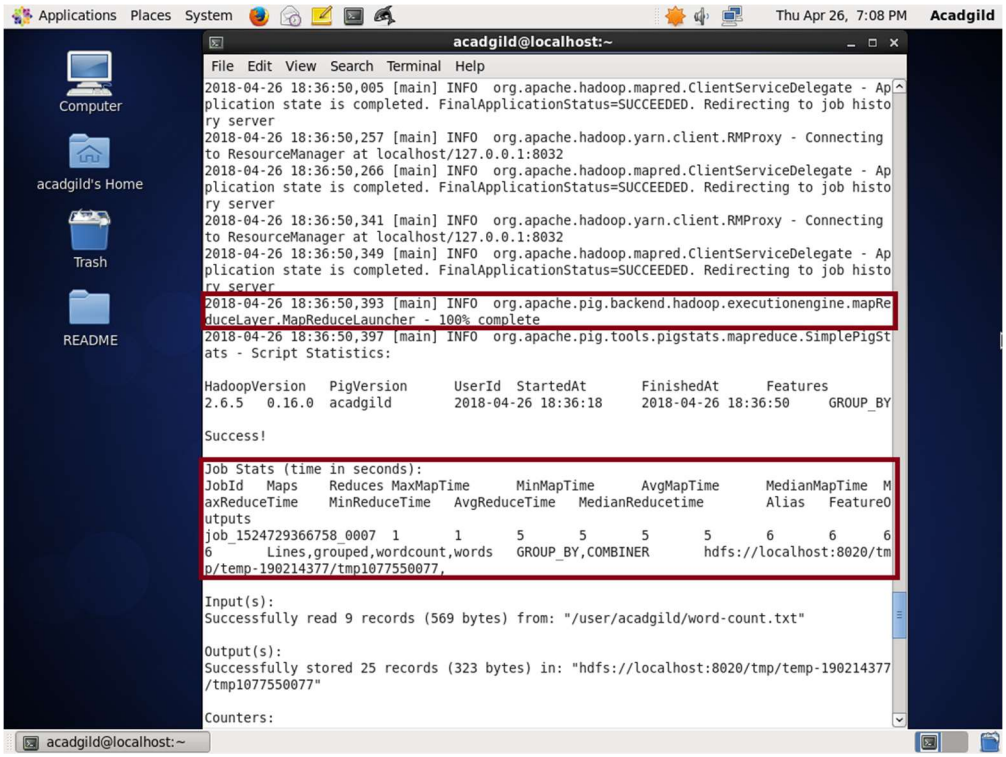


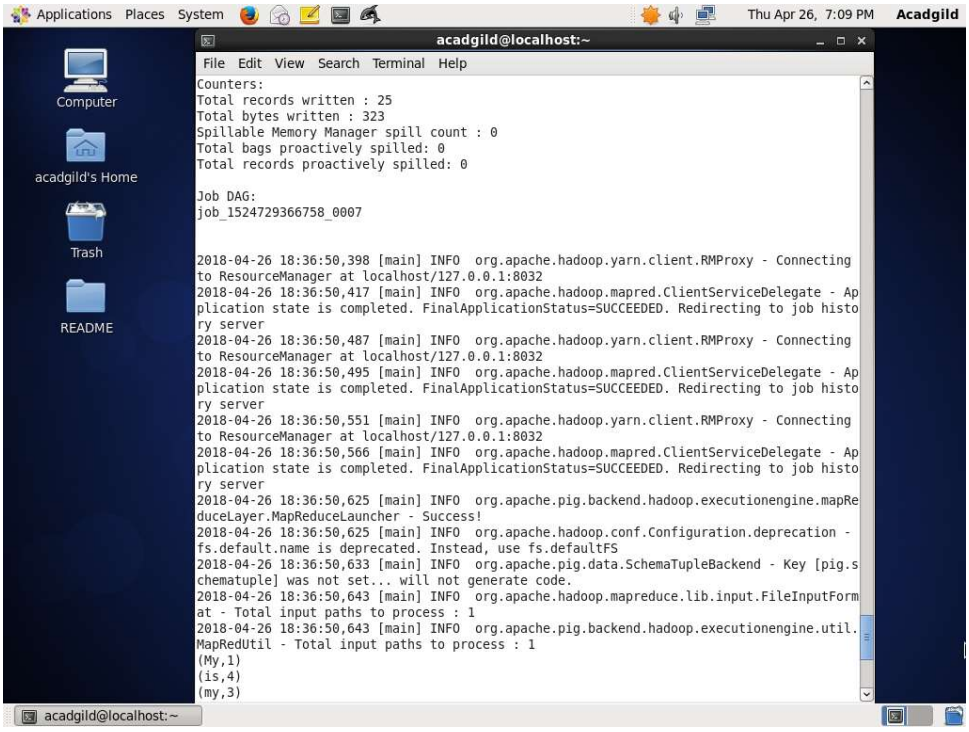


File input file one is processing. Mapreduce process is performed.



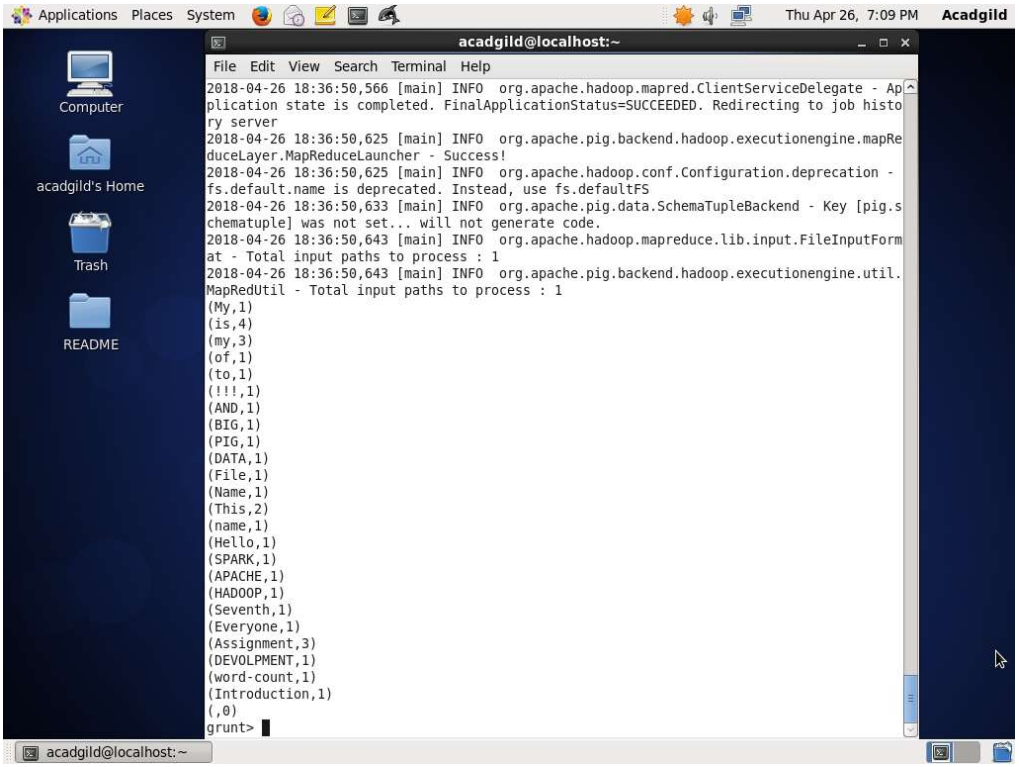
Map reduce launcher shows 100% and Job status is shown with JobId, Maps, Reduces, Maxmaptime, MinMaptime, AvgMaptime, MedianMaptime, MaxReducetime, MinReducetime, AvgReducetime, MedianReducetime





Result is shown below for wordcount.pig

The word count for the input file which is processed as shown below



- Task 2:
    - We have employee_details and employee_expenses files. Use local mode while running Pig and write Pig Latin script to get below results:

        - employee_details (EmpID, Name, Salary, DepartmentID) https://github.com/prateekATacadgild/DatasetsForCognizant/blob/master/employee_details.txt

        - employee_expenses (EmpID, Expense) https://github.com/prateekATacadgild/DatasetsForCognizant/blob/master/employee_expenses.txt

Load

To load the data either from local filesystem or Hadoop filesystem.

Syntax:

LOAD 'path_of_data' [USING function] [AS schema];

Where;

path_of_data : file/directory name in single quotes.

USING : is the keyword.

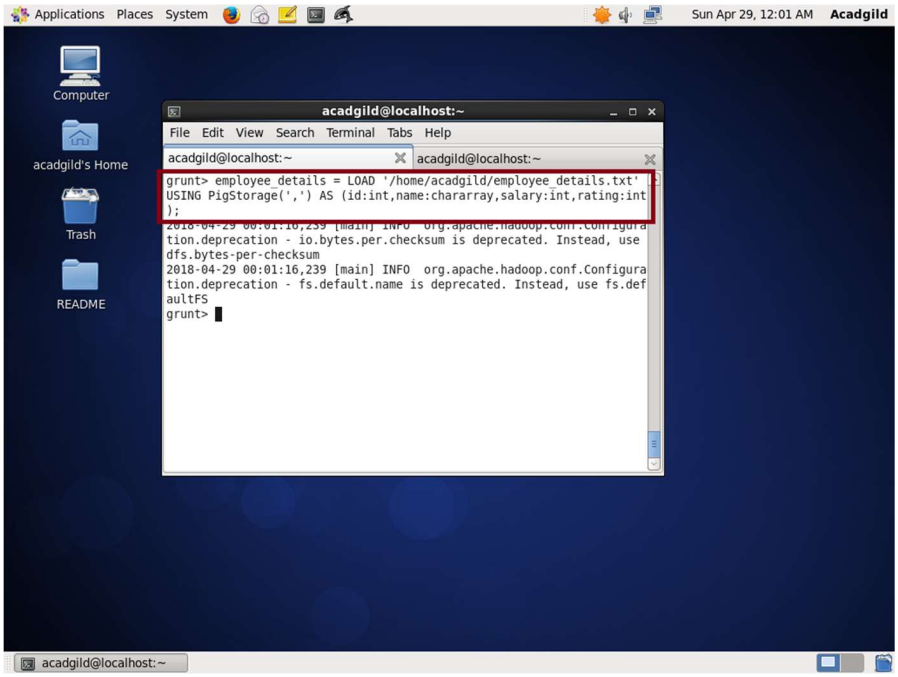
function : If you choose to omit this, default load function PigStorage() is used.

AS : is the keyword

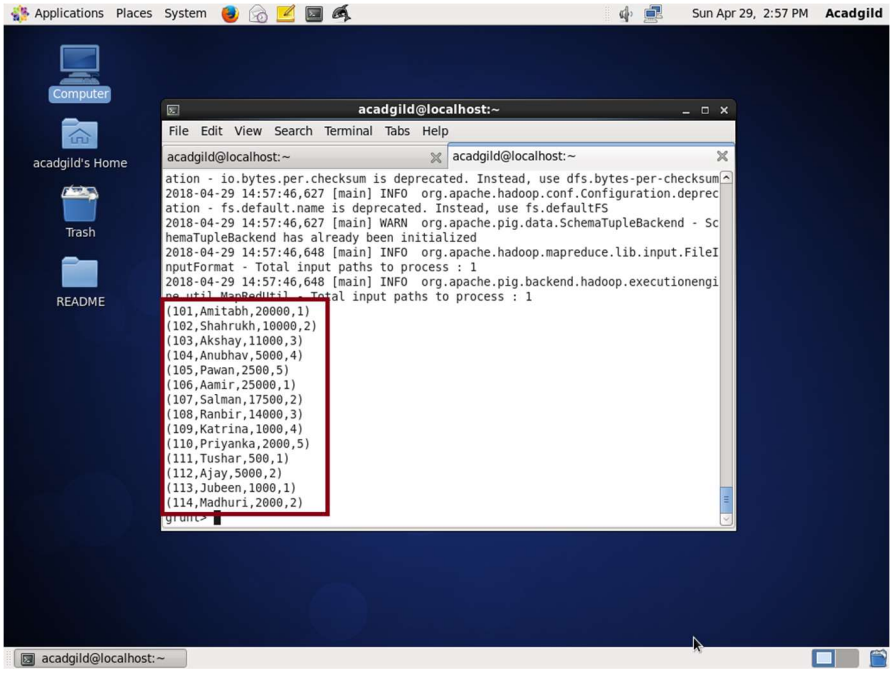
schema : schema of your data along with data type.

The file named employee_details.txt is comma separated file and we are going to load it from local file system.

employee_details = LOAD '/home/acadgild/employee_details.txt' USING PigStorage(',') AS (id:int,name:chararray,salary:int,rating:int);



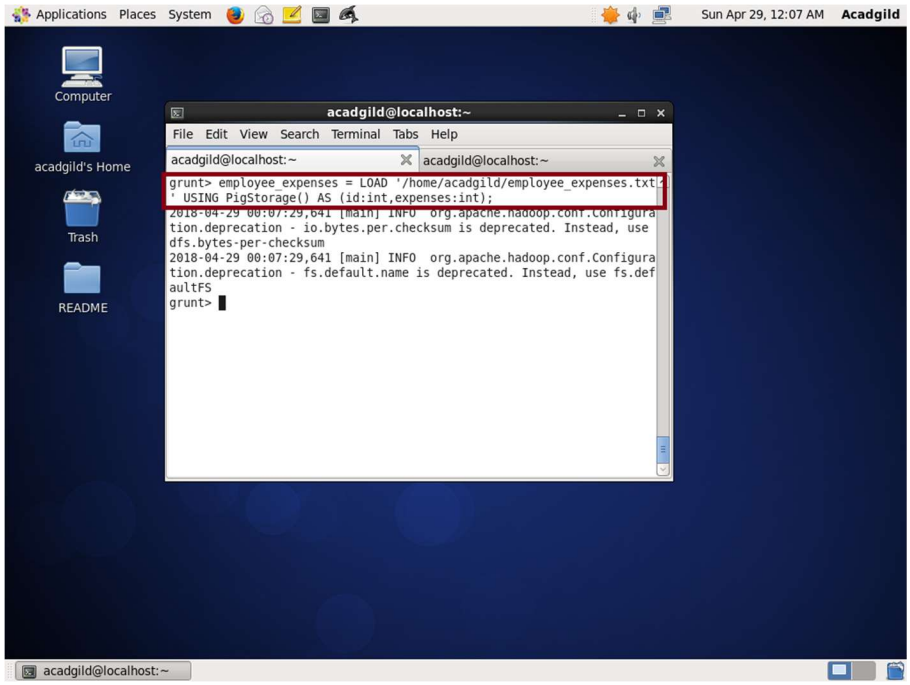
To check the result, you can use DUMP command.



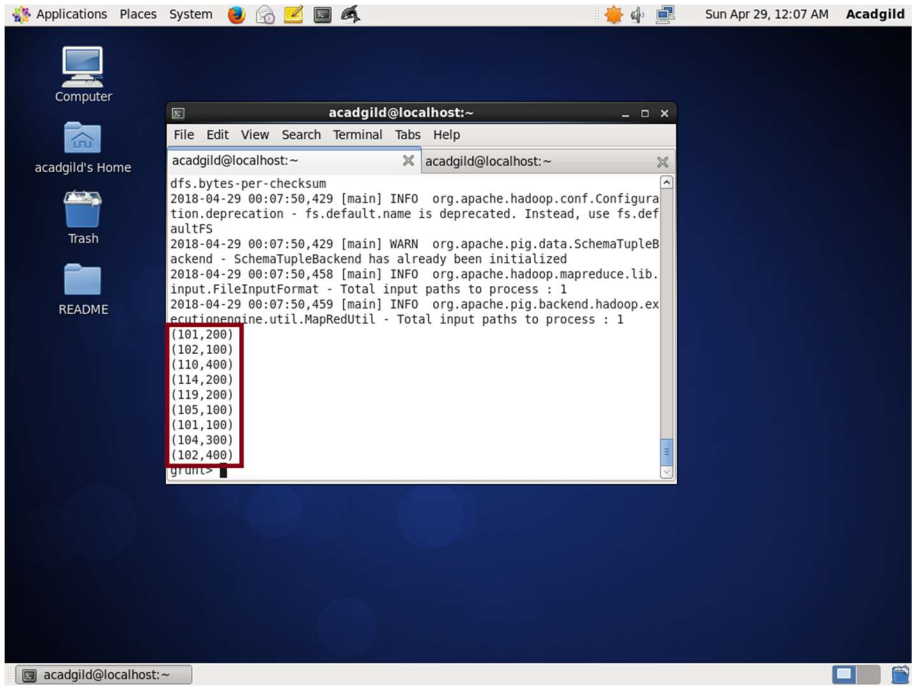
Similarly, you can load another data into another relation, say employee_expenses.txt

The file named employee_expenses.txt is tab separated file and we are going to load it from local file system.

employee_expenses = LOAD '/home/acadgild/employee_expenses.txt' USING PigStorage() AS (id:int,expenses:int);



To check the result, you can use DUMP command.



- **(a)Top 5 employees (employee id and employee name) with highest rating. (In case two employees have same rating, employee with name coming first in dictionary should get preference)**

Order

Sorts a relation based on single or multiple fields.

Syntax:

alias = ORDER alias BY {field_name [ASC | DESC]

Where;

alias : is the relation.

ORDER : is the keyword.

BY : is the keyword.

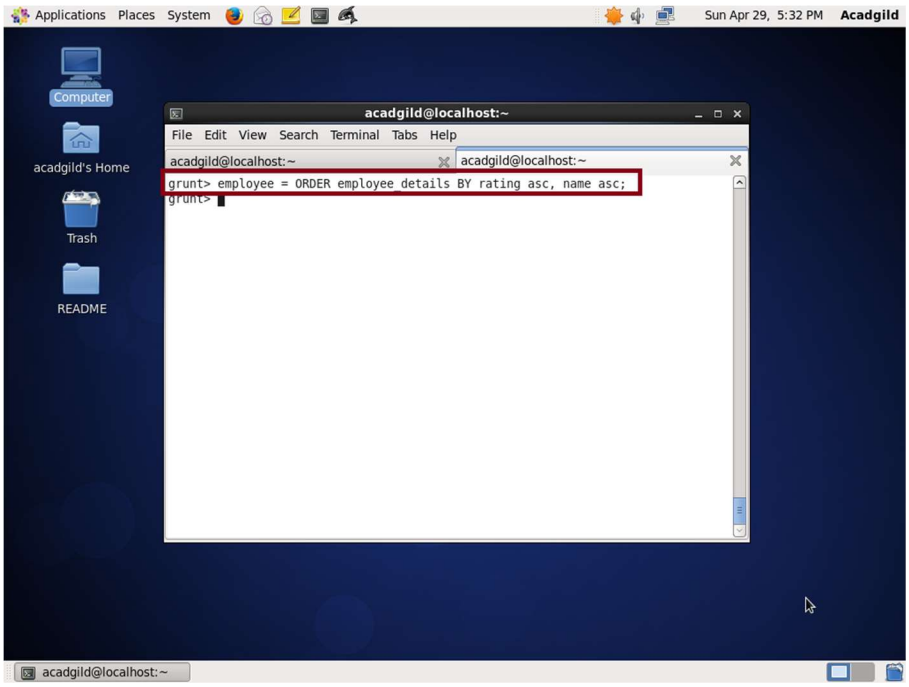
field_name : column on which you want to sort the relation.

ASC : sort in ascending order.

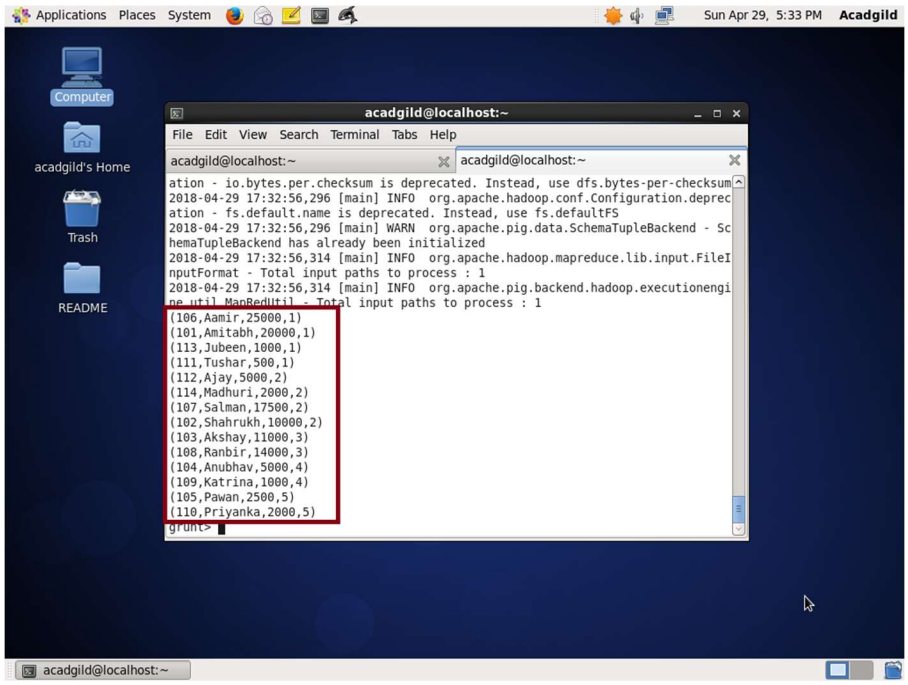
DESC : sort in descending order.

By using the following command the employee table is sorted.

employee = ORDER employee_details BY rating asc, name asc



To check the result, you can use DUMP command.



Limit

Used to limit the number of outputs to the desired number.

Syntax:

Alias = LIMIT alias n;

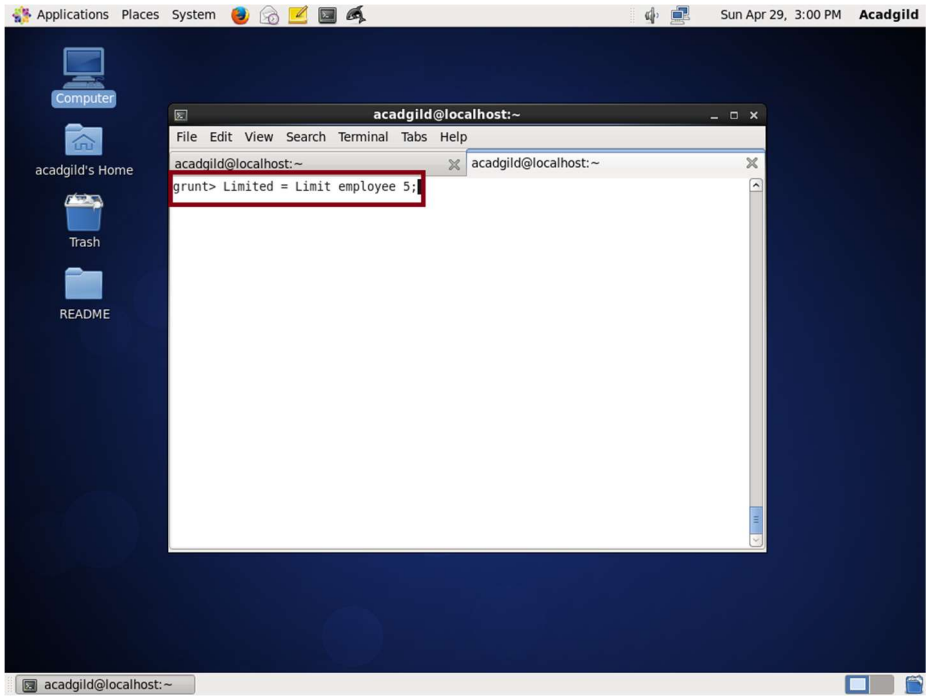
Where;

alias : name of the relation.

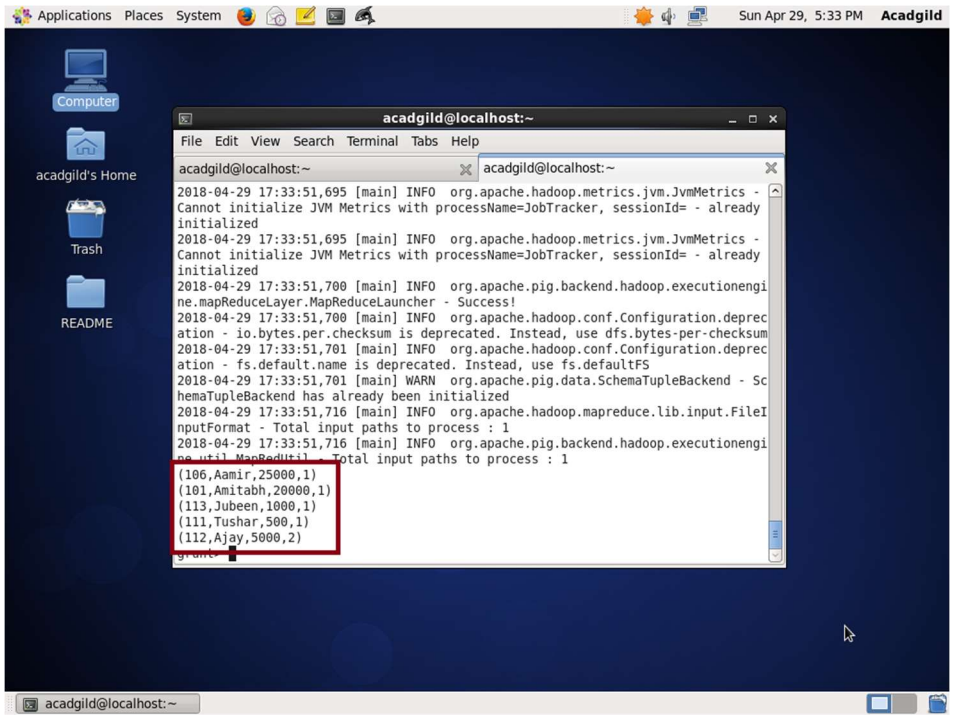
n : number of tuples to be displayed.

By using the following the command we can Limit the top 5 employee

Limited= Limit employee 5;



To check the result, you can use DUMP command.



Foreach

It generates data transformations based on desired columns of data.

Syntax:

alias = FOREACH alias GENERATE {expression | field};

Where;

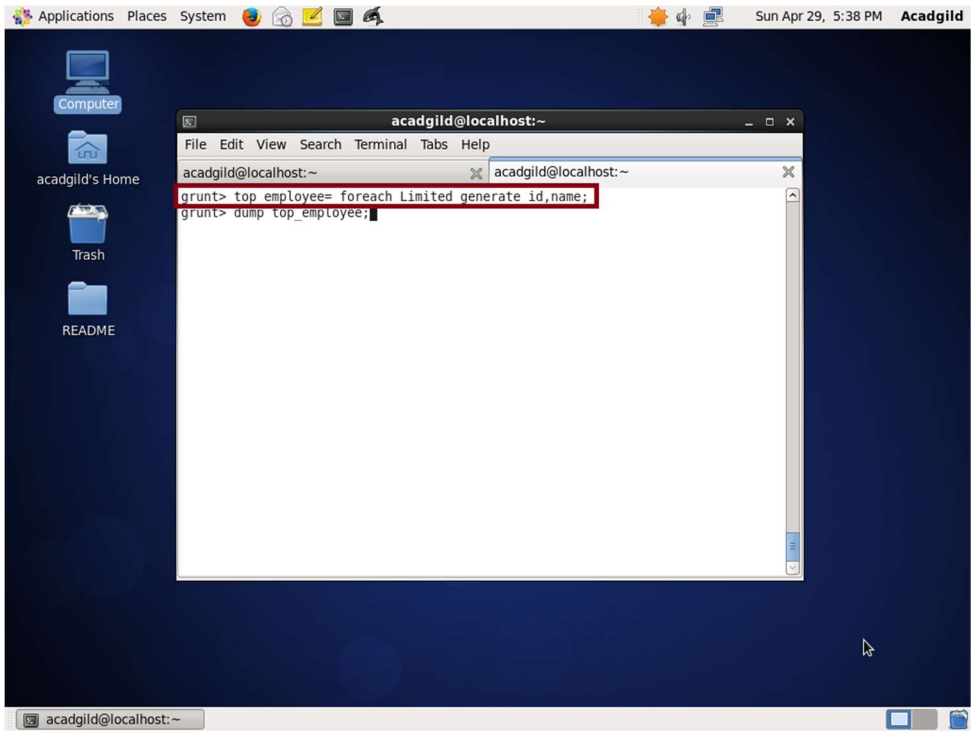
alias : is the relation

FOREACH : is the keyword

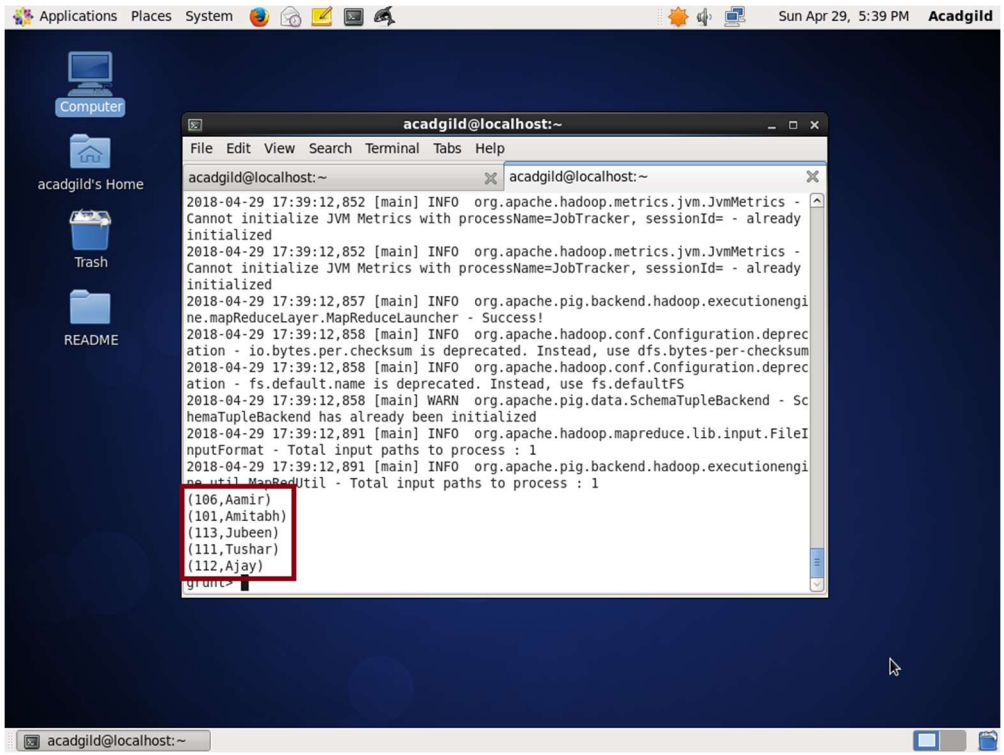
GENERATE : is the keyword

By using the following command value of top employees are stored in **top_employee**

top_employee= foreach Limited generate id,name;



To check the result, you can use DUMP command

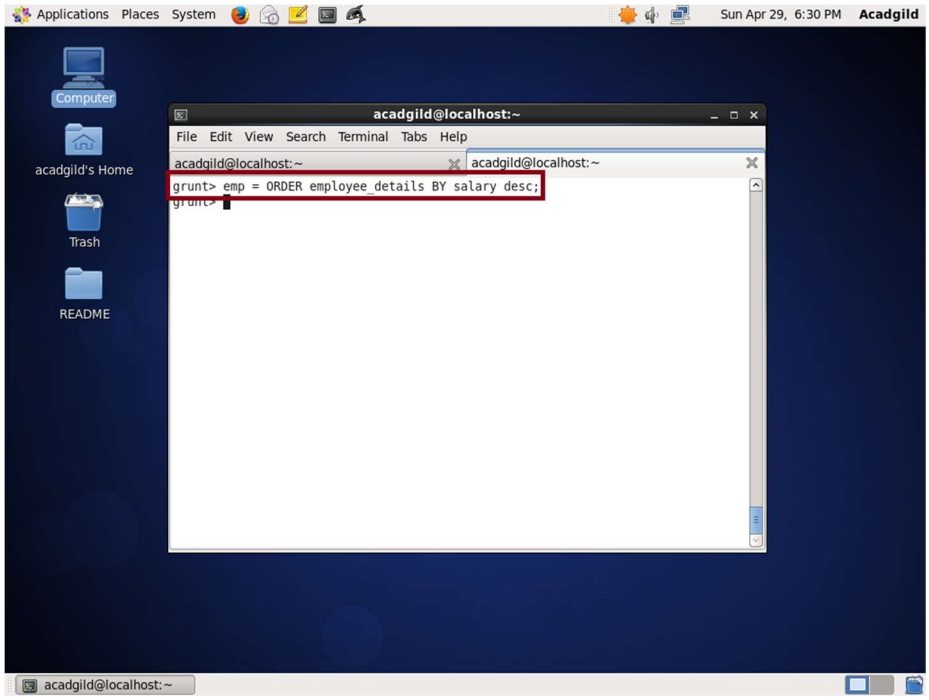


- **Top 3 employees (employee id and employee name) with highest salary, whose employee id is an odd number. (In case two employees have same salary, employee with name coming first in dictionary should get preference)**

The table of employee details are populated by using ORDER BY relation to get the highest salary details of employees.

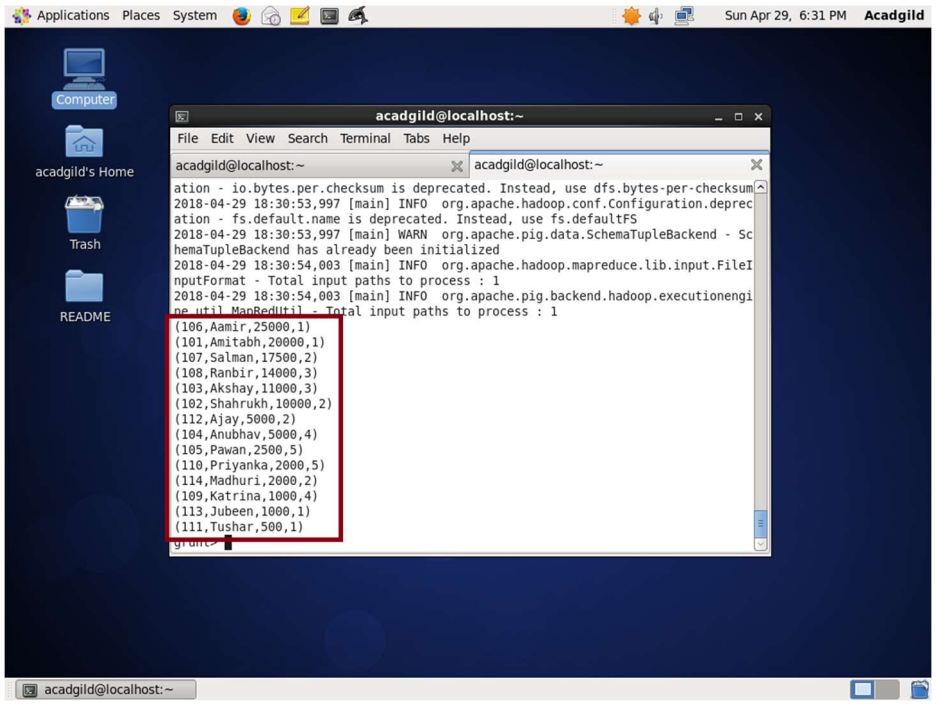
The following command explains the above,

emp = ORDER employee_details BY salary desc;



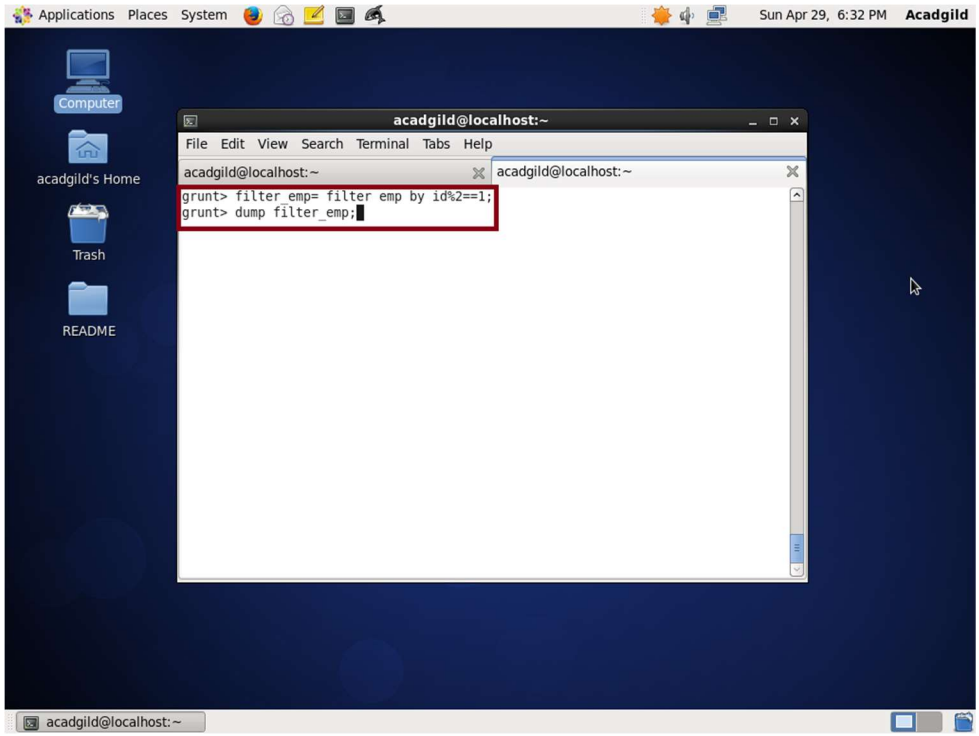
To check the result, you can use DUMP command

Here we get the list of employee details with highest salary.

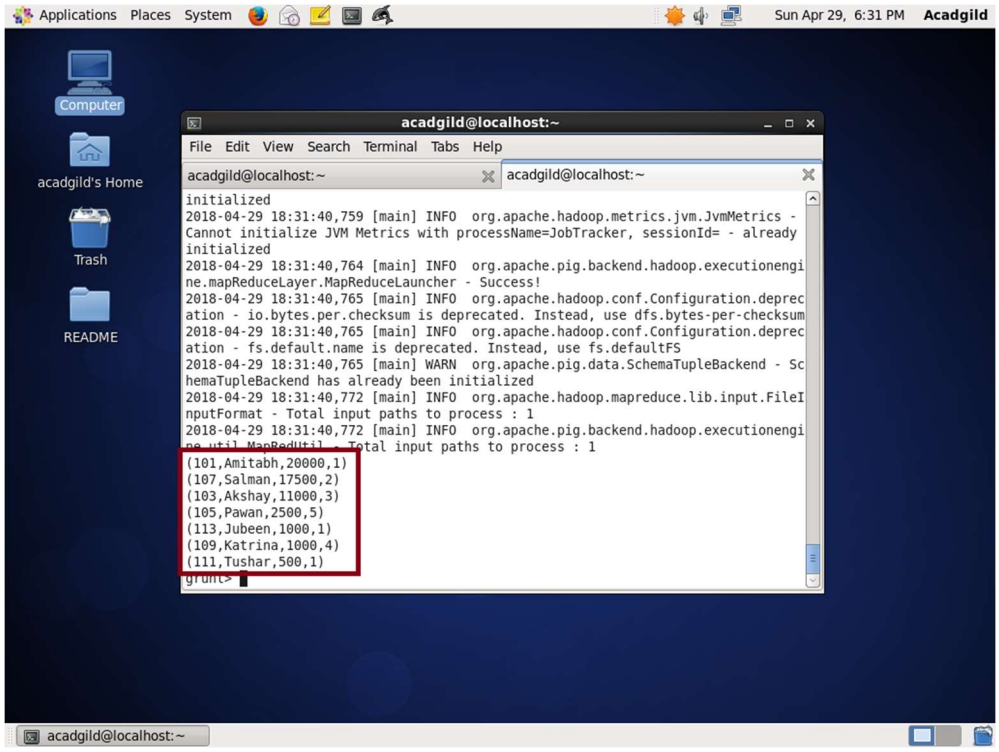


By using the below filter relation, we can get the employee details with highest salary, whose id are odd

filter_emp=filter emp by id%2==1;

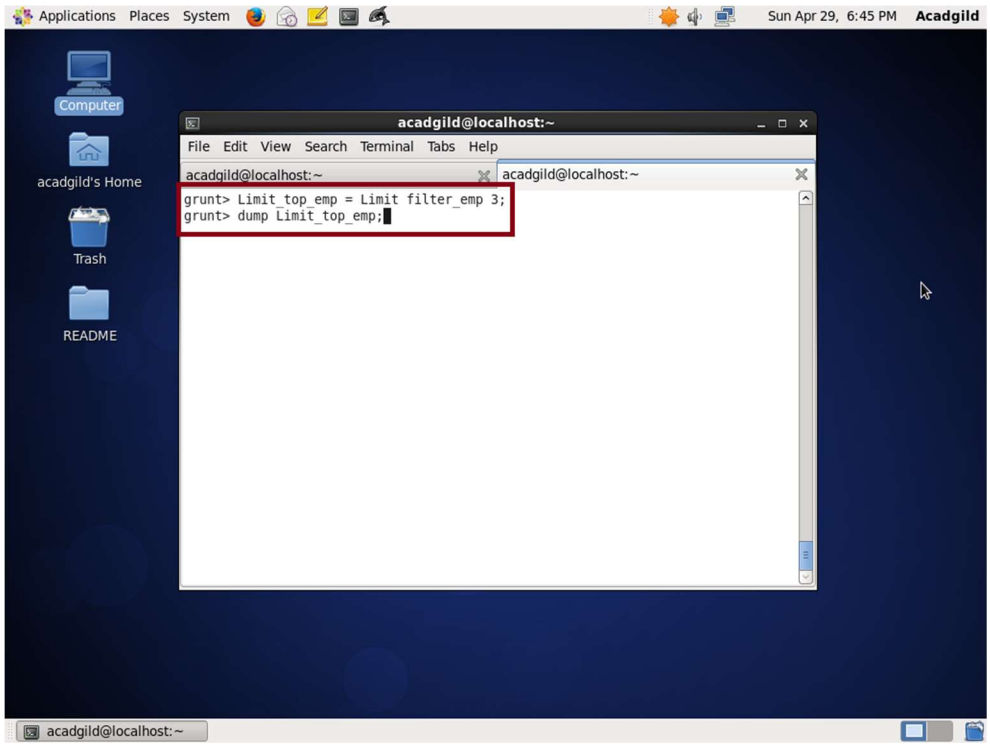


To check the result, you can use DUMP command

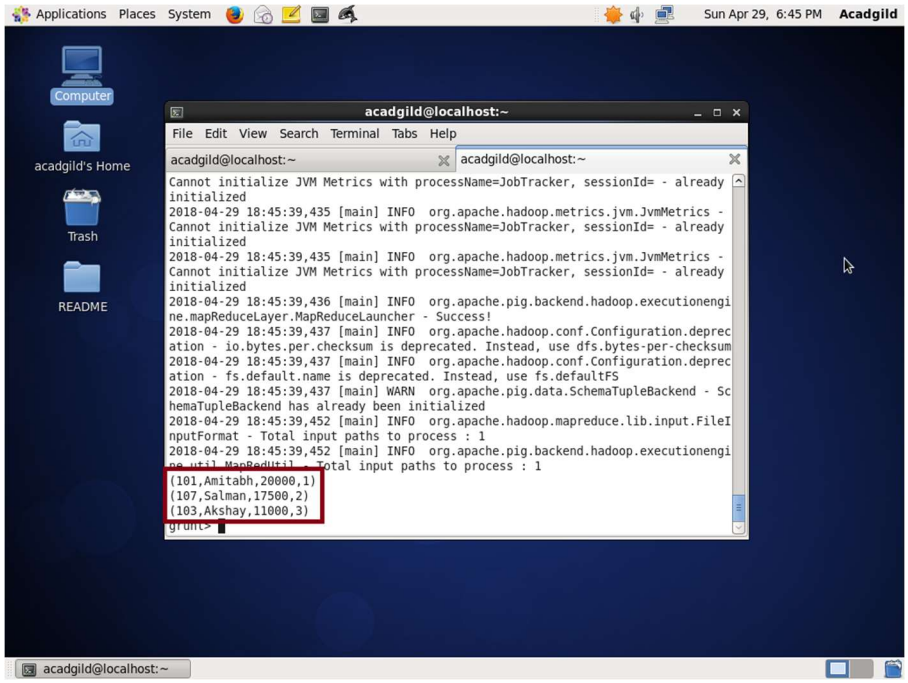


By using Limit top_emp = Limit filter_emp 3;

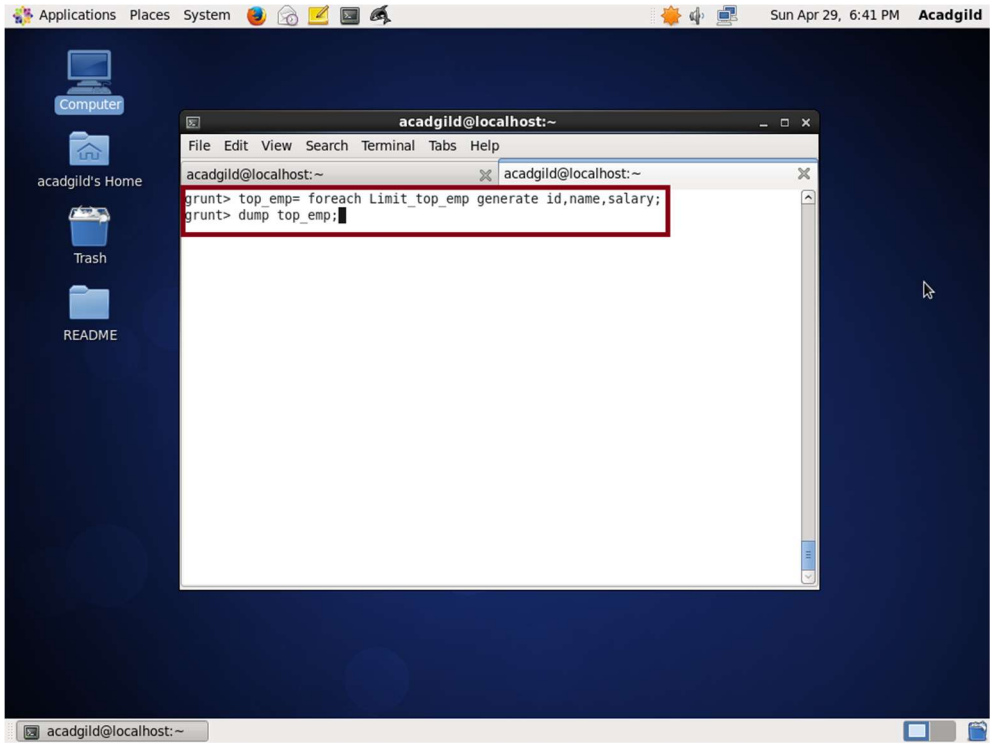
We can limit the top 3 employees with high salary.



To check the result, you can use DUMP command

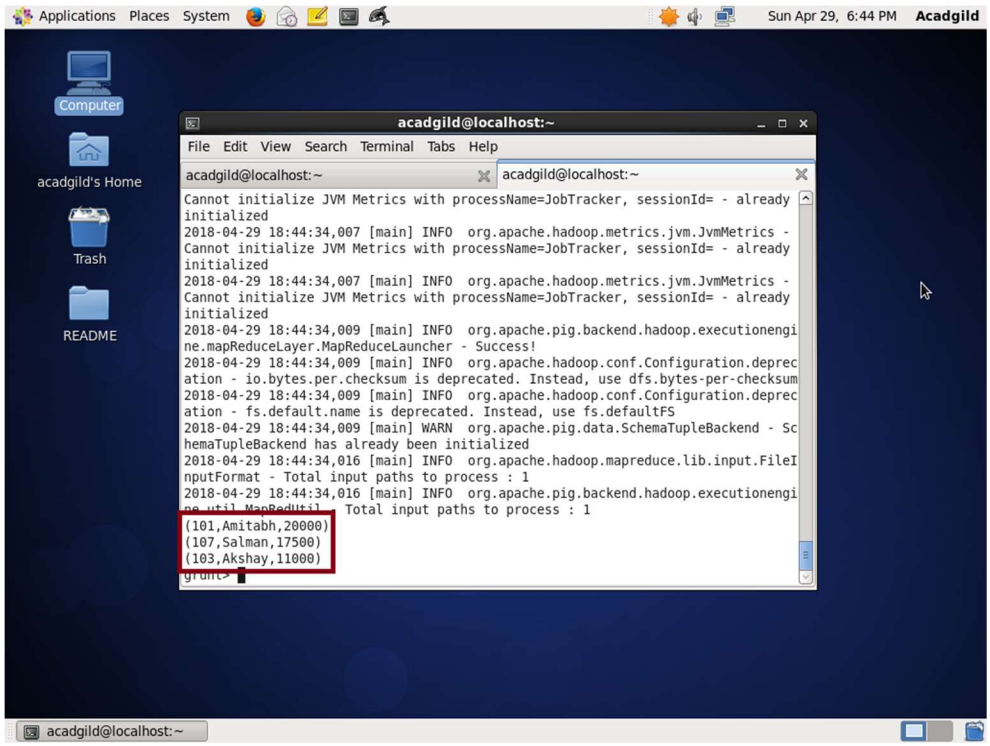


To specifically print the employee id and employee name with high salary, FOREACH is used to GENERATE the result



top_emp = foreach Limit_top_emp generate id, name , salary;

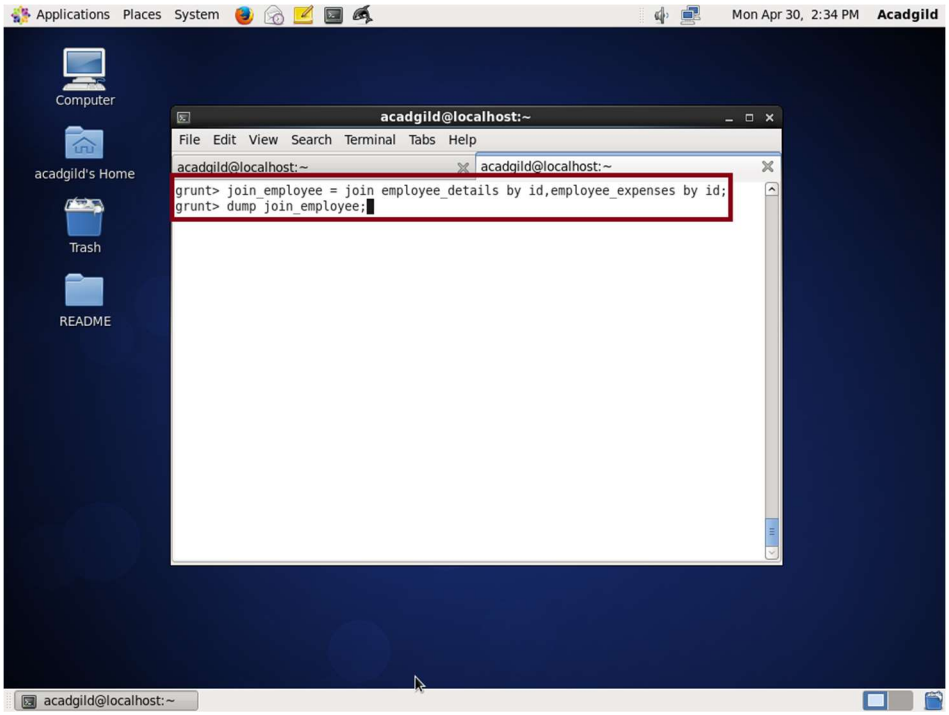
To check the result, you can use DUMP command



- **(c) Employee (employee id and employee name) with maximum expense (In case two employees have same expense, employee with name coming first in dictionary should get preference)**

Join relation is used to join two table, when both the table contents match.

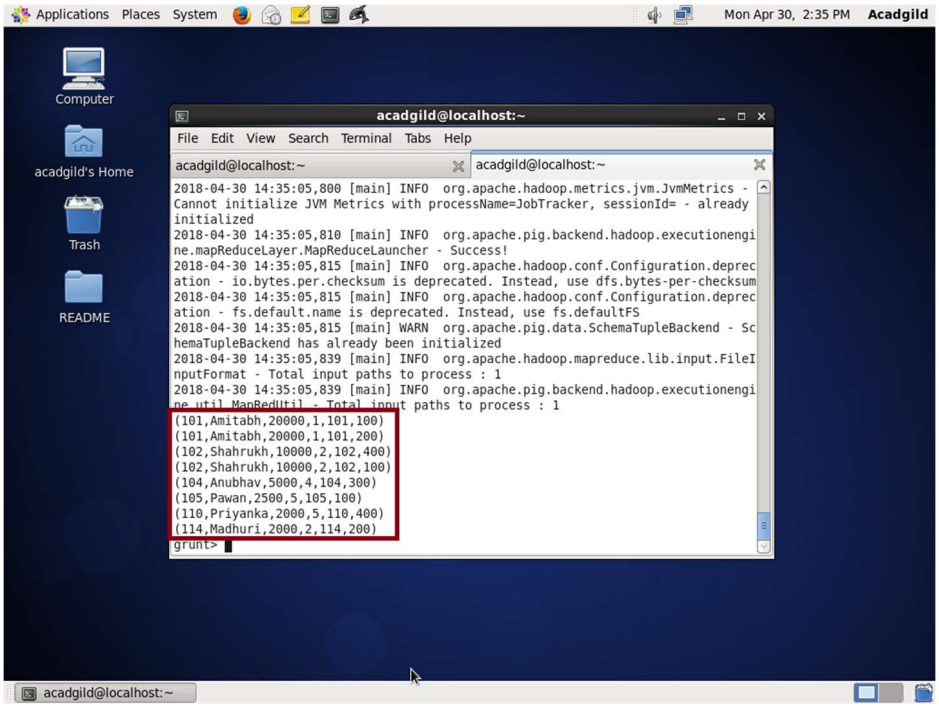
It creates a new relation by combining column values of two relations (say A and B) based upon the join-predicate. The query compares each row of A with each row of B to find all pairs of rows which satisfy the join-predicate. When the join-predicate is satisfied, the column values for each matched pair of rows of A and B are combined into a result row.



By using the following command, the two tables are joined by matching pair in the rows of employee details and employee expenses are combined into result.

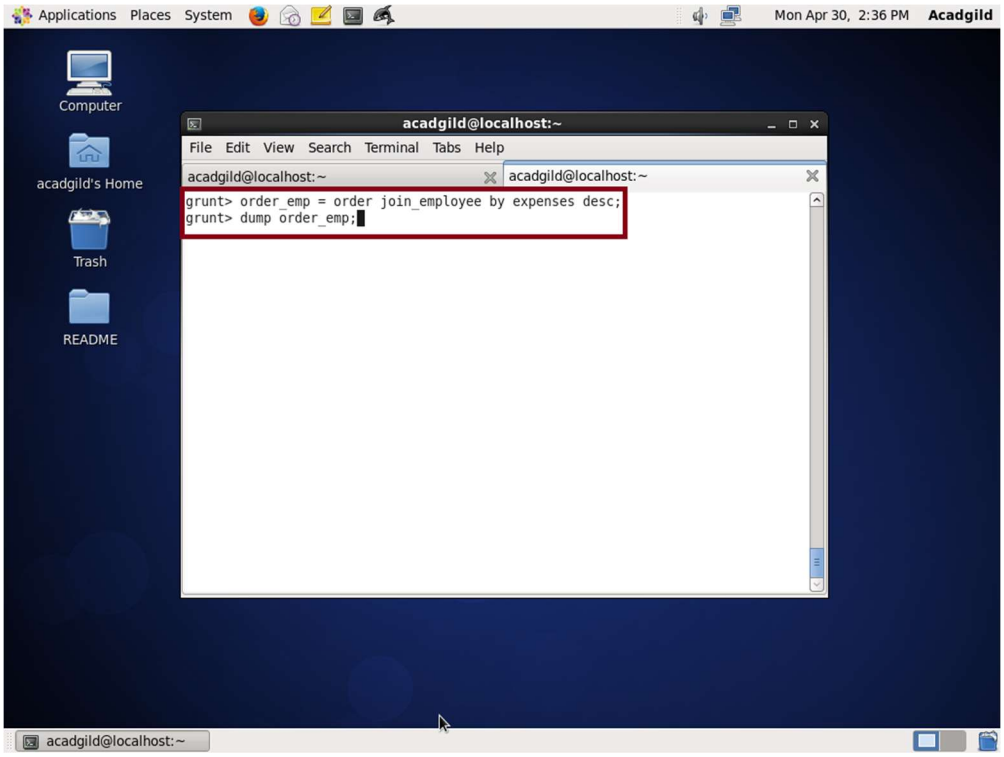
join_employee = join employee_details by id, employee_expenses by id;

To check the result, you can use DUMP command

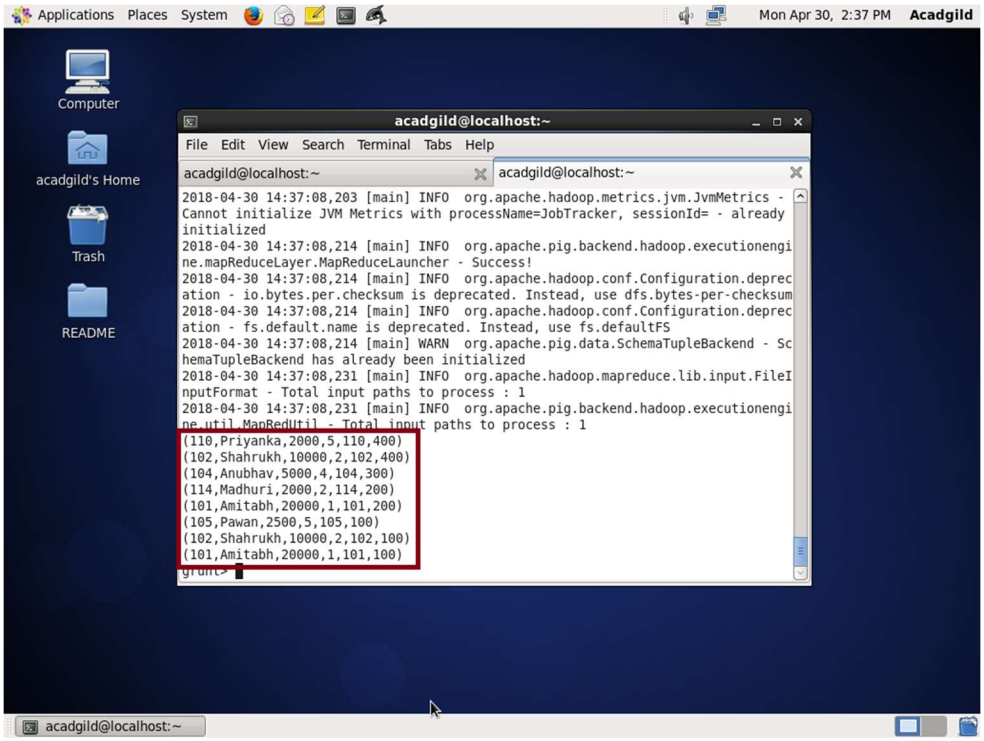


By using the following command, the result which is obtained by the

order_emp = order join_employee by expenses desc;

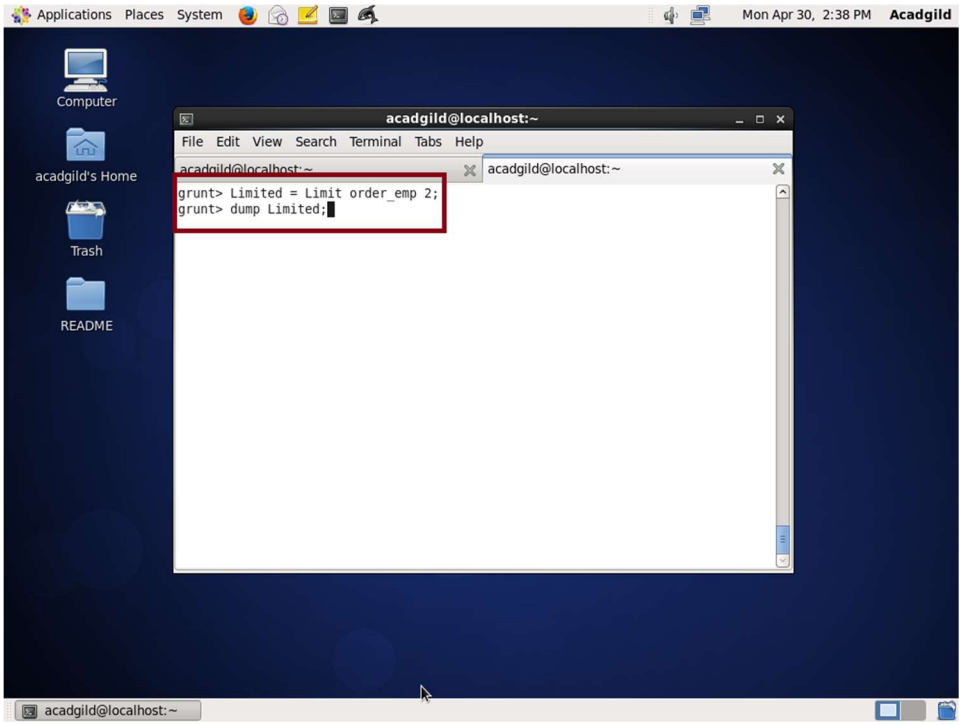


To check the result, you can use DUMP command

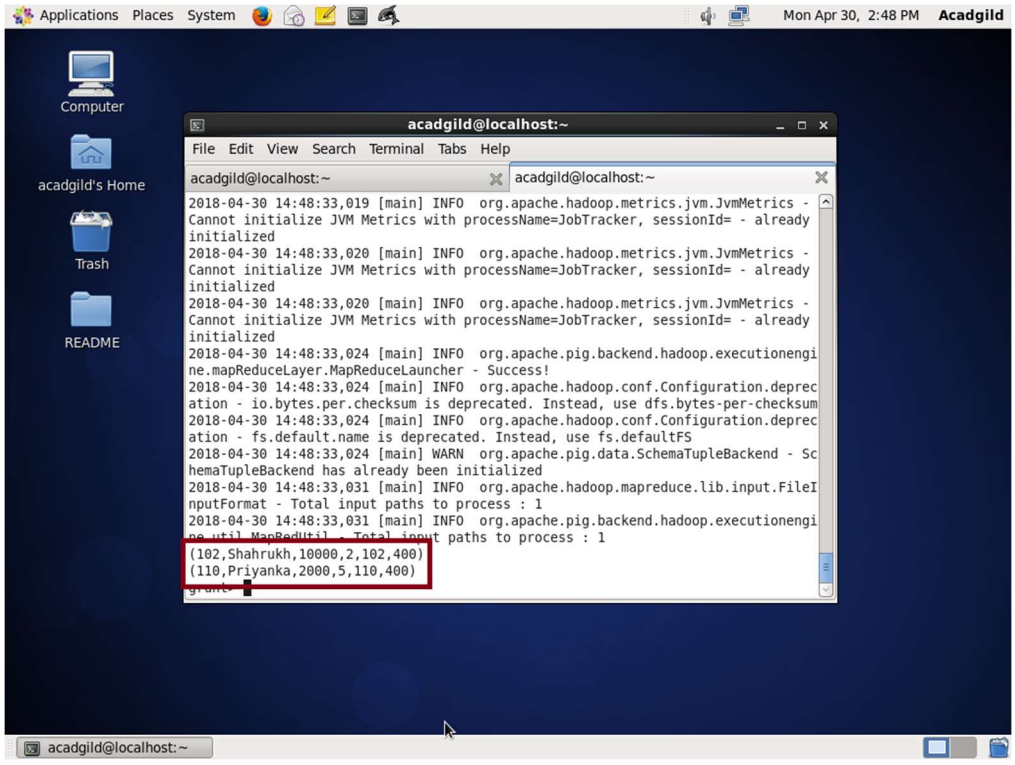


By using Limit operation, the data are limited to 2.

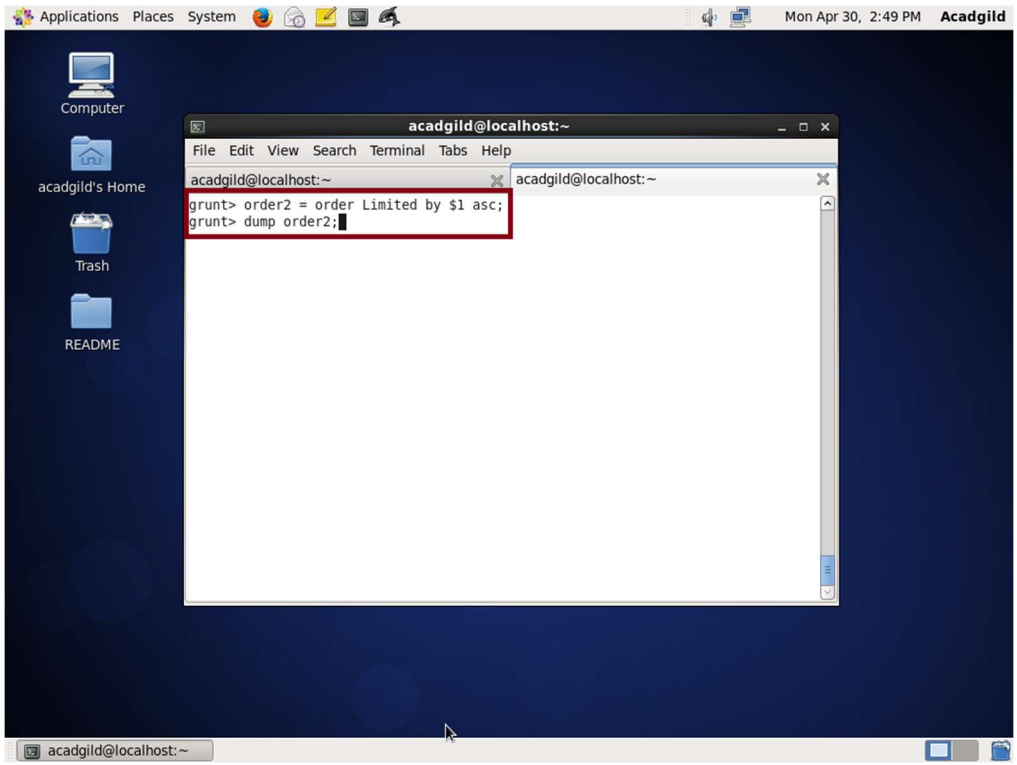
Limited = Limit order_emp 2;



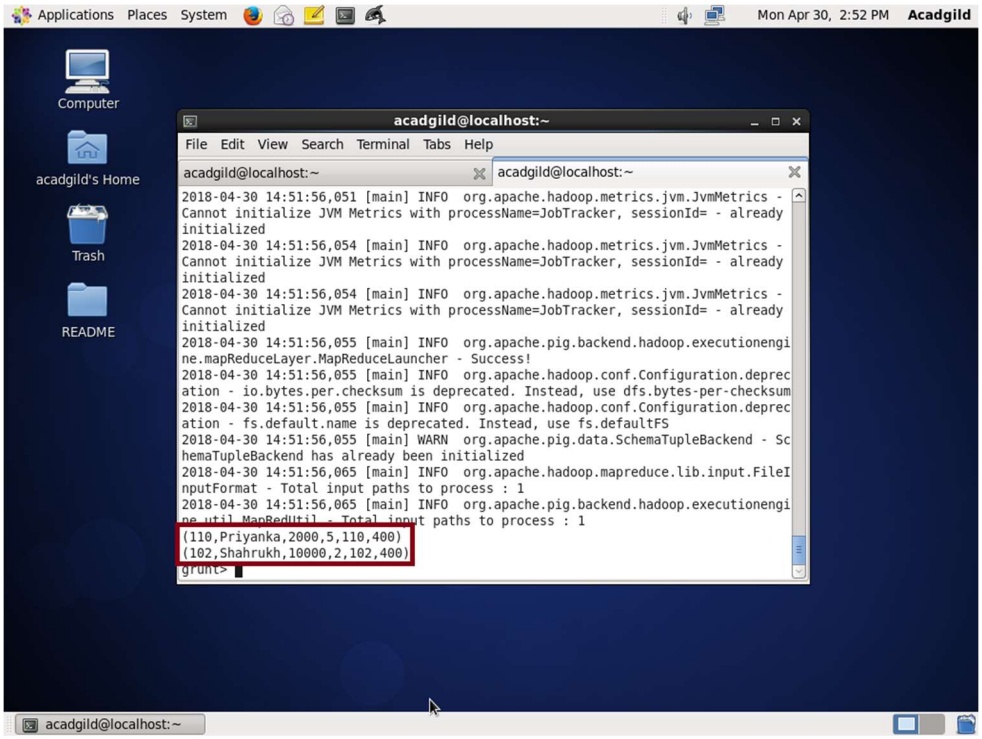
To check the result, you can use DUMP command



Here the two employees have same expense, employee with name coming first in dictionary should get preference. Hence we use ORDER operation to get the Ascending order of the data obtained.

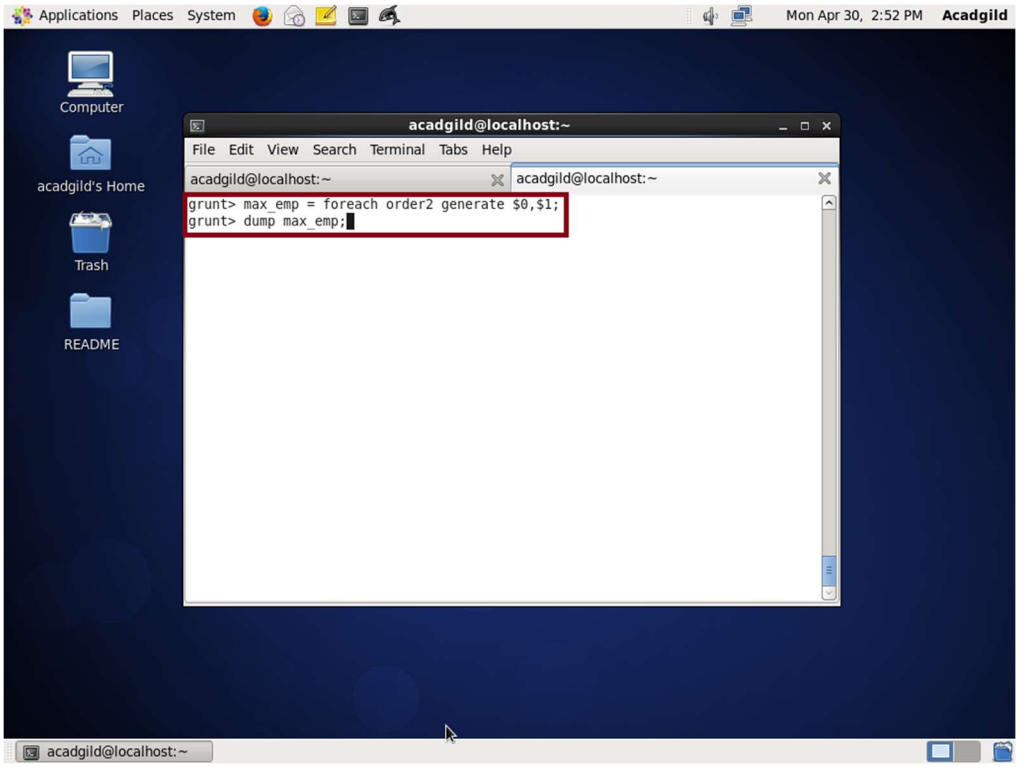


To check the result, you can use DUMP command

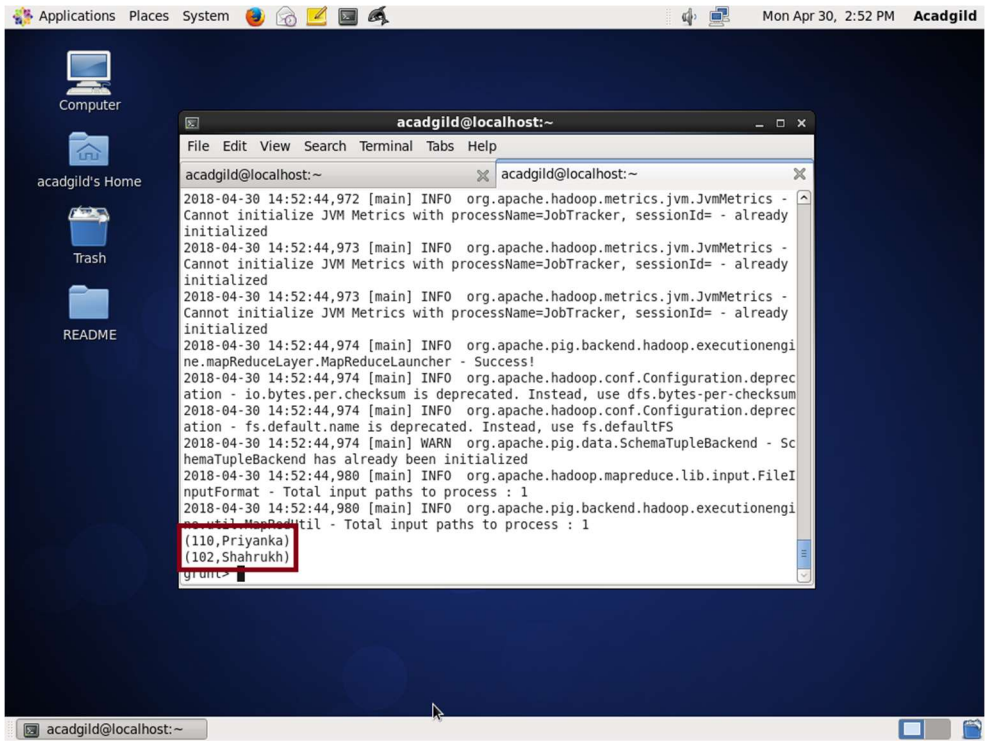


The Maximum Expense made by the employee are displayed with employee id and employee name.

max_emp = foreach order2 generate $0,$1;



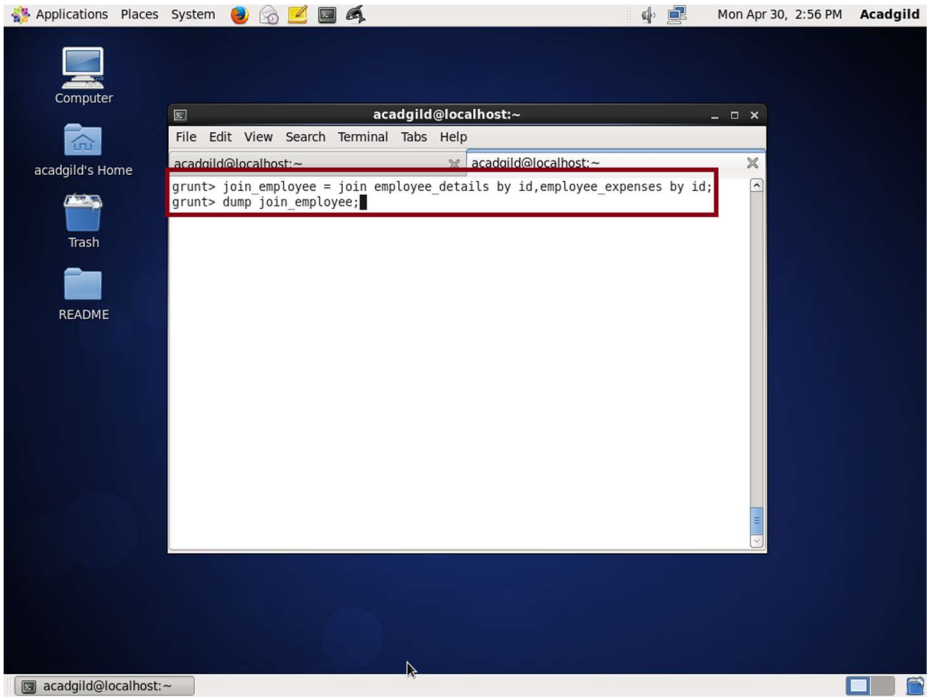
To check the result, you can use DUMP command



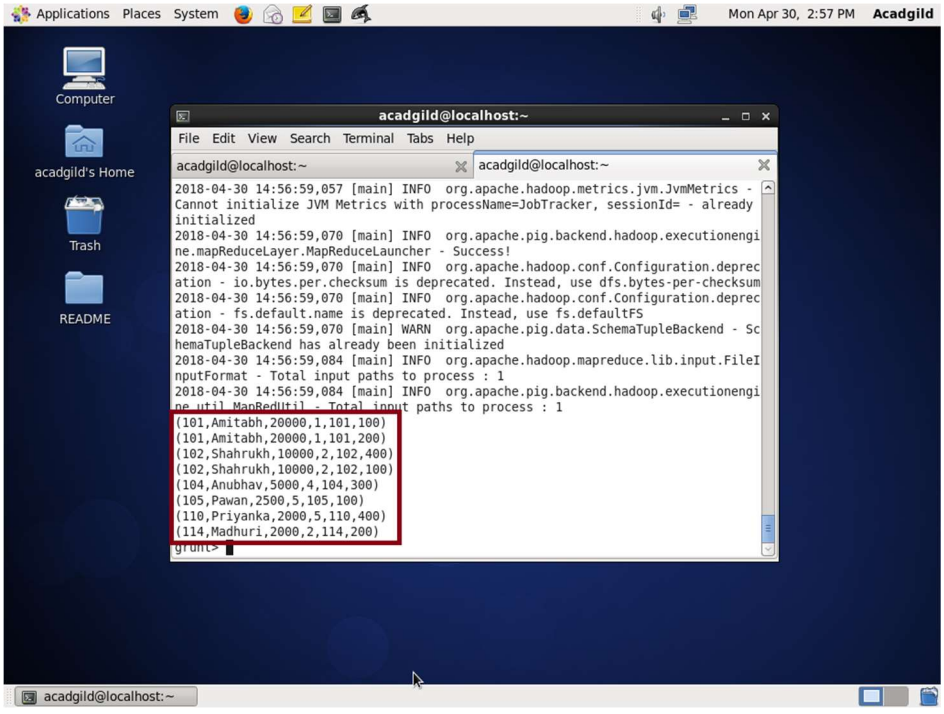
- **(d) List of employees (employee id and employee name) having entries in employee_expenses file.**

By using the join operator, the tables are joined and the data are obtained.

join_employee = join employee_details by id, employee_expenses by id;

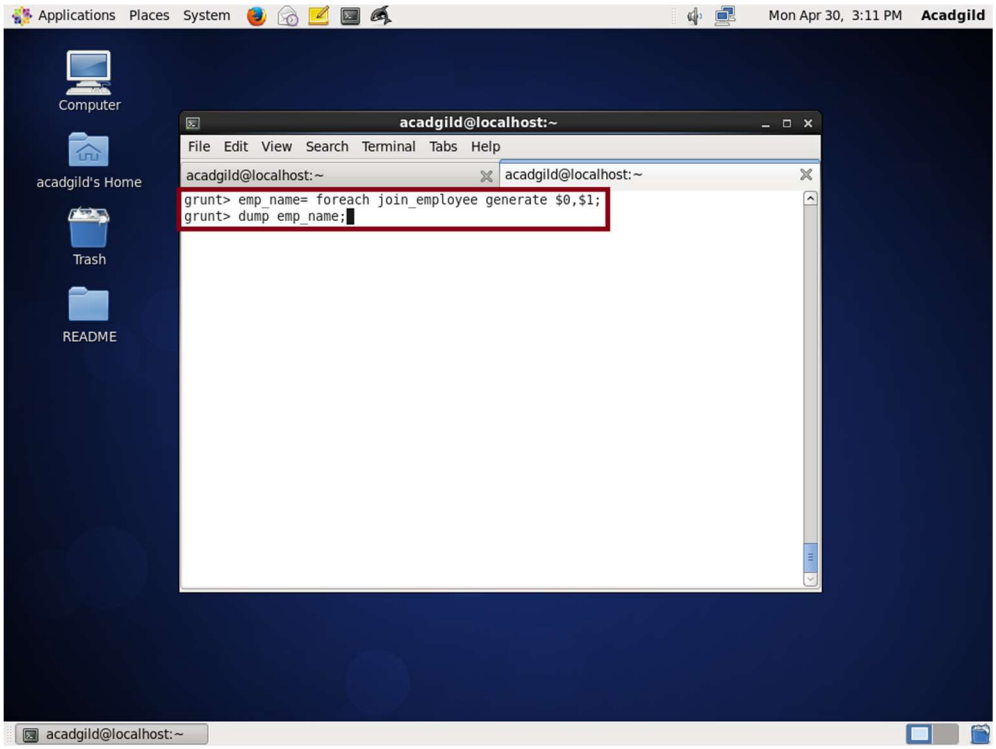


To check the result, you can use DUMP command

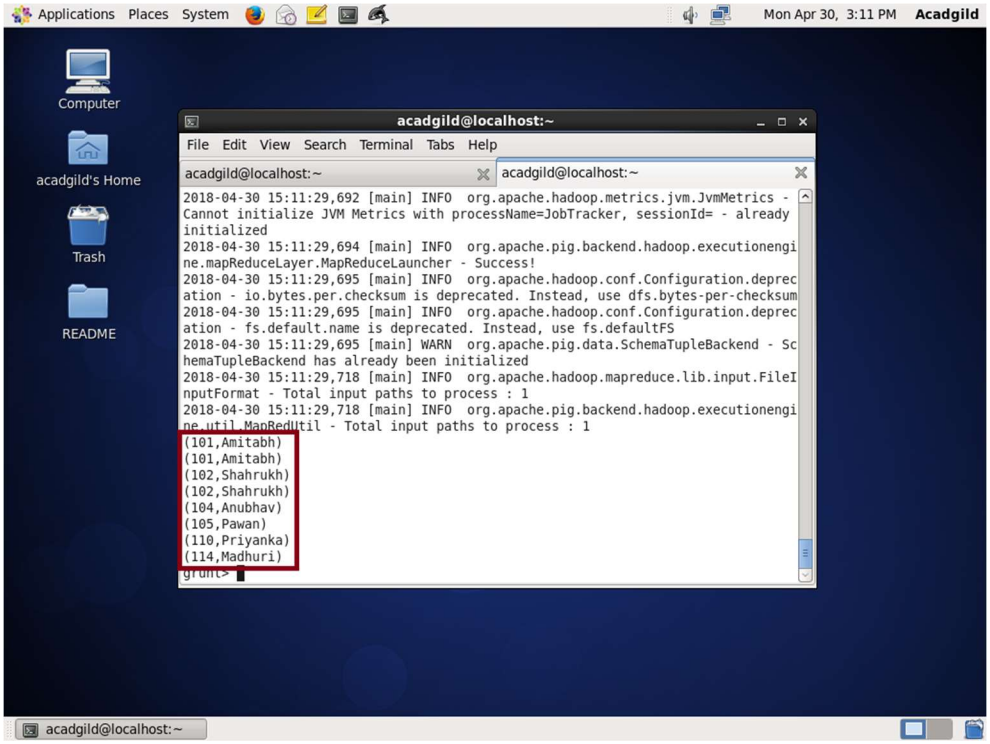


By using the below command, we can generate the employee id and employee name who have the entries in the employee expenses table.

emp_name = foreach join_employee generate $0, $1;



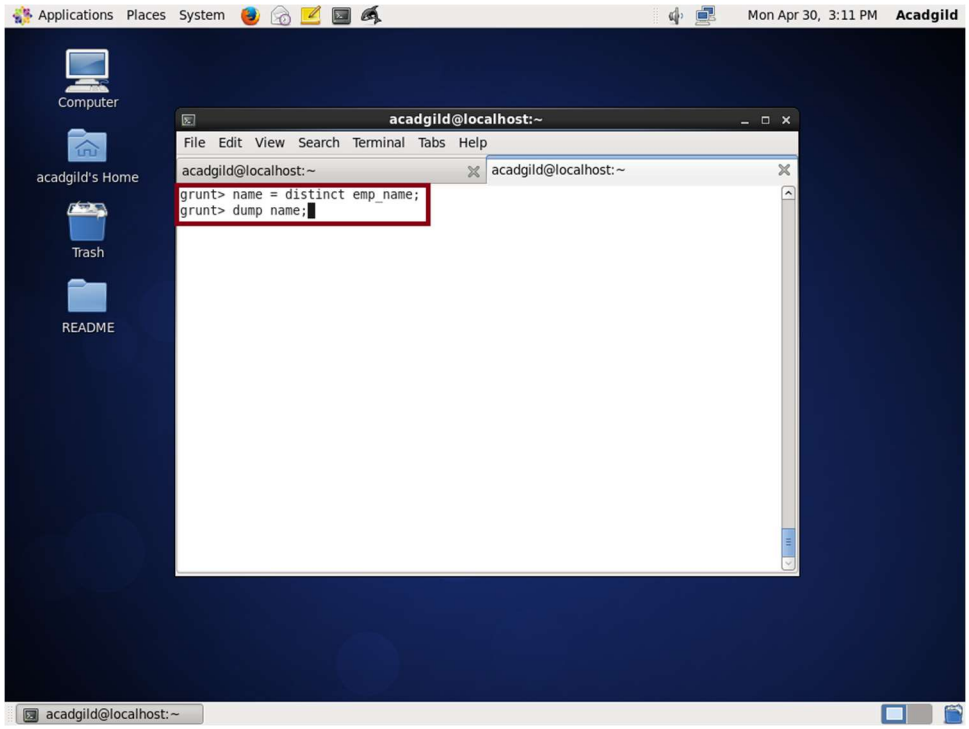
To check the result, you can use DUMP command



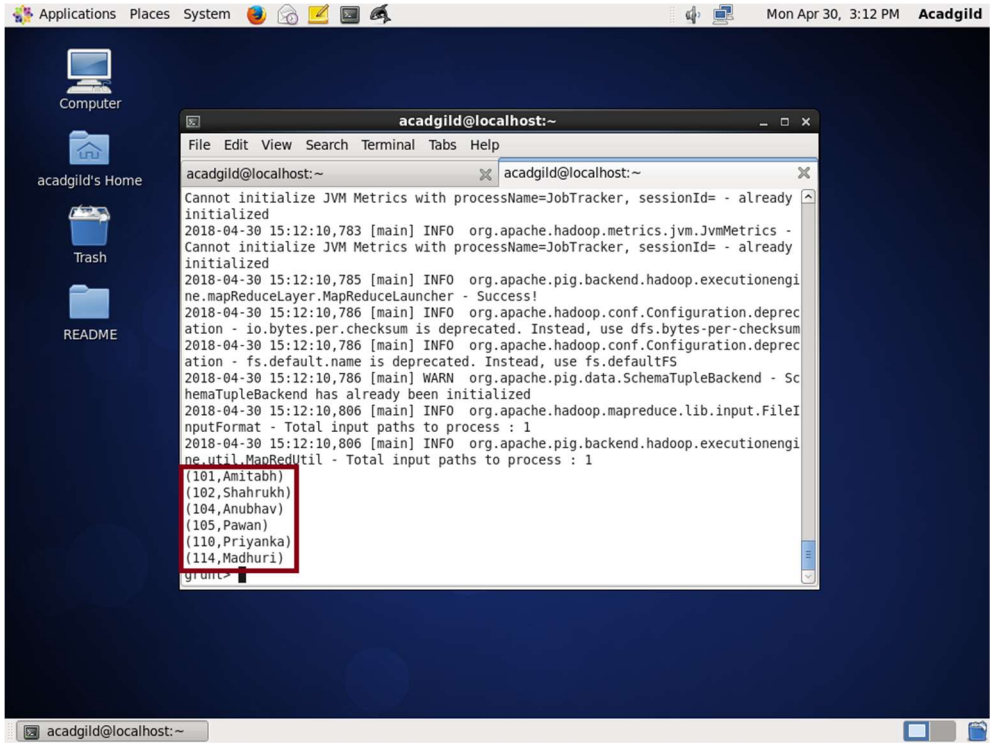
By using distinct operator, we can remove the duplicate entries in the table.

By using the following command, the duplicate entries are removed.

name = distinct emp_name;



To check the result, you can use DUMP command

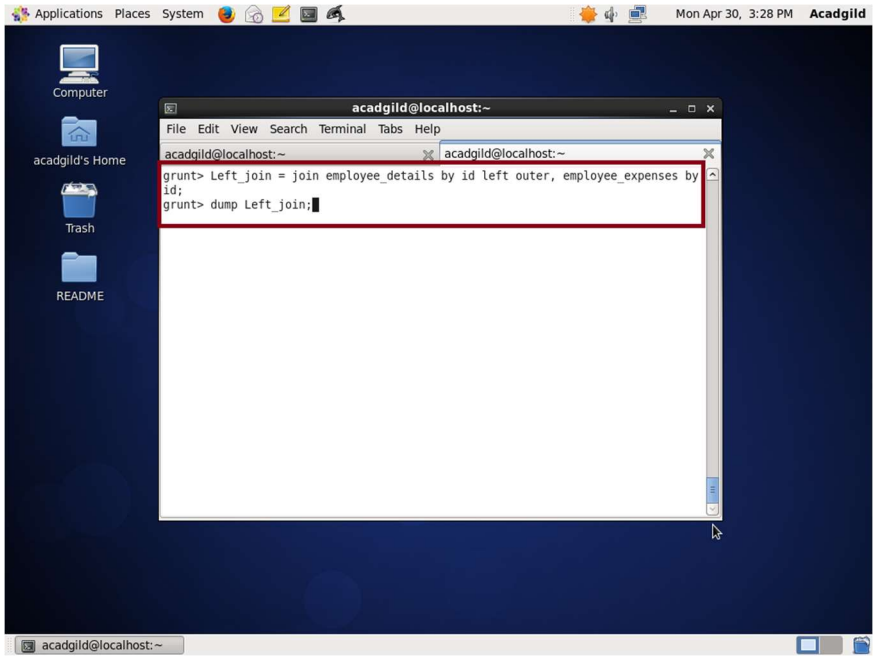


- **(e) List of employees (employee id and employee name) having no entry in employee_expenses file.**

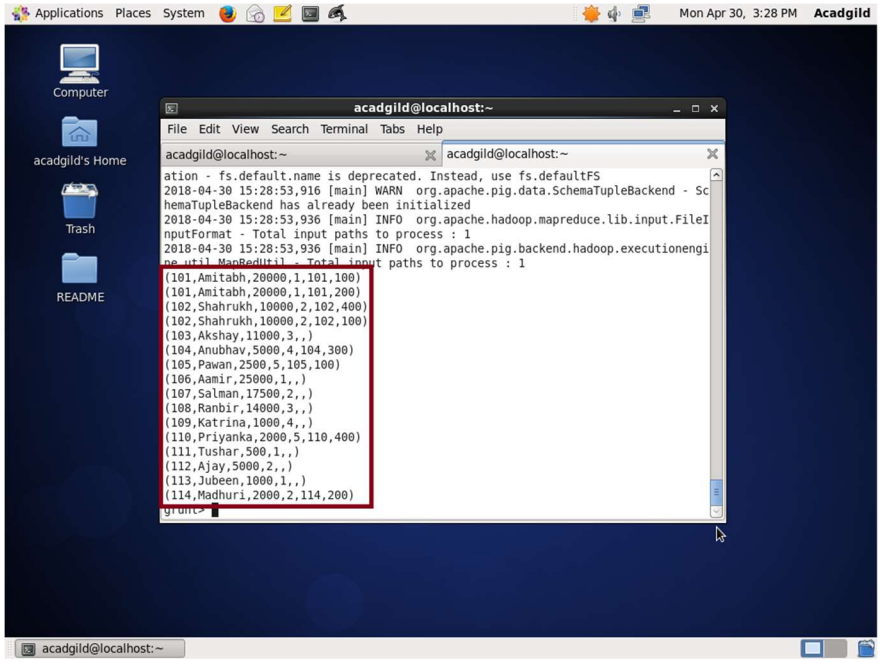
Left outer join is used to get all the data from the employee details table to get the list of employees who have no entry in the employee expenses file.

By using the following command, the Left outer join is performed.

Left_join =join employee_details by id left outer, employee_expenses by id;

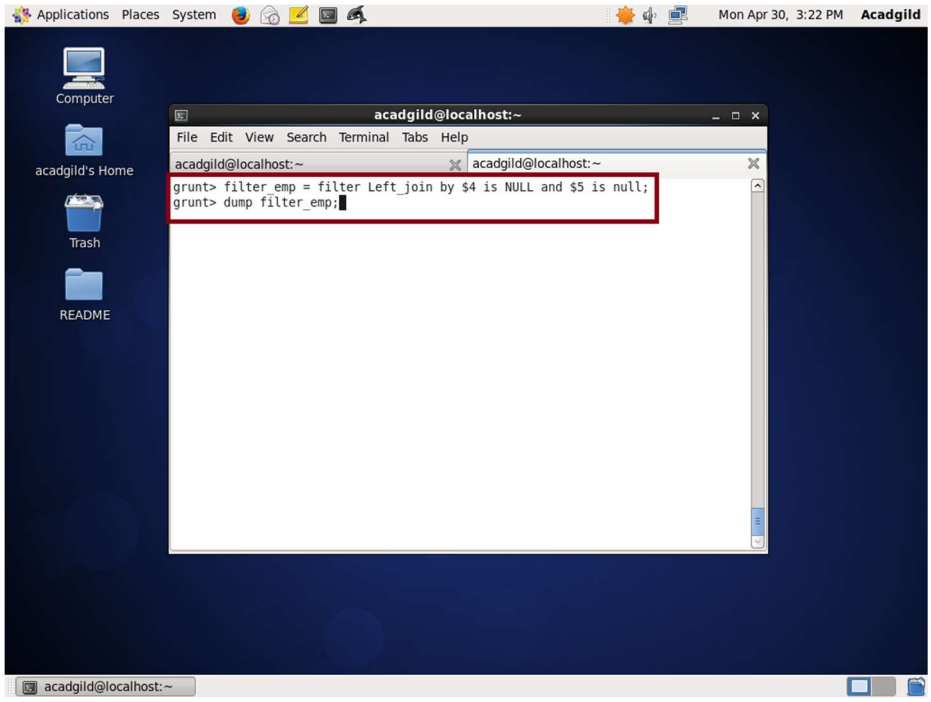


To check the result, you can use DUMP command

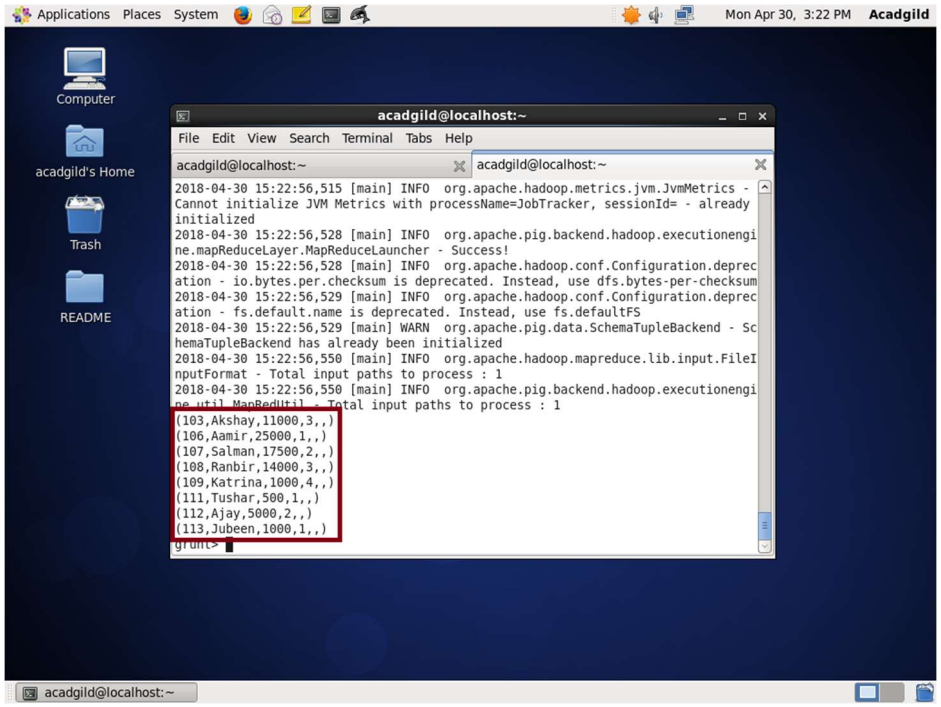


By using the following filter operation to filter out the data entries of employee details which have null data entries in the employee expense table.

filter_emp = filter Left_join by $4 is NULL and $5 is NULL;

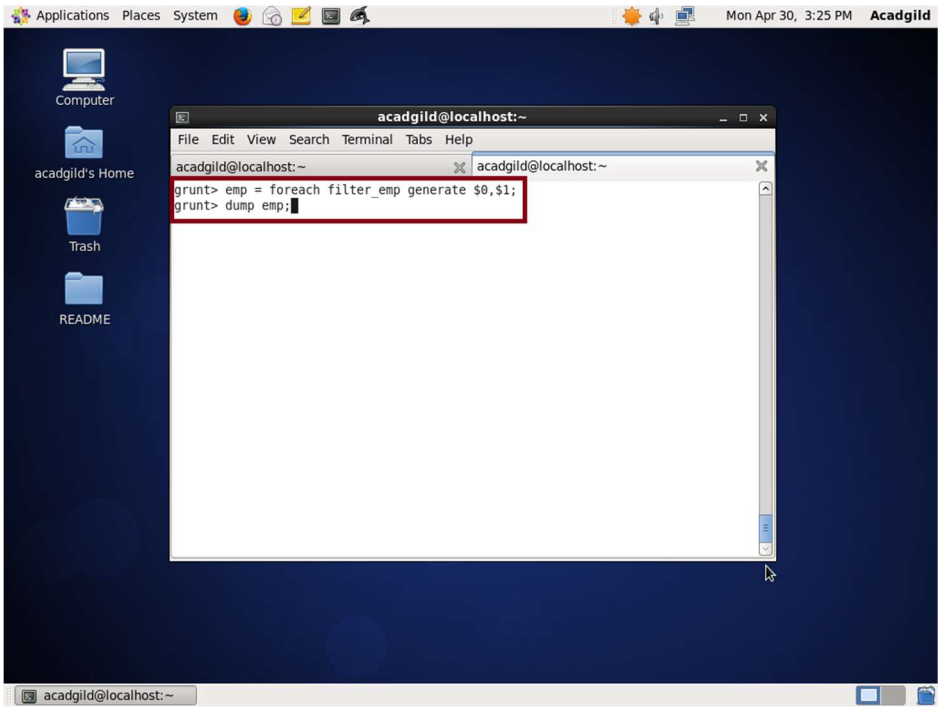


To check the result, you can use DUMP command

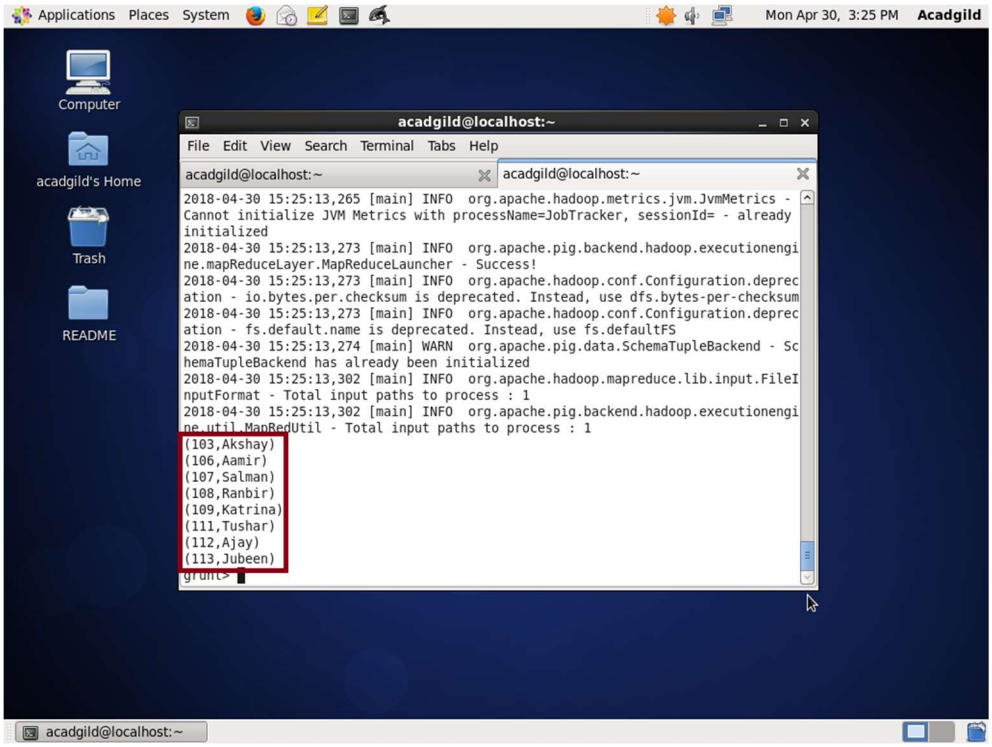


By using the following command, the employee id and employee name are generated.

emp = foreach filter_emp generate $0, $1;



To check the result, you can use DUMP command



- Task 3
  - **Implement the use case present in below blog link and share the complete steps along with screenshot(s) from your end.**

https://acadgild.com/blog/aviation-data-analysis-using-apache-pig

The U.S. Department of Transportation's (DOT) Bureau of Transportation Statistics (BTS) tracks the on-time performance of domestic flights operated by large air carriers. Summary information on the number of on-time, delayed, canceled, and diverted flights appears in DOT's monthly Air Travel Consumer Report, published about 30 days after the month's end, as well as in summary tables posted on this website. Summary statistics and raw data are made available to the public at the time the Air Travel Consumer Report is released.

You can download the datasets from the following links:

Delayed_Flights.csv

Airports.csv

These are 2 different datasets, i.e., Delayed_Flights.csv and Airports.csv. Let us understand one at a time.

Delayed_Flights.csv Datasets

There are 29 columns in this dataset. Some of them have been mentioned below:

Year: 1987 – 2008

Month: 1 – 12

FlightNum: Flight number

Canceled: Was the flight canceled?

CancelleationCode: The reason for cancellation.

For complete details, refer to this link.

Airports.csv Datasets

- iata: the international airport abbreviation code
- name of the airport
- city and country in which airport is located.
- lat and long: the latitude and longitude of the airport

Now, using Apache pig, we will try to gain more insights from these datasets.

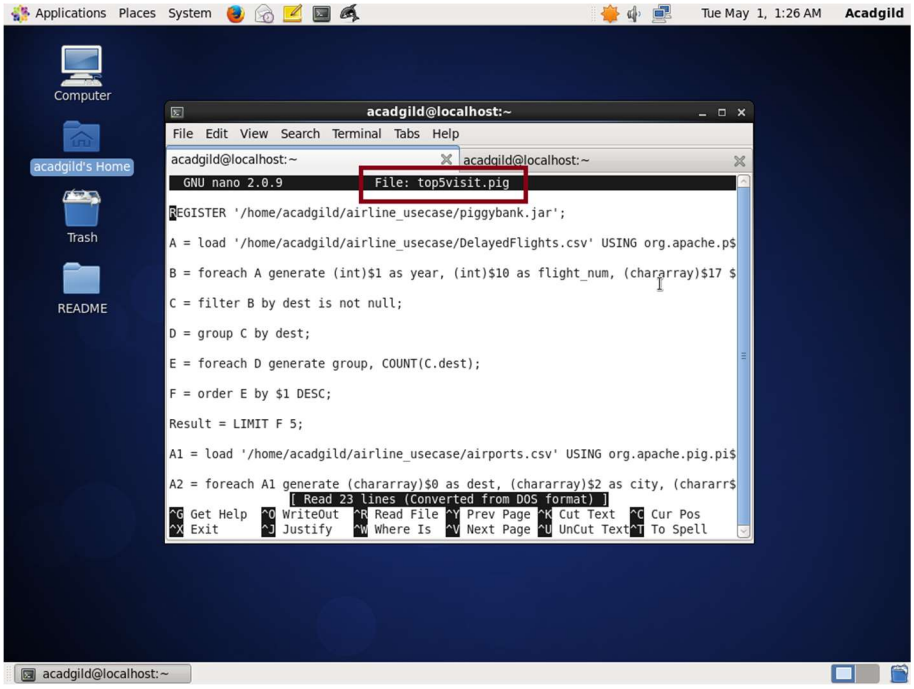
Problem Statement 1

Find out the top 5 most visited destinations.

nano top5visit.pig

Create the top5visit.pig file using, nano top5visit.pig command and save the file.

Here I create a pig file with the name top5visit.pig for the below code and run them to find the top 5 most visited destinations.



REGISTER

Registers a JAR file so that the UDFs in the file can be used.

Usage

Use the REGISTER statement inside a Pig script to specify the path of a Java JAR file containing UDFs.

You can register additional files (to use with your Pig script) via the command line using the -Dpig.additional.jars option.

For more information about UDFs, see the User Defined Function Guide. Note that Pig currently only supports functions written in Java.

Add the following codes to the pig file to implement the word count of the text input file

```
REGISTER '/home/acadgild/airline_usecase/piggybank.jar';

A = load '/home/acadgild/airline_usecase/DelayedFlights.csv' USING
org.apache.pig.piggybank.storage.CSVExcelStorage(',','NO_MULTILINE','UNIX'
,'SKIP_INPUT_HEADER');

B = foreach A generate (int)$1 as year, (int)$10 as flight_num,
(chararray)$17 as origin,(chararray) $18 as dest;

C = filter B by dest is not null;

D = group C by dest;

E = foreach D generate group, COUNT(C.dest);

F = order E by $1 DESC;

Result = LIMIT F 5;

A1 = load '/home/acadgild/airline_usecase/airports.csv' USING
org.apache.pig.piggybank.storage.CSVExcelStorage(',','NO_MULTILINE','UNIX'
,'SKIP_INPUT_HEADER');

A2 = foreach A1 generate (chararray)$0 as dest, (chararray)$2 as city,
(chararray)$4 as country;

joined_table = join Result by $0, A2 by dest;

dump joined_table;
```

In Line 1: We are registering the piggybank jar in order to use the CSVExcelStorage class.

In relation A, we are loading the dataset using CSVExcelStorage because of its effective technique to handle double quotes and headers.

In relation B, we are generating the columns that are required for processing and explicitly typecasting each of them.

In relation C, we are filtering the null values from the “dest” column.

In relation D, we are grouping relation C by “dest.”

In relation E, we are generating the grouped column and the count of each.

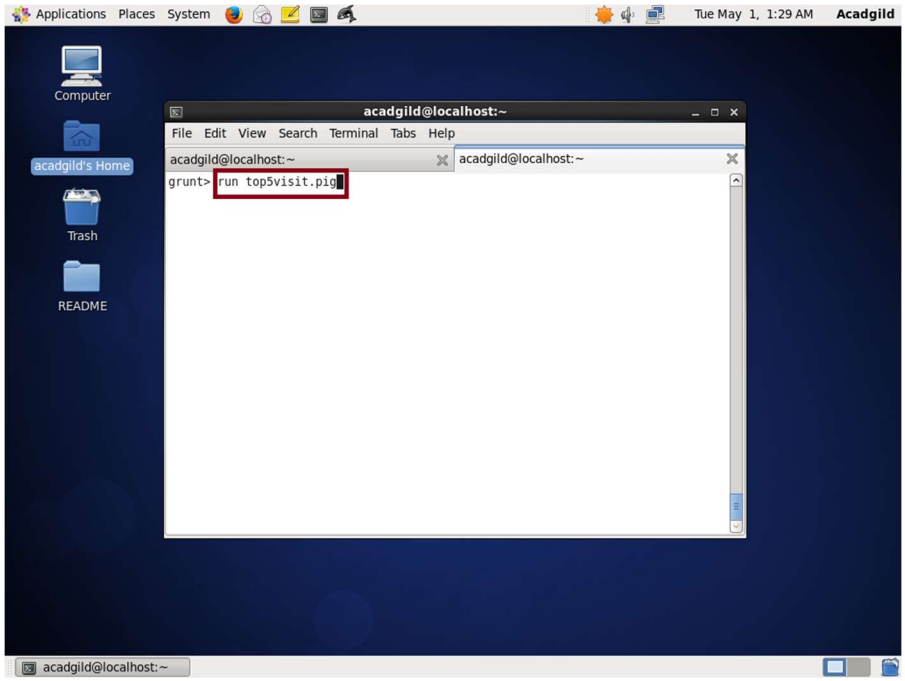
Relation F and Result is used to order and limit the result to top 5.

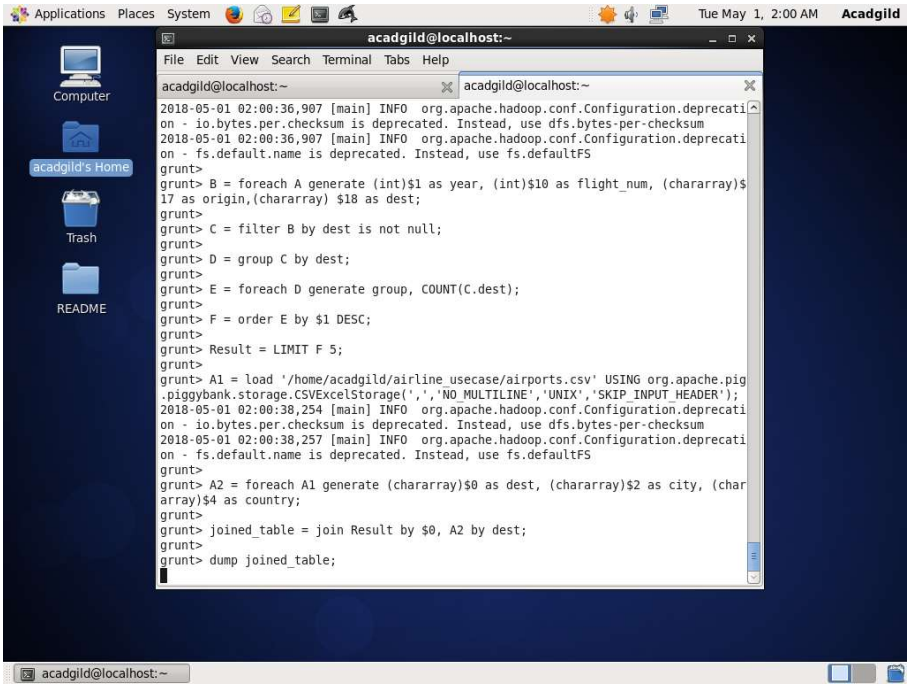
These are the steps to find the top 5 most visited destinations. However, adding few more steps in this process, we will be using another table to find the city name and country as well.

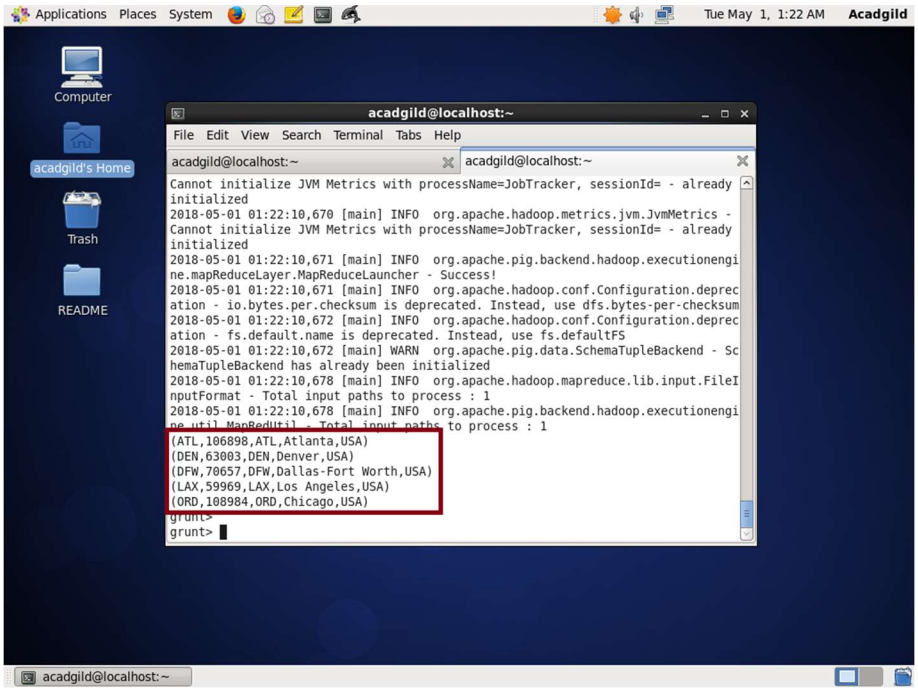
In relation **A1**, we are loading another table to which we will look-up and find the city as well as the country.
In relation **A2**, we are generating dest, city, and country from the previous relation.
In relation **joined_table**, we are joining Result and A2 based on a common column, i.e., “dest”
Finally, using dump, we are printing the result.

By using the following command, the top5visit.pig is made to run.

run top5visit.pig




Applications Places System
Tue May 1, 2:00 AM
Acadgild
acadgild@localhost:~
File Edit View Search Terminal Tabs Help
acadgild@localhost:~
acadgild@localhost:~
2018-05-01 02:00:36,907 [main] INFO org.apache.hadoop.conf.Configuration.deprecati
on - io.bytes.per.checksum is deprecated. Instead, use dfs.bytes-per-checksum
2018-05-01 02:00:36,907 [main] INFO org.apache.hadoop.conf.Configuration.deprecati
on - fs.default.name is deprecated. Instead, use fs.defaultFS
grunt>
grunt> B = foreach A generate (int)$1 as year, (int)$10 as flight_num, (chararray)$
17 as origin,(chararray) $18 as dest;
grunt>
grunt> C = filter B by dest is not null;
grunt>
grunt> D = group C by dest;
grunt>
grunt> E = foreach D generate group, COUNT(C.dest);
grunt>
grunt> F = order E by $1 DESC;
grunt>
grunt> Result = LIMIT F 5;
grunt>
grunt> A1 = load '/home/acadgild/airline_usecase/airports.csv' USING org.apache.pig
.piggybank.storage.CSVExcelStorage(',','NO_MULTILINE','UNIX','SKIP_INPUT_HEADER');
2018-05-01 02:00:38,254 [main] INFO org.apache.hadoop.conf.Configuration.deprecati
on - io.bytes.per.checksum is deprecated. Instead, use dfs.bytes-per-checksum
2018-05-01 02:00:38,257 [main] INFO org.apache.hadoop.conf.Configuration.deprecati
on - fs.default.name is deprecated. Instead, use fs.defaultFS
grunt>
grunt> A2 = foreach A1 generate (chararray)$0 as dest, (chararray)$2 as city, (char
array)$4 as country;
grunt>
grunt> joined_table = join Result by $0, A2 by dest;
grunt>
grunt> dump joined_table;
Computer
acadgild's Home
Trash
README
acadgild@localhost:~


Applications Places System
Tue May 1, 1:22 AM
Acadgild
acadgild@localhost:~
File Edit View Search Terminal Tabs Help
acadgild@localhost:~
acadgild@localhost:~
Cannot initialize JVM Metrics with processName=JobTracker, sessionId= - already
initialized
2018-05-01 01:22:10,670 [main] INFO org.apache.hadoop.metrics.jvm.JvmMetrics -
Cannot initialize JVM Metrics with processName=JobTracker, sessionId= - already
initialized
2018-05-01 01:22:10,671 [main] INFO org.apache.pig.backend.hadoop.executionengi
ne.mapReduceLayer.MapReduceLauncher - Success!
2018-05-01 01:22:10,671 [main] INFO org.apache.hadoop.conf.Configuration.deprec
ation - io.bytes.per.checksum is deprecated. Instead, use dfs.bytes-per-checksum
2018-05-01 01:22:10,672 [main] INFO org.apache.hadoop.conf.Configuration.deprec
ation - fs.default.name is deprecated. Instead, use fs.defaultFS
2018-05-01 01:22:10,672 [main] WARN org.apache.pig.data.SchemaTupleBackend - Sc
hemaTupleBackend has already been initialized
2018-05-01 01:22:10,678 [main] INFO org.apache.hadoop.mapreduce.lib.input.FileI
nputFormat - Total input paths to process : 1
2018-05-01 01:22:10,678 [main] INFO org.apache.pig.backend.hadoop.executionengi
ne.util.MapRedUtil - Total input paths to process : 1
(ATL,106898,ATL,Atlanta,USA)
(DEN,63003,DEN,Denver,USA)
(DFW,70657,DFW,Dallas-Fort Worth,USA)
(LAX,59969,LAX,Los Angeles,USA)
(ORD,108984,ORD,Chicago,USA)
grunt>
grunt>
Computer
acadgild's Home
Trash
README
acadgild@localhost:~

Problem Statement 2

Which month has seen the most number of cancellations due to bad weather?

nano Mostcancel.pig

Create the Mostcancel.pig file using, nano Mostcancel.pig command and save the file.

Here I create a pig file with the name Mostcancel.pig for the below code and run them to find the most number of cancellations due to bad weather.

```
REGISTER '/home/acadgild/airline_usecase/piggybank.jar';

A = load '/home/acadgild/airline_usecase/DelayedFlights.csv' USING
org.apache.pig.piggybank.storage.CSVExcelStorage(',','NO_MULTILINE','UNIX'
,'SKIP_INPUT_HEADER');

B = foreach A generate (int)$2 as month,(int)$10 as flight_num,(int)$22 as
cancelled,(chararray)$23 as cancel_code;

C = filter B by cancelled == 1 AND cancel_code =='B';

D = group C by month;

E = foreach D generate group, COUNT(C.cancelled);

F= order E by $1 DESC;

Result = limit F 1;

dump Result;
```

In Line 1: We are registering piggybank jar in order to use the CSVExcelStorage class.

In relation A, we are loading the dataset using CSVExcelStorage because of its effective technique to handle double quotes and header.

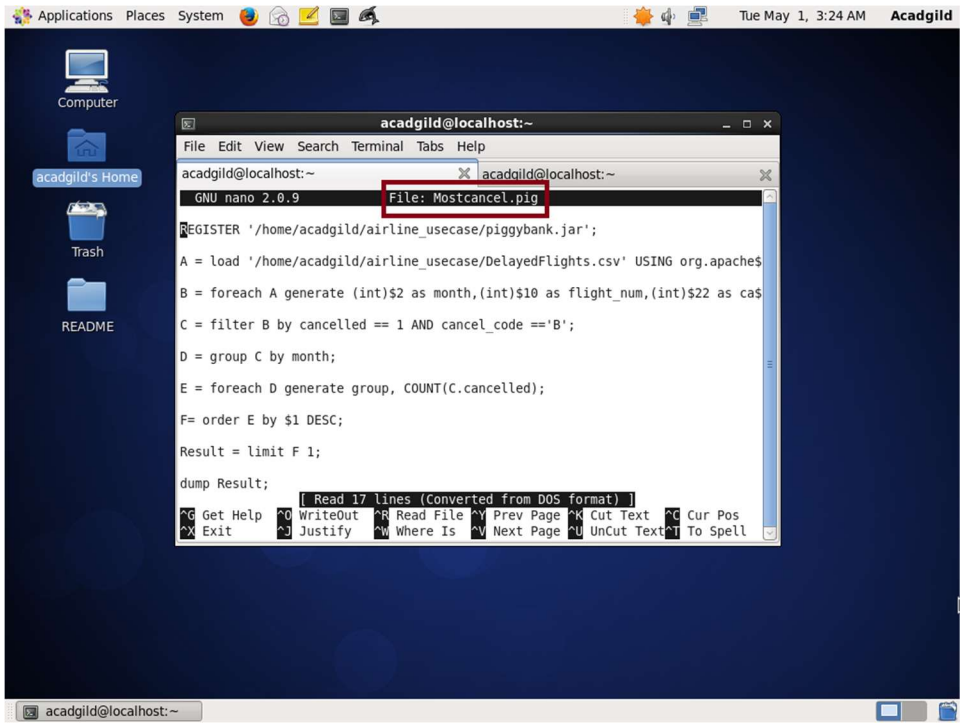
In relation B, we are generating the columns which are required for processing and explicitly typecasting each of them.

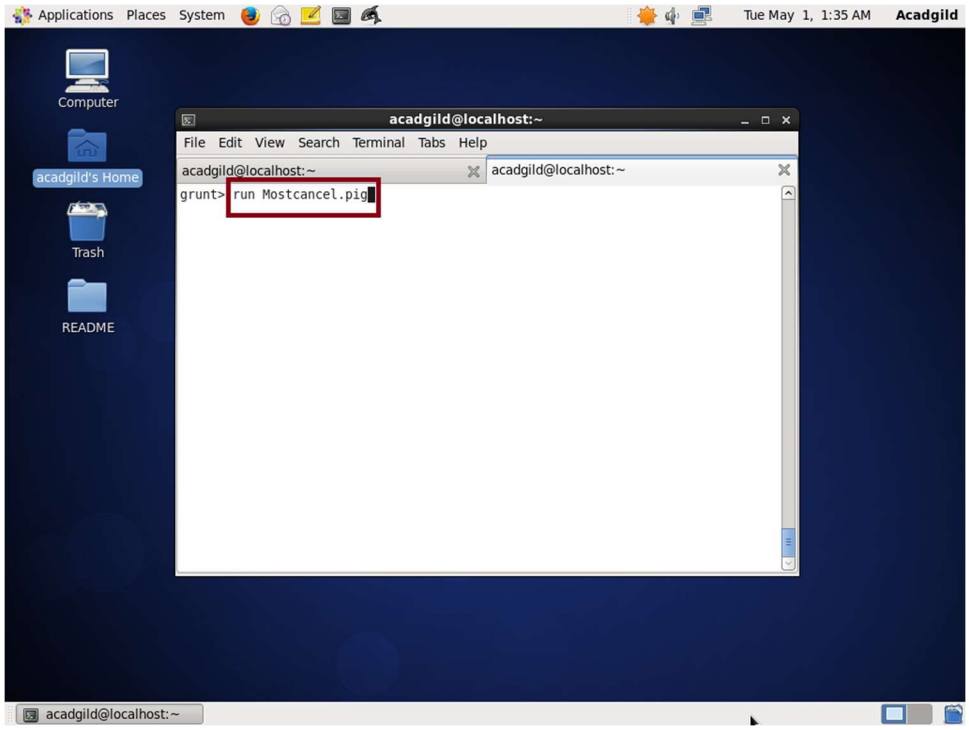
In relation C, we are filtering the data based on cancellation and cancellation code, i.e., canceled = 1 means flight have been canceled and cancel_code = ‘B’ means the reason for cancellation is “weather.” So relation C will point to the data which consists of canceled flights due to bad weather.

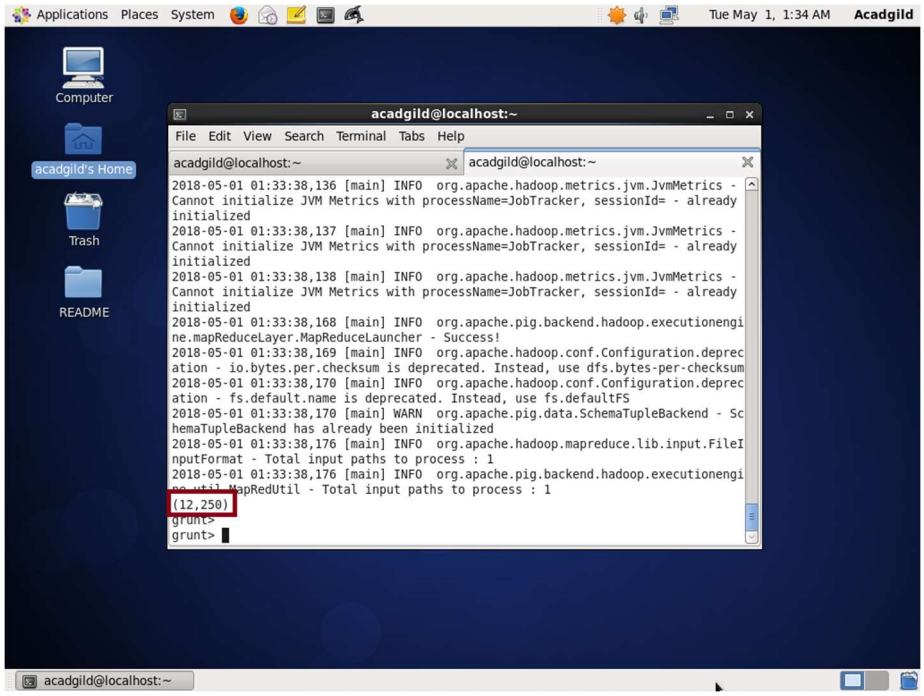
In relation D, we are grouping the relation C based on every month.

In relation E, we are finding the count of canceled flights every month.

Relation F and Result is for ordering and finding the top month based on cancellation.






Applications Places System
Tue May 1, 1:34 AM Acadgild
Computer
acadgild's Home
Trash
README
acadgild@localhost:~
File Edit View Search Terminal Tabs Help
acadgild@localhost:~
acadgild@localhost:~
2018-05-01 01:33:38,136 [main] INFO org.apache.hadoop.metrics.jvm.JvmMetrics - Cannot initialize JVM Metrics with processName=JobTracker, sessionId= - already initialized
2018-05-01 01:33:38,137 [main] INFO org.apache.hadoop.metrics.jvm.JvmMetrics - Cannot initialize JVM Metrics with processName=JobTracker, sessionId= - already initialized
2018-05-01 01:33:38,138 [main] INFO org.apache.hadoop.metrics.jvm.JvmMetrics - Cannot initialize JVM Metrics with processName=JobTracker, sessionId= - already initialized
2018-05-01 01:33:38,168 [main] INFO org.apache.pig.backend.hadoop.executionengine.mapReduceLayer.MapReduceLauncher - Success!
2018-05-01 01:33:38,169 [main] INFO org.apache.hadoop.conf.Configuration.deprecation - io.bytes.per.checksum is deprecated. Instead, use dfs.bytes-per-checksum
2018-05-01 01:33:38,170 [main] INFO org.apache.hadoop.conf.Configuration.deprecation - fs.default.name is deprecated. Instead, use fs.defaultFS
2018-05-01 01:33:38,170 [main] WARN org.apache.pig.data.SchemaTupleBackend - SchemaTupleBackend has already been initialized
2018-05-01 01:33:38,176 [main] INFO org.apache.hadoop.mapreduce.lib.input.FileInputFormat - Total input paths to process : 1
2018-05-01 01:33:38,176 [main] INFO org.apache.pig.backend.hadoop.executionengine.util.MapRedUtil - Total input paths to process : 1
(12,250)
grunt>
grunt>
acadgild@localhost:~

Problem Statement 3

Top ten origins with the highest AVG departure delay

To find the top ten origins with high AVG departure delay, the following code is build and saved as pig file.

By using nano command the code is saved in to pig file.

nano topten.pig

```
REGISTER '/home/acadgild/airline_usecase/piggybank.jar';

A = load '/home/acadgild/airline_usecase/DelayedFlights.csv' USING
org.apache.pig.piggybank.storage.CSVExcelStorage(',','NO_MULTILINE','UNIX'
,'SKIP_INPUT_HEADER');

B1 = foreach A generate (int)$16 as dep_delay, (chararray)$17 as origin;

C1 = filter B1 by (dep_delay is not null) AND (origin is not null);

D1 = group C1 by origin;

E1 = foreach D1 generate group, AVG(C1.dep_delay);

Result = order E1 by $1 DESC;

Top_ten = limit Result 10;

Lookup = load '/home/acadgild/airline_usecase/airports.csv' USING
org.apache.pig.piggybank.storage.CSVExcelStorage(',','NO_MULTILINE','UNIX'
,'SKIP_INPUT_HEADER');

Lookup1 = foreach Lookup generate (chararray)$0 as origin, (chararray)$2
as city, (chararray)$4 as country;

Joined = join Lookup1 by origin, Top_ten by $0;

Final = foreach Joined generate $0,$1,$2,$4;

Final_Result = ORDER Final by $3 DESC;

dump Final_Result;
```

Explanation of first 3 lines are the same as explained in the previous 2 problem statements.

In relation C1, we are removing the null values fields present if any.

In relation D1, we are grouping the data based on column “origin.”

In relation E1, we are finding average delay from each unique origin.

Relations named Result and Top_ten are ordering the results in descending order and printing the top ten values.

These steps are good enough to find the top ten origins with the highest average departure delay.

However, rather than generating just the code of origin, we will be following a few more steps to find some more details like country and city.

In the relation Lookup, we are loading another table to which we will look up and find the city as well as the country.

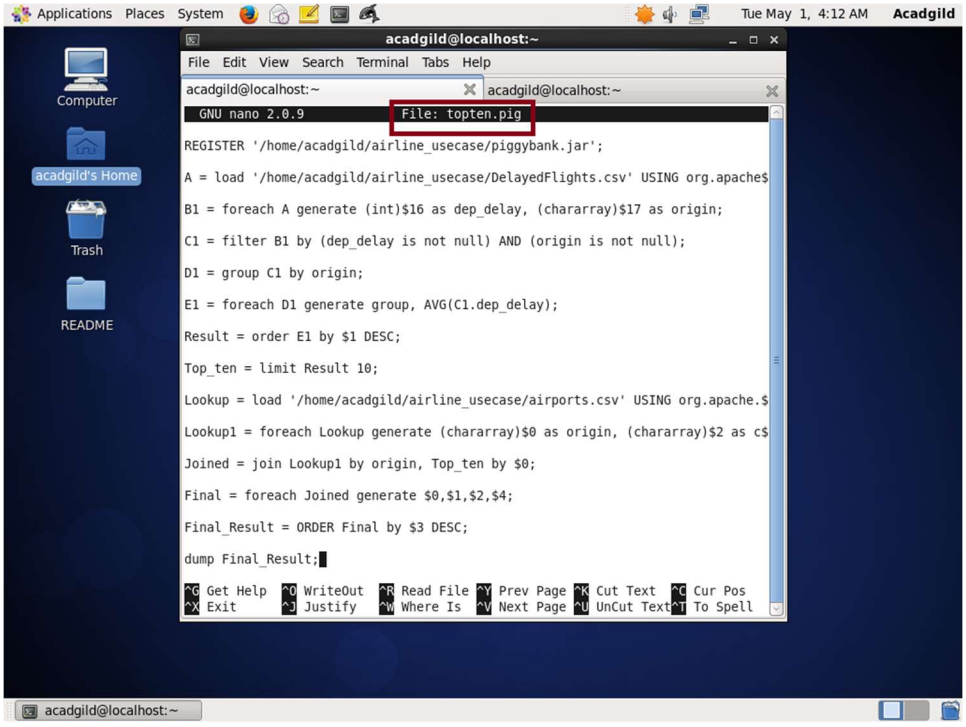
In the relation Lookup1, we are generating the destination, city, and country from the previous relation.

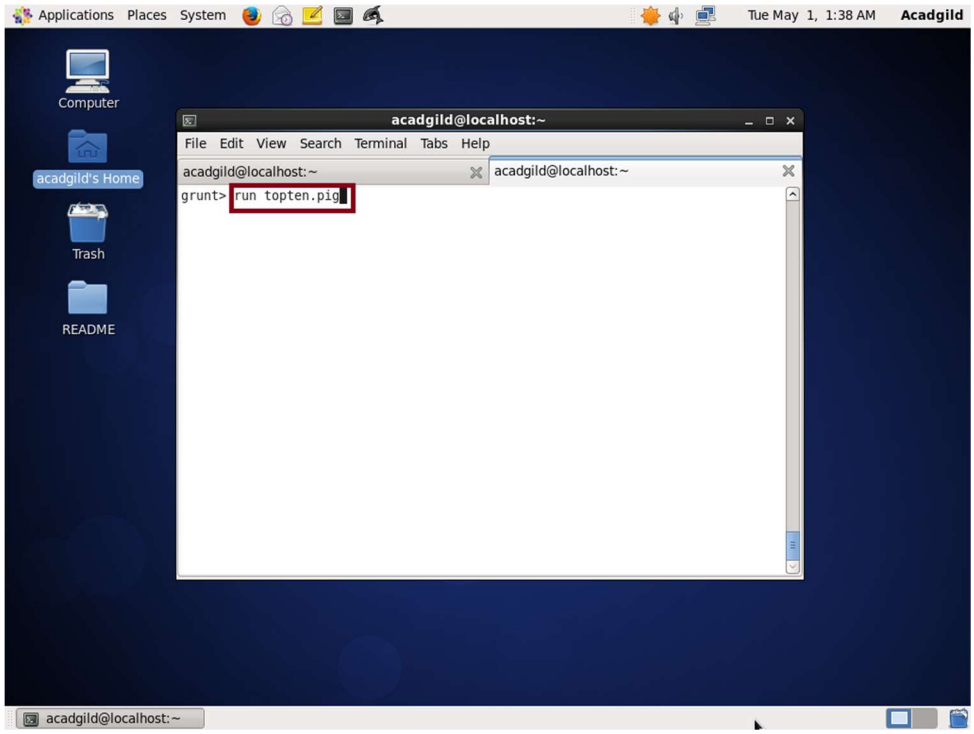
In the relation Joined, we are joining relation Top_ten and Lookup1 based on common a column, i.e., “origin.”

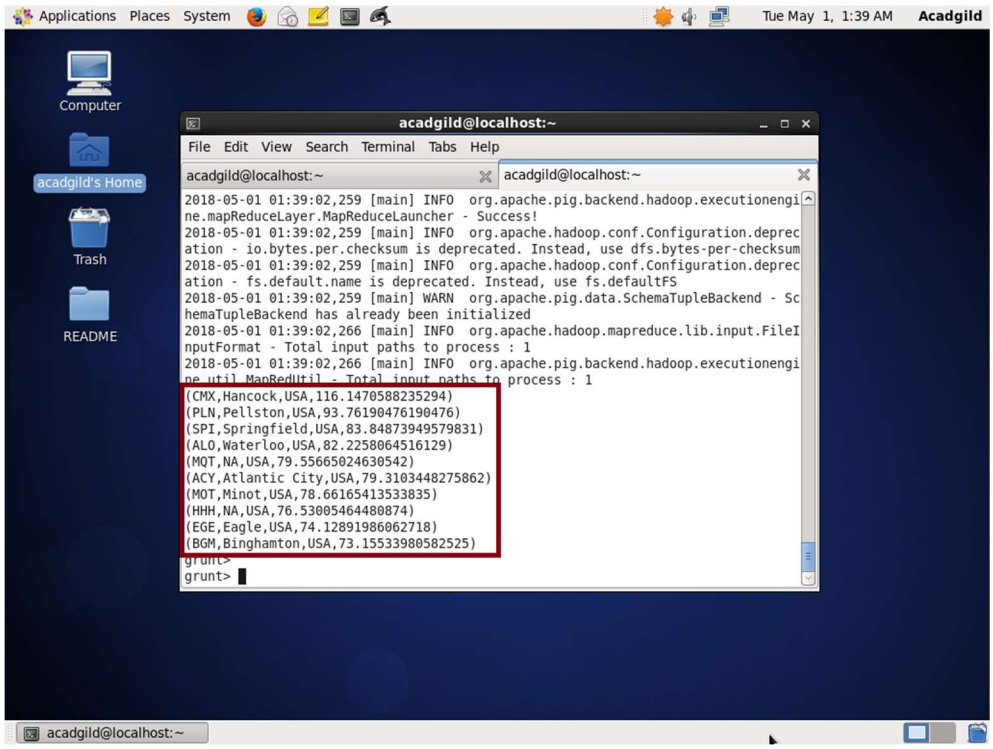
In the relation Final, we are generating required columns from the Joined table.

Finally, we are ordering and printing the results.In relation E, we are finding the count of canceled flights every month.

Relation F and Result is for ordering and finding the top month based on cancellation.




Applications Places System
Tue May 1, 1:38 AM Acadgild
Computer
acadgild's Home
Trash
README
acadgild@localhost:~
File Edit View Search Terminal Tabs Help
acadgild@localhost:~
acadgild@localhost:~
grunt> run topten.pig
acadgild@localhost:~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acadgild's Home
Trash
README
acadgild@localhost:~
File Edit View Search Terminal Tabs Help
acadgild@localhost:~
acadgild@localhost:~
2018-05-01 01:39:02,259 [main] INFO org.apache.pig.backend.hadoop.executionengine.mapReduceLayer.MapReduceLauncher - Success!
2018-05-01 01:39:02,259 [main] INFO org.apache.hadoop.conf.Configuration.deprecation - io.bytes.per.checksum is deprecated. Instead, use dfs.bytes-per-checksum
2018-05-01 01:39:02,259 [main] INFO org.apache.hadoop.conf.Configuration.deprecation - fs.default.name is deprecated. Instead, use fs.defaultFS
2018-05-01 01:39:02,259 [main] WARN org.apache.pig.data.SchemaTupleBackend - SchemaTupleBackend has already been initialized
2018-05-01 01:39:02,266 [main] INFO org.apache.hadoop.mapreduce.lib.input.FileInputFormat - Total input paths to process : 1
2018-05-01 01:39:02,266 [main] INFO org.apache.pig.backend.hadoop.executionengine.util.MapRedUtil - Total input paths to process : 1
(CMX,Hancock,USA,116.1470588235294)
(PLN,Pellston,USA,93.76190476190476)
(SPI,Springfield,USA,83.84873949579831)
(ALO,Waterloo,USA,82.2258064516129)
(MQT,NA,USA,79.55665024630542)
(ACY,Atlantic City,USA,79.3103448275862)
(MOT,Minot,USA,78.66165413533835)
(HHH,NA,USA,76.53005464480874)
(EGE,Eagle,USA,74.12891986062718)
(BGM,Binghamton,USA,73.15533980582525)
grunt>
grunt>
acadgild@localhost:~

Problem Statement 4

Which route (origin & destination) has seen the maximum diversion?

To find the maximum diversion between the origin and destination, the following code is build and saved in the pig file using nano.

nano maxdiversion.pig

```
REGISTER '/home/acadgild/airline_usecase/piggybank.jar';

A = load '/home/acadgild/airline_usecase/DelayedFlights.csv' USING
org.apache.pig.piggybank.storage.CSVExcelStorage(',','NO_MULTILINE','UNIX'
,'SKIP_INPUT_HEADER');

B = FOREACH A GENERATE (chararray)$17 as origin, (chararray)$18 as dest,
(int)$24 as diversion;

C = FILTER B BY (origin is not null) AND (dest is not null) AND (diversion
== 1);

D = GROUP C by (origin,dest);

E = FOREACH D generate group, COUNT(C.diversion);

F = ORDER E BY $1 DESC;

Result = limit F 10;

dump Result;
```

In Line 1: We are registering *piggybank* jar in order to use CSVExcelStorage class.

In relation **A**, we are loading the dataset using CSVExcelStorage because of its effective technique to handle double quotes and headers.

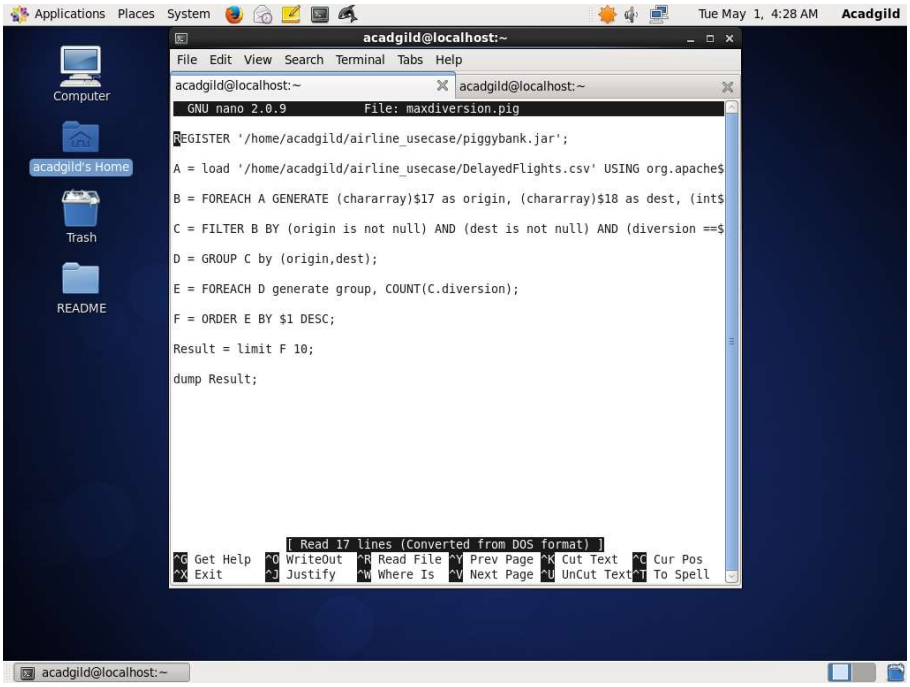
In relation **B**, we are generating the columns which are required for processing and explicitly type-casting each of them.

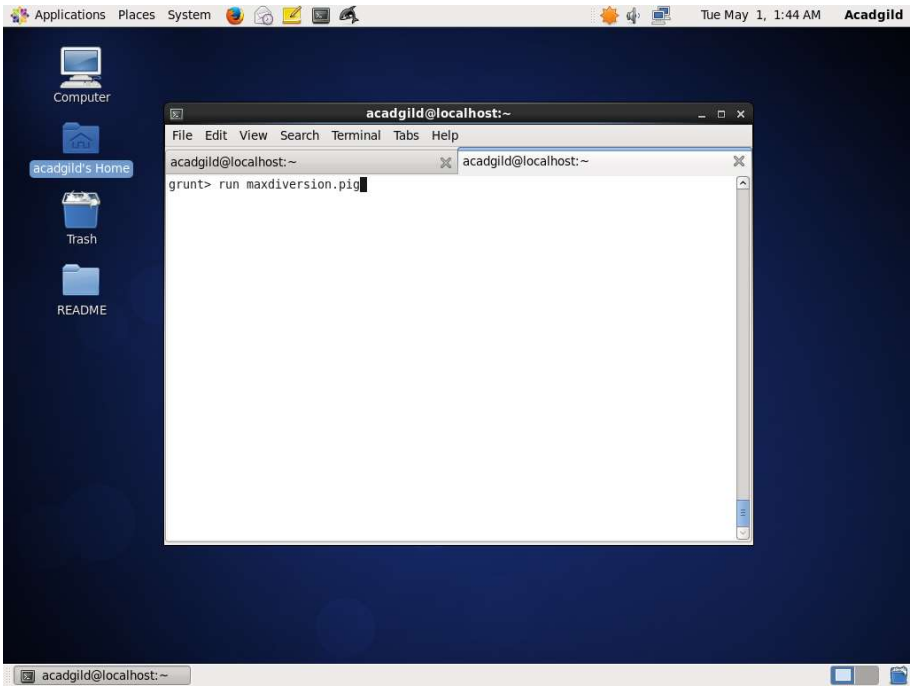
In relation **C**, we are filtering the data based on “not null” and diversion =1. This will remove the null records, if any, and give the data corresponding to the diversion taken.

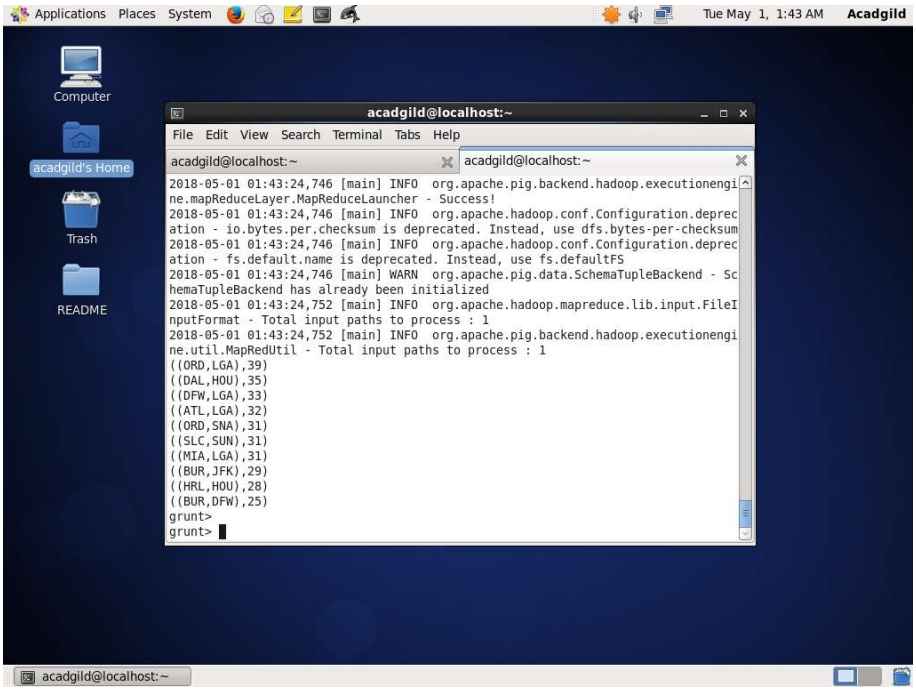
In relation **D**, we are grouping the data based on origin and destination.

Relation **D** finds the count of diversion taken per unique origin and destination.

Relations **F** and **Result** orders the result and produces top 10 results.






Applications Places System
Tue May 1, 1:43 AM Acadgild
Computer
acadgild's Home
Trash
README
acadgild@localhost:~
File Edit View Search Terminal Tabs Help
acadgild@localhost:~
acadgild@localhost:~
2018-05-01 01:43:24,746 [main] INFO org.apache.pig.backend.hadoop.executionengine.mapReduceLayer.MapReduceLauncher - Success!
2018-05-01 01:43:24,746 [main] INFO org.apache.hadoop.conf.Configuration.deprecation - io.bytes.per.checksum is deprecated. Instead, use dfs.bytes-per-checksum
2018-05-01 01:43:24,746 [main] INFO org.apache.hadoop.conf.Configuration.deprecation - fs.default.name is deprecated. Instead, use fs.defaultFS
2018-05-01 01:43:24,746 [main] WARN org.apache.pig.data.SchemaTupleBackend - SchemaTupleBackend has already been initialized
2018-05-01 01:43:24,752 [main] INFO org.apache.hadoop.mapreduce.lib.input.FileInputFormat - Total input paths to process : 1
2018-05-01 01:43:24,752 [main] INFO org.apache.pig.backend.hadoop.executionengine.util.MapRedUtil - Total input paths to process : 1
((ORD,LGA),39)
((DAL,HOU),35)
((DFW,LGA),33)
((ATL,LGA),32)
((ORD,SNA),31)
((SLC,SUN),31)
((MIA,LGA),31)
((BUR,JFK),29)
((HRL,HOU),28)
((BUR,DFW),25)
grunt>
grunt>
acadgild@localhost:~