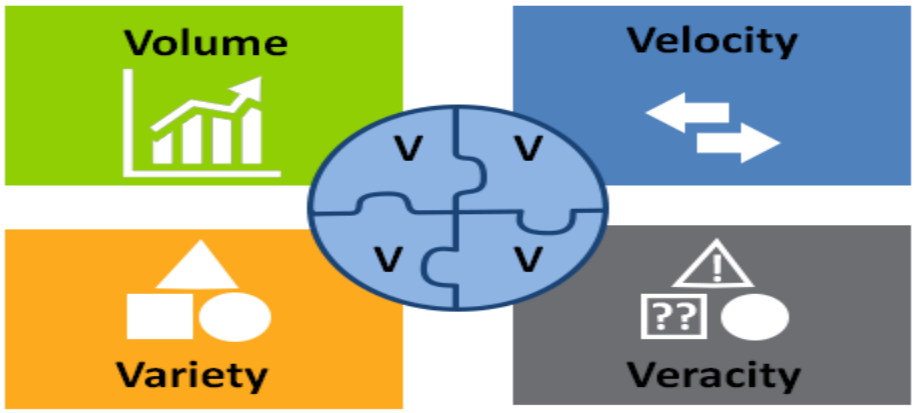
NEHA OHRI -S18000650030

Big data is a term for data sets that are so large or complex that traditional data processing applications are inadequate to deal with them. **Big data** challenges include capturing **data**, **data** storage,**data** analysis, search, sharing, transfer, visualization, querying, updating and information private.

4V'S OF Big Data



Volume

It is estimated that, on an average, 2.3 trillion gigabytes of data aregenerated every day. Forget analyzing, simply capturing such quantities of data is impractical. Most companies in the US have at least 100,000 gigabytes of data stored; and almost all of them will tell you that they aren't collecting enough data.

The right approach is to fight the urge of making your company's server a data dump. Efforts must be made to employ the right software to filter the relevant data.

Variety

Along with quantity, the diversity of data is equally important. The variety in data can be in terms of the devices or the sources of data generation.

Velocity

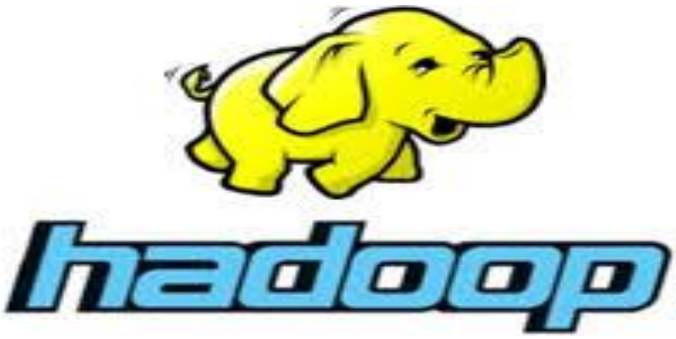
Not only is the volume of data ever increasing, but the rate of data generation (from the Internet of Things, social media, etc.) is increasing as well.

Veracity

Not all data is good. In fact, unfiltered data is more likely to be bad than good. Although data quality and usability depends largely on the source, you can never rule out junk.

This unreliability of data makes many business heads reluctant to rely on information analysis. That's the wrong approach.

HADOOP



Apache Hadoop is an open-source software framework used for distributed storage and processing of very large data sets.It consists of computer clusters built from commodity hardware. All the modules in Hadoop are designed with a fundamental assumption that hardware failures are a common occurrence and should be automatically handled by the frame.

HIVE

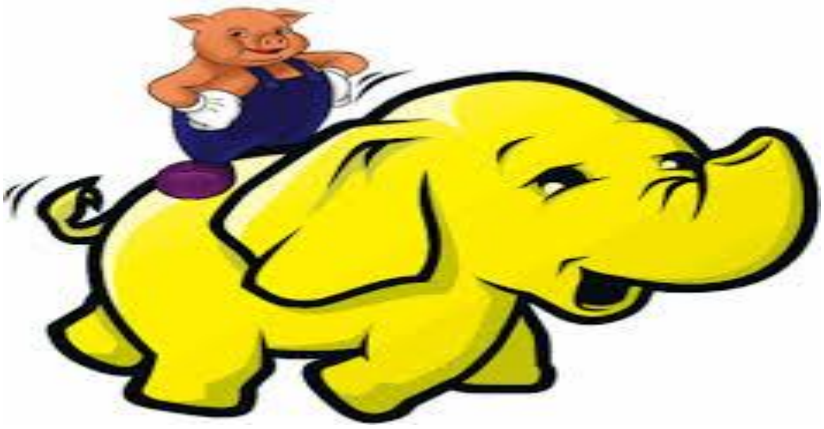
Apache Hive is a data warehouse infrastructure built on top of Hadoop for providing data summarization, query, and analysis.

Hive gives an SQL-like interface to query data stored in various databases and filesystems that integrate with Hadoop.

It is built on top of Hadoop and developed by Facebook.Hive provides a way to query the data using a SQL-like query language called HiveQL(Hive query Language).

Internally, a compiler translates HiveQL statements into MapReduce jobs, which are then submitted toHadoop framework for execution.

Apache Pig

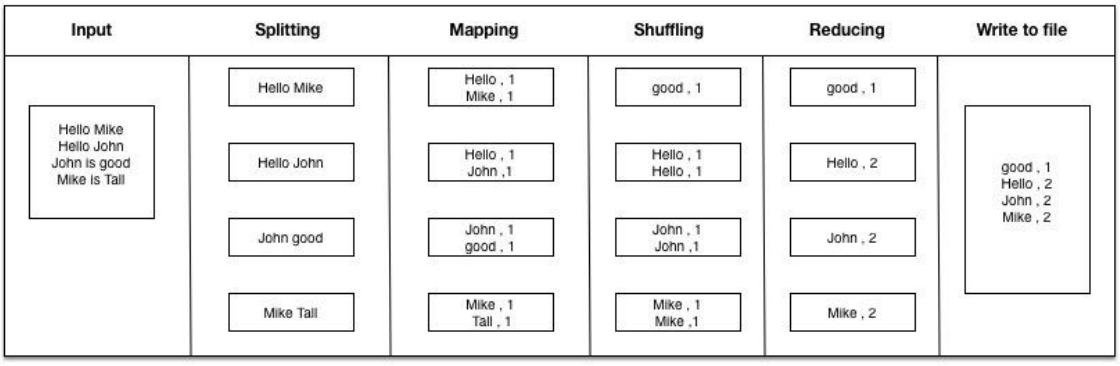


Apache Pig is a high-level platform for creating programs that run on Apache Hadoop. The language for this platform is called Pig Latin.

Pig can execute its Hadoop jobs in Map Reduce, Apache Tez, or Apache Spark. Pig Latin abstracts the programming from the Java Map Reduce idiom into a notation which makes Map Reduce programming high level, similar to that of SQL for RDBMS.

Pig Latin can be extended using User Defined Functions (UDFs) which the user can write in Java, Python, JavaScript, Ruby or Groovy and then call directly from the language.

MAP REDUCE



TaskTracker split the file and pass to mapper and mapper converts it into <Key, Value> map. As per above example it uses TextInputFormat to split input file into lines.Mapper split the line into word and uses Text to store word as key and

IntWritable to store 1 as count value. Mapper passes map to OutputCollector, which intern shuffle and sort the map. Combiner is optional which optimize the reducer on node level. Here we are using Reducer as Combiner to combine the output to a single.

SQOOP

Sqoop is a tool designed to transfer data between Hadoop and relational database servers. It is used to import data from relational databases such as MySQL, Oracle to Hadoop HDFS, and export from Hadoop file system to relational databases.

H1-B CASE STUDY

PROJECT OBJECTIVE--- The H1- B is an employment –based, non-immigrant visa category for temporary foreign workers in the United States. For a foreign national to apply H1-B Visa, an US employer must offer a job and petition for H1-B visa with the US immigration department. This is the most common visa status applied for and held by international students once they complete college/higher education (Maters, Ph.D.) and work in a full-time position.

Hardware Requirements-

6 GB RAM

64Bit OS

Technology Requirements-

- Apache Hadoop
- MapReduce
- Hive
- Pig
- SQOOP

Software Used–

- VMware
- Ubuntu
- Eclipse
- MySQL

Assumptions:

- VMware Workstation – Configurations are set correctly.
- Ubuntu is lying on the Virtual Box and it is powered on
- Hadoop Folder must be extracted and all the services of the Hadoop is running. Configuration to be made in the XML are set.
- Confirmation Box Below that Everything is Set Right.

Datasets Required-

- H1-B CASE Applications Data
- The Dataset has nearly 3 million records.

The Dataset given below——

The columns in the dataset include:

1. CASE_STATUS:Status associated with the last significant event or decision. Valid values include “Certified,”“Certified-Withdrawn,” Denied,” and “Withdrawn”.

Certified: Employer filed the LCA, which was approved by DOL

Certified Withdrawn: LCA was approved but later withdrawn by employer

Withdrawn: LCA was withdrawn by employer before approval

Denied: LCA was denied by DOL

2.EMPLOYER_NAME:Name of employer submitting labour condition application.

3.SOC_NAME:The Occupational name associated with the SOC_CODE.

SOC_CODE is the occupational code associated with the job being requested for temporary labour condition, as classified by the Standard Occupational Classification (SOC) System.

4.JOB_TITLE: Title of the job

5.FULL_TIME_POSITION:Y = Full Time Position; N = Part Time Position

6.PREVAILING_WAGE:Prevailing Wage for the job being requested for temporary labour condition. The wage is listed at annual scale in USD. The prevailing wage for a job position is defined as the average wage paid to similarly employed workers in the requested occupation in the area of intended employment. The prevailing wage is based on the employer’s minimum requirements for the position.

7.YEAR:Year in which the H1B visa petition was filed

8.WORKSITE:City and State information of the foreign worker’s intended area of employment

9.LONGITUDE: longitude of the Worksite

10. LATITUDE:latitude of the Worksite

Outcome of this Project:

To generate reports and hence,

We will be performing analysis on the H1B visa applicants between the years 2011-2016. After analysing the data, we can derive the following facts.

1 a) Is the number of petitions with Data Engineer job title increasing over time?

b) Find top 5 job titles who are having highest avg growth in applications. [ALL]

2 a) Which part of the US has the most Data Engineer jobs for each year?

b) find top 5 locations in the US who have got certified visa for each year. [certified]

3)Which industry(SOC_NAME) has the most number of Data Scientist positions?

[certified]

4)Which top 5 employers file the most petitions each year? - Case Status - ALL

5) Find the most popular top 10 job positions for H1B visa applications for each year?

a) for all the applications

b) for only certified applications.

6) Find the percentage and the count of each case status on total applications for each year. Create a line graph depicting the pattern of All the cases over the period of time.

7) Create a bar graph to depict the number of applications for each year [All]

8) Find the average Prevailing Wage for each Job for each Year (take part time and full time separate). Arrange the output in descending order - [Certified and Certified Withdrawn.]

9) Which are the employers along with the number of petitions who have the success rate more than 70% in petitions. (total petitions filed 1000 OR more than 1000)?

10) Which are the job positions along with the number of petitions which have the success rate more than 70% in petitions (total petitions filed 1000 OR more than 1000)?

11) Export result for question no 10 to MySQL database.

Create a table to load the h1b applicant's data as shown below:

CREATE TABLE h1b_applications (s_no int, case_status string, employer_name string, soc_name string, job_title string, full_time_position string, prevailing_wage bigint, year string, worksitestring, longitute double, latitute double) ROW FORMAT SERDE 'org. apache. hadoop. hive. serde2.OpenCSVSerde'

```
WITH SERDEPROPERTIES (
"separatorChar" = ",",
"quoteChar" = "\""
) STORED AS TEXTFILE;
```

- load data local inpath '/home/hduser/Downloads/H1Project/h1b.csv' overwrite into tableh1b_applications.

- CREATE TABLE h1b_app2(s_no int, case_status string, employer_namestring, soc_name string, job_title string, full_time_positionstring, prevailing_wage bigint, year string, worksite string, longitutedouble, latitute double)
  row format delimited
  fields terminated by '\t'
  STORED AS TEXTFILE;

- INSERT OVERWRITE TABLE h1b_app2 SELECT regexp_replace (s_no, "\t", ""), regexp_replace (case_status, "\t", ""), regexp_replace (employer_name,

"\t", ""), regexp_replace (soc_name, "\t", ""),regexp_replace (job_title, "\t", ""),
regexp_replace (full_time_position, "\t", ""), prevailing_wage,
regexp_replace (year, "\t", ""), regexp_replace (worksite, "\t", ""), regexp_replace (longitute, "\t", ""), regexp_replace (latitute, "\t","") FROM hıb_applications where case_status! = "NA";

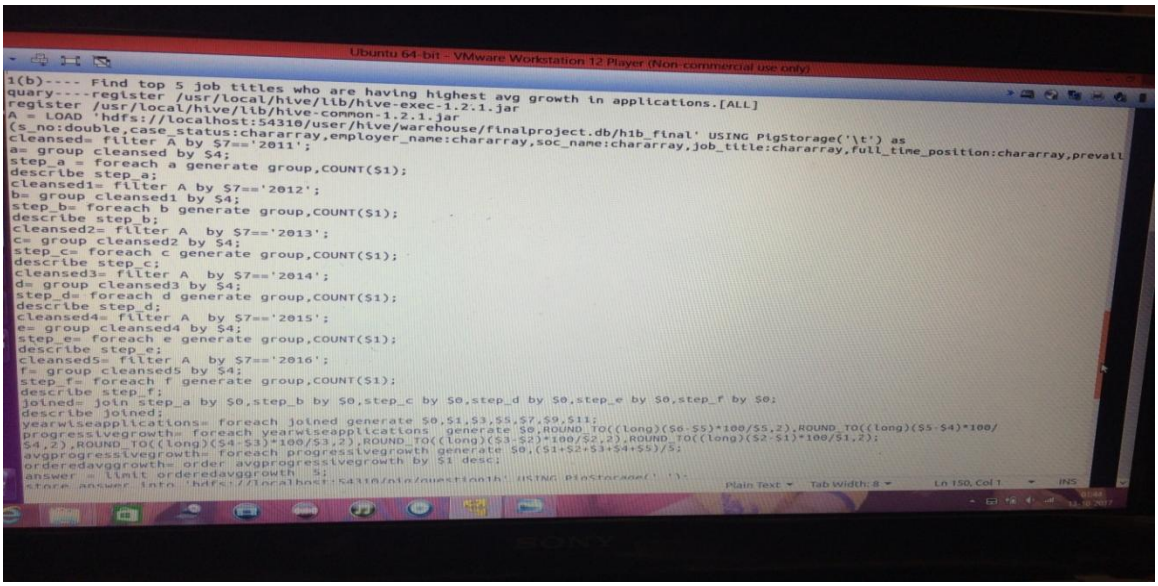
- CREATE TABLE hıb_final (s_no int, case_status string, employer_name string, soc_name string, job_title string, full_time_position string, prevailing_wage bigint, year string, worksite string, longitute double, latitute double)
  row format delimited
  fields terminated by '\t'
  STORED AS TEXTFILE;

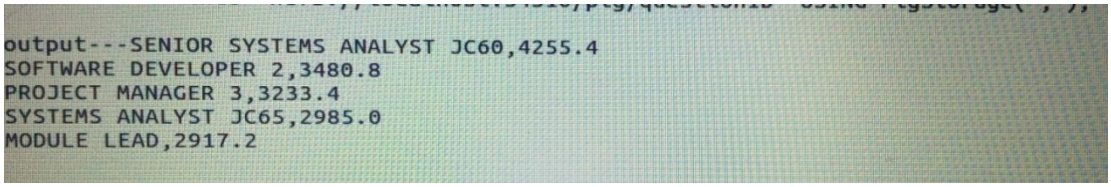
- INSERT OVERWRITE TABLE hıb_final SELECT s_no,
  case when trim(case_status) = "PENDING QUALITY AND COMPLIANCE REVIEW -
  UNASSIGNED" then "DENIED"
  when trim(case_status) = "REJECTED" then "DENIED"
  when trim(case_status) = "INVALIDATED" then "DENIED"
  else case_status end,
  employer_name, soc_name, job_title, full_time_position,
  case when prevailing_wage is null then 100000
  else prevailing_wage end, year, worksite, longitute, latituteFROM hıb_app2;

PIG QUESTIONS

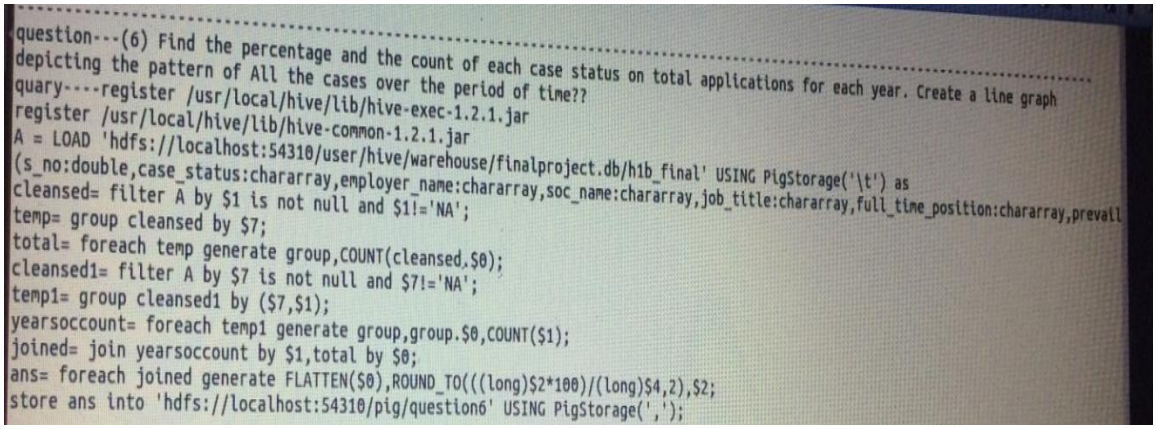
1 b) Find top 5 job titles who are having highest average growth in applications.[ALL]

Solution:



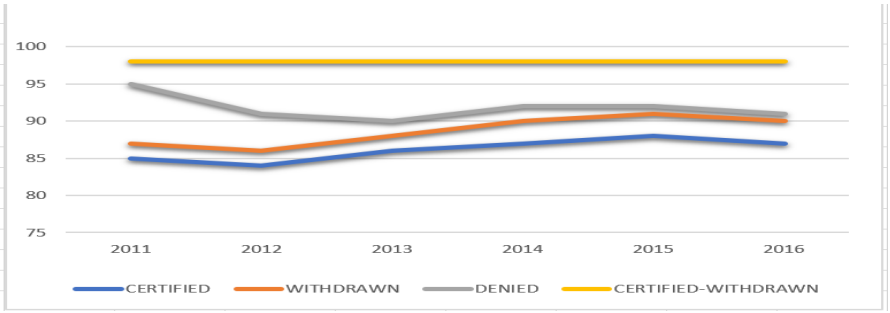


6) Find the percentage and the count of each case status on total applications for each year. Create a line graph depicting the pattern of All the cases over the period of time?

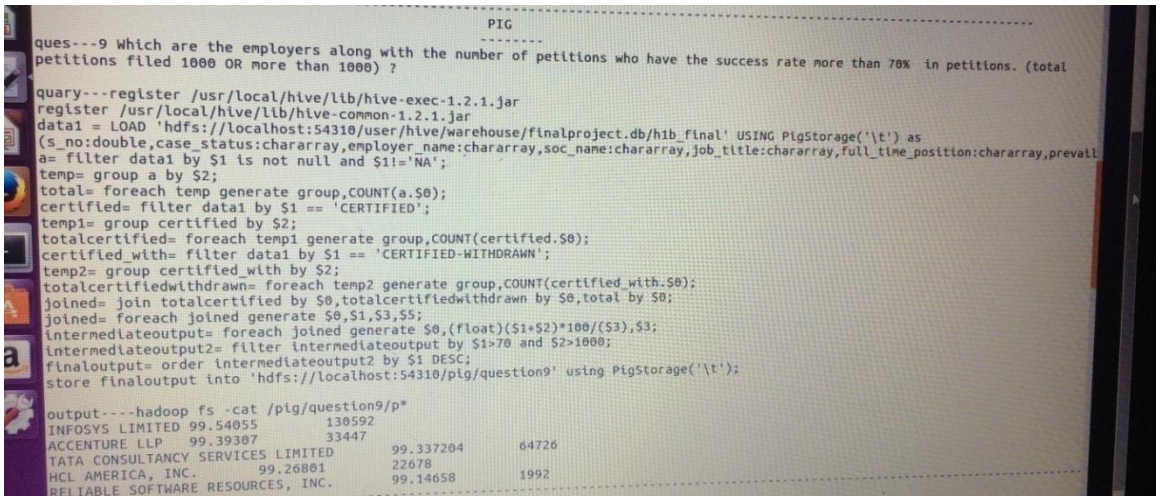


```
2011,DENIED,8.0,29130
2011,CERTIFIED,85.0,307936
2011,WITHDRAWN,2.0,10105
2011,CERTIFIED-WITHDRAWN,3.0,11596
2012,DENIED,5.0,21096
2012,CERTIFIED,84.0,352668
2012,WITHDRAWN,2.0,10725
2012,CERTIFIED-WITHDRAWN,7.0,31118
2013,PENDING QUALITY AND COMPLIANCE REVIEW - UNASSIGNED,0.0,15
2013,CERTIFIED-WITHDRAWN,8.0,35432
2013,WITHDRAWN,2.0,11590
2013,CERTIFIED,86.0,382951
2013,DENIED,2.0,12126
2014,WITHDRAWN,3.0,16034
2014,CERTIFIED,87.0,455144
2014,DENIED,2.0,11899
2014,CERTIFIED-WITHDRAWN,6.0,36350
2015,DENIED,1.0,10923
2015,CERTIFIED,88.0,547278
2015,WITHDRAWN,3.0,19455
2015,CERTIFIED-WITHDRAWN,6.0,41071
2016,DENIED,1.0,9175
2016,CERTIFIED,87.0,569646
2016,WITHDRAWN,3.0,21890
2016,CERTIFIED-WITHDRAWN,7.0,47092
hduser@ubuntu:~$
```

YEAR	CERTIFIED	WITHDRAWN	DENIED	CERTIFIED-WITHDRAWN	TOTAL
2011	85	2	8	3	98
2012	84	2	5	7	98
2013	86	2	2	8	98
2014	87	3	2	6	98
2015	88	3	1	6	98
2016	87	3	1	7	98

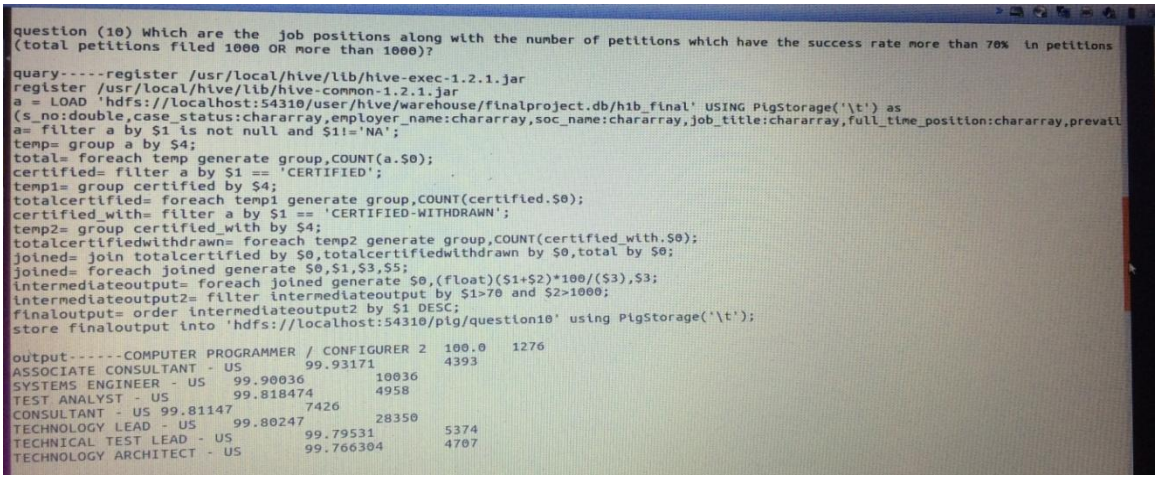


9) Which are the employers along with the number of petitions who have the success rate more than 70% in petitions. (total petitions filed 1000 OR more than 1000)?



```
                                                    PIG
                                                    ---
ques---9 Which are the employers along with the number of petitions who have the success rate more than 70%  in petitions. (total
petitions filed 1000 OR more than 1000) ?

quary---register /usr/local/hive/lib/hive-exec-1.2.1.jar
register /usr/local/hive/lib/hive-common-1.2.1.jar
data1 = LOAD 'hdfs://localhost:54310/user/hive/warehouse/finalproject.db/h1b_final' USING PigStorage('\t') as
(s_no:double,case_status:chararray,employer_name:chararray,soc_name:chararray,job_title:chararray,full_time_position:chararray,prevail
a= filter data1 by $1 is not null and $1!='NA';
temp= group a by $2;
total= foreach temp generate group,COUNT(a.$0);
certified= filter data1 by $1 == 'CERTIFIED';
temp1= group certified by $2;
totalcertified= foreach temp1 generate group,COUNT(certified.$0);
certified_with= filter data1 by $1 == 'CERTIFIED-WITHDRAWN';
temp2= group certified_with by $2;
totalcertifiedwithdrawn= foreach temp2 generate group,COUNT(certified_with.$0);
joined= join totalcertified by $0,totalcertifiedwithdrawn by $0,total by $0;
joined= foreach joined generate $0,$1,$3,$5;
intermediateoutput= foreach joined generate $0,(float)($1+$2)*100/($3),$3;
intermediateoutput2= filter intermediateoutput by $1>70 and $2>1000;
finaloutput= order intermediateoutput2 by $1 DESC;
store finaloutput into 'hdfs://localhost:54310/pig/question9' using PigStorage('\t');

output----hadoop fs -cat /pig/question9/p*
INFOSYS LIMITED 99.54055        130592
ACCENTURE LLP   99.39307        33447
TATA CONSULTANCY SERVICES LIMITED       99.337204       64726
HCL AMERICA, INC.       99.26801        22678
RELIABLE SOFTWARE RESOURCES, INC.       99.14658        1992
```

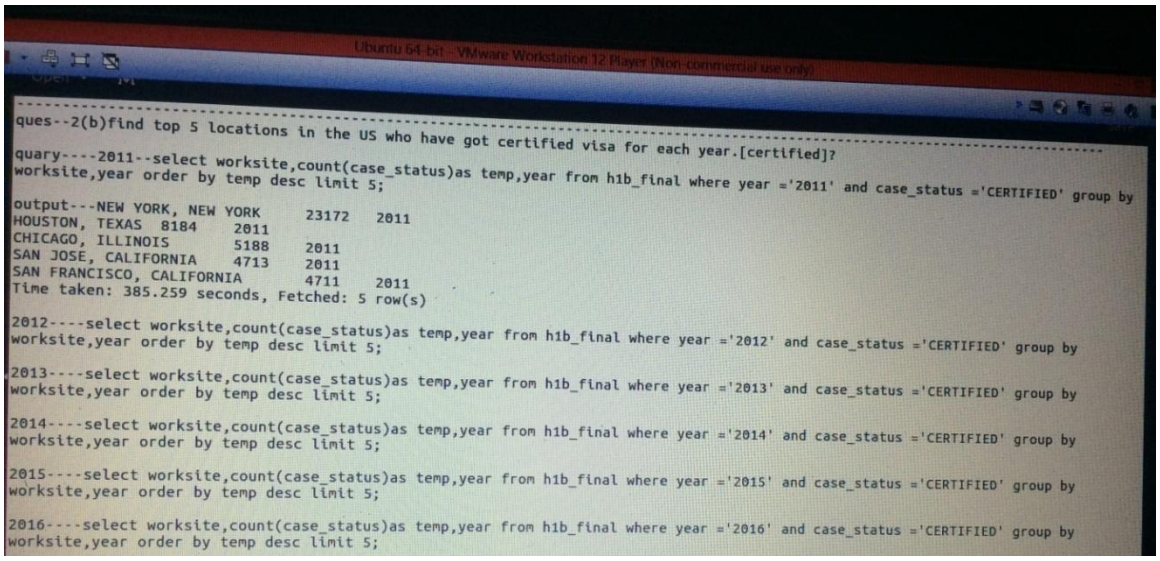
10) Which are the job positions along with the number of petitions which have the success rate more than 70% in petitions (total petitions filed 1000 OR more than1000)?



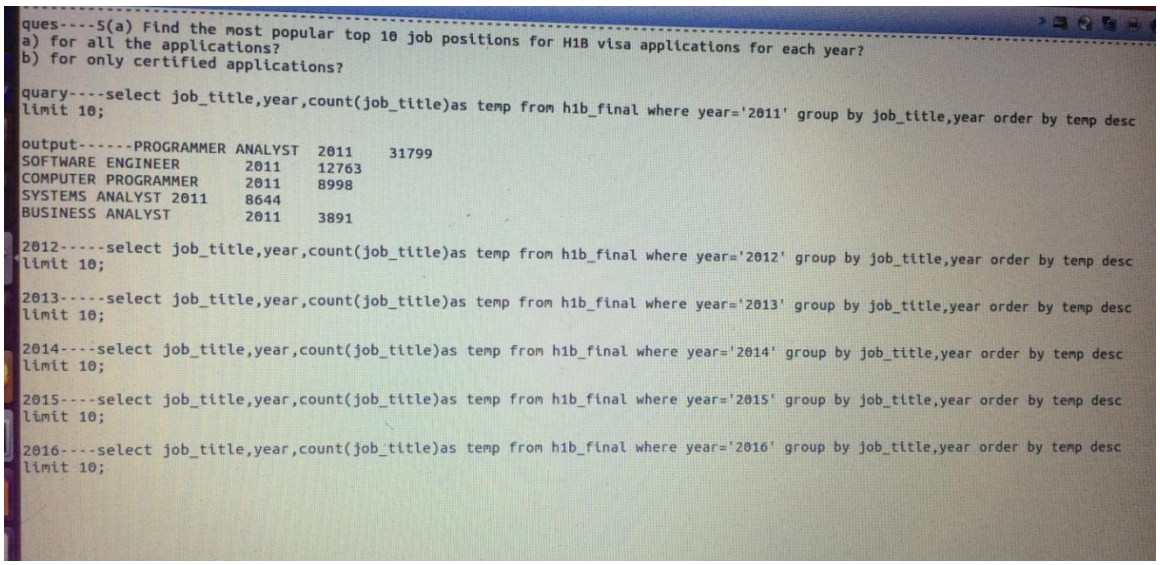
```
question (10) Which are the  job positions along with the number of petitions which have the success rate more than 70%  in petitions
(total petitions filed 1000 OR more than 1000)?

quary-----register /usr/local/hive/lib/hive-exec-1.2.1.jar
register /usr/local/hive/lib/hive-common-1.2.1.jar
a = LOAD 'hdfs://localhost:54310/user/hive/warehouse/finalproject.db/h1b_final' USING PigStorage('\t') as
(s_no:double,case_status:chararray,employer_name:chararray,soc_name:chararray,job_title:chararray,full_time_position:chararray,prevail
a= filter a by $1 is not null and $1!='NA';
temp= group a by $4;
total= foreach temp generate group,COUNT(a.$0);
certified= filter a by $1 == 'CERTIFIED';
temp1= group certified by $4;
totalcertified= foreach temp1 generate group,COUNT(certified.$0);
certified_with= filter a by $1 == 'CERTIFIED-WITHDRAWN';
temp2= group certified_with by $4;
totalcertifiedwithdrawn= foreach temp2 generate group,COUNT(certified_with.$0);
joined= join totalcertified by $0,totalcertifiedwithdrawn by $0,total by $0;
joined= foreach joined generate $0,$1,$3,$5;
intermediateoutput= foreach joined generate $0,(float)($1+$2)*100/($3),$3;
intermediateoutput2= filter intermediateoutput by $1>70 and $2>1000;
finaloutput= order intermediateoutput2 by $1 DESC;
store finaloutput into 'hdfs://localhost:54310/pig/question10' using PigStorage('\t');

output------COMPUTER PROGRAMMER / CONFIGURER 2  100.0   1276
ASSOCIATE CONSULTANT - US       99.93171        4393
SYSTEMS ENGINEER - US   99.90036        10036
TEST ANALYST - US       99.818474       4958
CONSULTANT - US 99.81147        7426
TECHNOLOGY LEAD - US    99.80247        28350
TECHNICAL TEST LEAD - US        99.79531        5374
TECHNOLOGY ARCHITECT - US       99.766304       4707
```

HIVE

2 b) find top 5 locations in the US who have got certified visa for each year.[certified]



5) Find the most popular top 10 job positions for H1B visa applications for each year?
(a) for all the applications

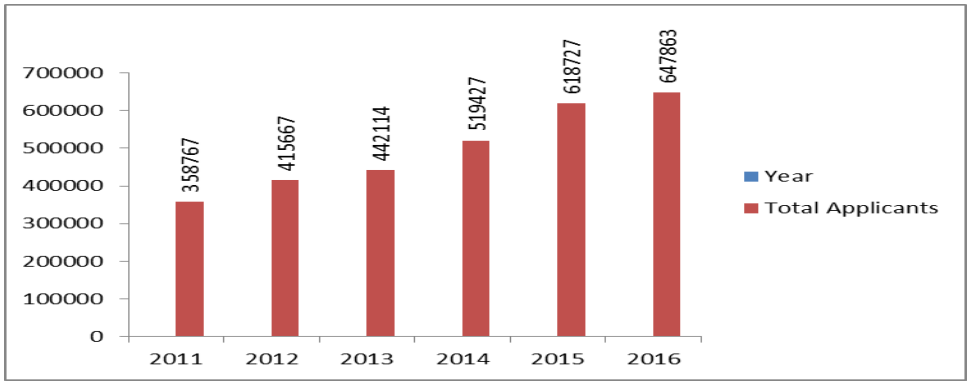


5 (b) for only certified applications?

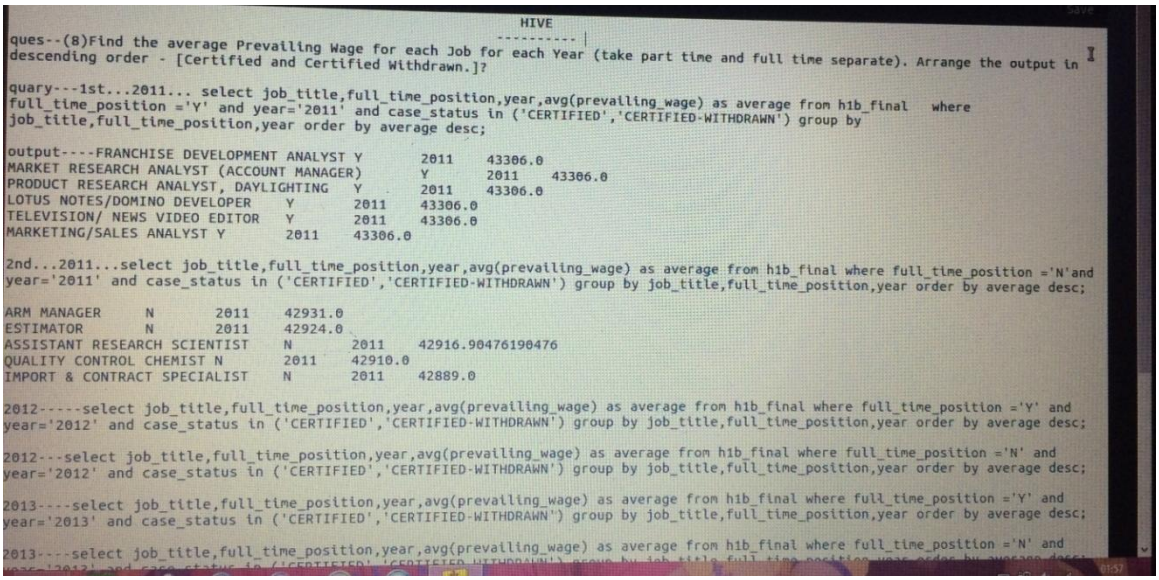
```
year='2016' group by job_title,year order by temp desc
5(b)---for only certified applications?

quary----5(b)-----select job_title,year,count(job_title)as temp from h1b_final where case_status='CERTIFIED' group by job_title,year
order by temp desc limit 10;

output----
PROGRAMMER ANALYST      2015    48203
PROGRAMMER ANALYST      2016    47964
PROGRAMMER ANALYST      2014    38625
PROGRAMMER ANALYST      2013    29906
PROGRAMMER ANALYST      2012    29226
PROGRAMMER ANALYST      2011    28806
SOFTWARE ENGINEER       2016    25890
SOFTWARE ENGINEER       2015    23352
SOFTWARE ENGINEER       2014    17278
COMPUTER PROGRAMMER     2014    13796
```

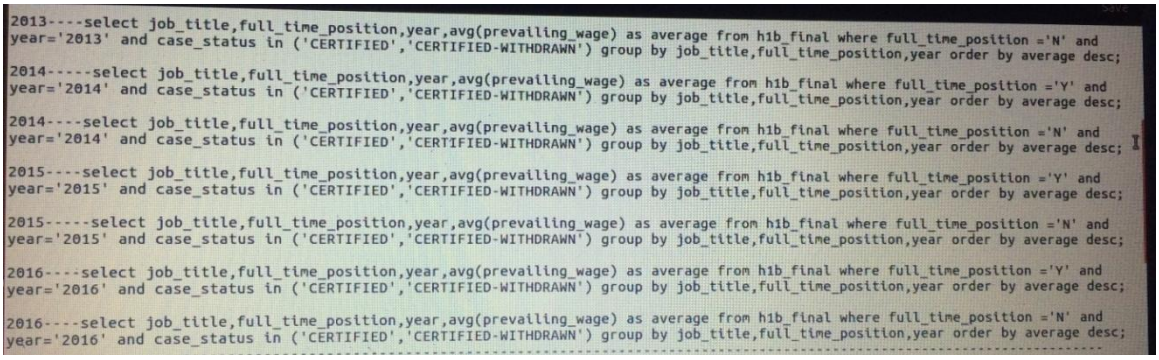
7) Create a bar graph to depict the number of applications for each year [All]

```
question----(7) Create a bar graph to depict the number of applications for each year [All]?

quary-----select year,count(*) from h1b_final group by year order by year;

output-----
2011    358767
2012    415607
2013    442114
2014    519427
2015    618727
2016    647803
```



8) Find the average Prevailing Wage for each Job for each Year (take part time and full time separate). Arrange the output in descending order - [Certified and Certified Withdrawn.]





MAPREDUCE

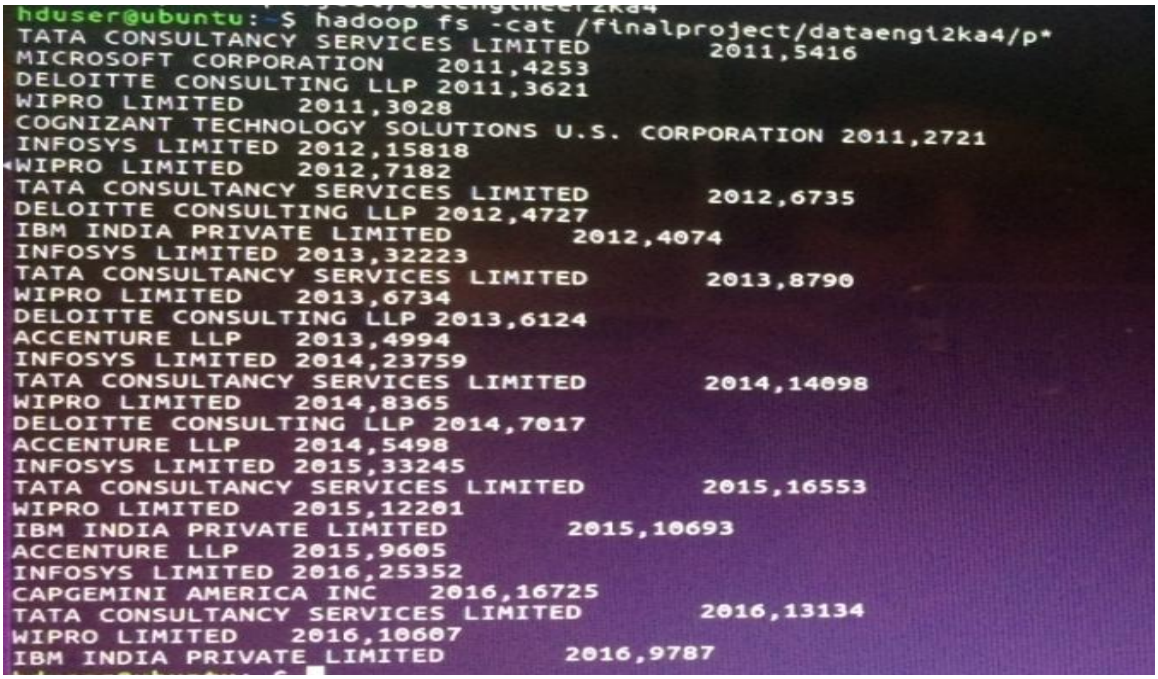
Question 2(a) – Which part of the US has the most Data Engineer Job for each year?

```
hduser@ubuntu:~$ hadoop fs -cat /finalproject/outputmapreduce1/p**
SEATTLE, WASHINGTON      2011,20
SAN FRANCISCO, CALIFORNIA        2011,4
SAN MATEO, CALIFORNIA    2011,3
WALTHAM, MASSACHUSETTS   2011,2
TALLAHASSEE, FLORIDA     2011,1
SEATTLE, WASHINGTON      2012,30
SAN FRANCISCO, CALIFORNIA        2012,10
PONTIAC, MICHIGAN        2012,3
SAN MATEO, CALIFORNIA    2012,2
WOODLAND HILLS, CALIFORNIA       2012,1
SEATTLE, WASHINGTON      2013,46
SAN FRANCISCO, CALIFORNIA        2013,17
MENLO PARK, CALIFORNIA   2013,12
NEW YORK, NEW YORK       2013,6
ATLANTA, GEORGIA         2013,5
SEATTLE, WASHINGTON      2014,45
SAN FRANCISCO, CALIFORNIA        2014,34
MENLO PARK, CALIFORNIA   2014,21
NEW YORK, NEW YORK       2014,18
MOUNTAIN VIEW, CALIFORNIA        2014,13
SEATTLE, WASHINGTON      2015,61
NEW YORK, NEW YORK       2015,41
```

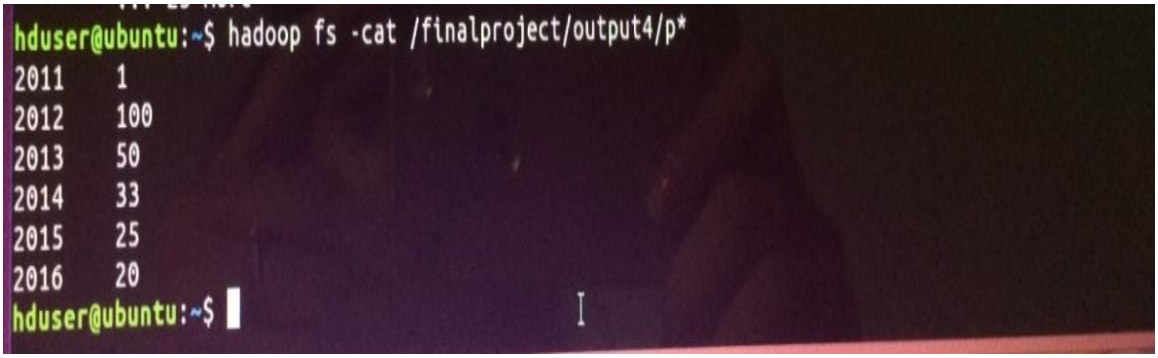
Question –(3) Which industry (SOC_NAME) has the most number of Data Scientist Position?[Certified]

```
hduser@ubuntu:~$ hadoop jar /home/hduser/Documents/DataScientist.jar DataScientist /user/hive/warehouse/finalproject.db/h1b_final /fi
nalproject/DScientoutput
hduser@ubuntu:~$ hadoop fs -cat /finalproject/DScientoutput/p*
STATISTICIANS,572
COMPUTER AND INFORMATION RESEARCH SCIENTISTS,419
OPERATIONS RESEARCH ANALYSTS,380
Computer and Information Research Scientists,181
COMPUTER OCCUPATIONS, ALL OTHER,160
hduser@ubuntu:~$
```

Question 4—Which top 5 employer file the most petitions each year Case Status—ALL??



Question 1-(a) Is the number of petitions with Data Engineer job title increasing over time?

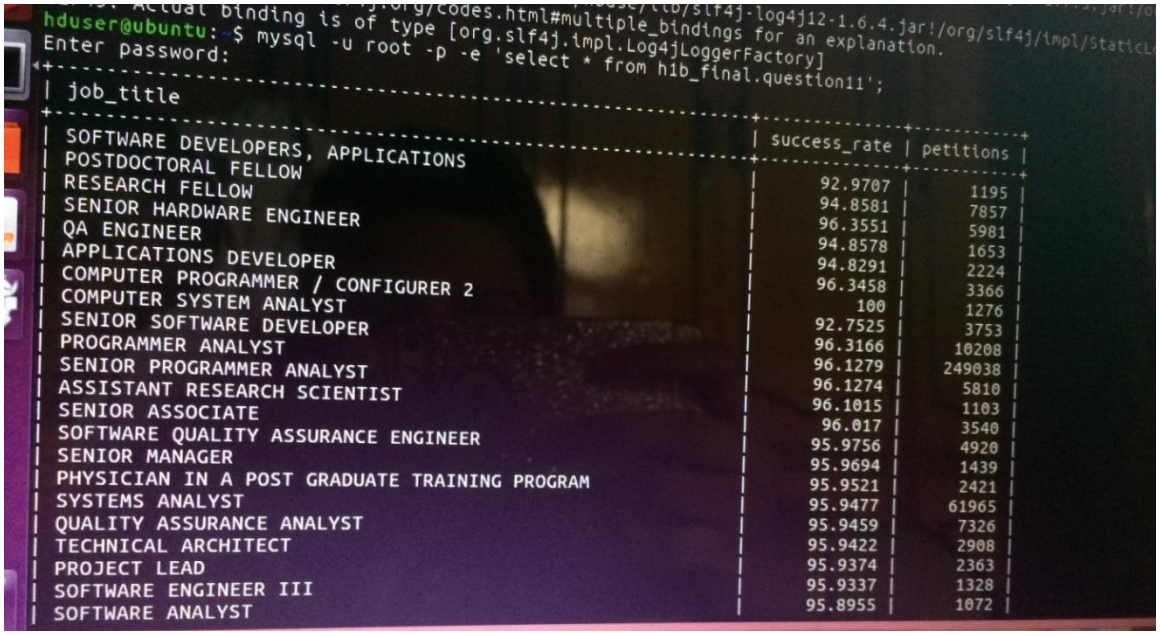


11) Export result for question no 10 to MySQL database.

Solution:

Quary –sqoop export --connect jdbc:mysql: //localhost/hıb_final --username root --password linux --table questionıı --update-mode allowinsert --export –dir /pig/questionıo/p* --input-fields-terminated-by '|\t' ;

Output show--- mysql -u root -p -e 'select * from hıb_final.questionıı';



```
hduser@ubuntu:~$ mysql -u root -p -e 'select * from h1b_final.question11';
Enter password:
+-----------------------------------------------------+--------------+-----------+
| job_title                                           | success_rate | petitions |
+-----------------------------------------------------+--------------+-----------+
| SOFTWARE DEVELOPERS, APPLICATIONS                   |      92.9707 |      1195 |
| POSTDOCTORAL FELLOW                                 |      94.8581 |      7857 |
| RESEARCH FELLOW                                     |      96.3551 |      5981 |
| SENIOR HARDWARE ENGINEER                            |      94.8578 |      1653 |
| QA ENGINEER                                         |      94.8291 |      2224 |
| APPLICATIONS DEVELOPER                              |      96.3458 |      3366 |
| COMPUTER PROGRAMMER / CONFIGURER 2                  |          100 |      1276 |
| COMPUTER SYSTEM ANALYST                             |      92.7525 |      3753 |
| SENIOR SOFTWARE DEVELOPER                           |      96.3166 |     10208 |
| PROGRAMMER ANALYST                                  |      96.1279 |    249038 |
| SENIOR PROGRAMMER ANALYST                           |      96.1274 |      5810 |
| ASSISTANT RESEARCH SCIENTIST                        |      96.1015 |      1103 |
| SENIOR ASSOCIATE                                    |       96.017 |      3540 |
| SOFTWARE QUALITY ASSURANCE ENGINEER                 |      95.9756 |      4920 |
| SENIOR MANAGER                                      |      95.9694 |      1439 |
| PHYSICIAN IN A POST GRADUATE TRAINING PROGRAM       |      95.9521 |      2421 |
| SYSTEMS ANALYST                                     |      95.9477 |     61965 |
| QUALITY ASSURANCE ANALYST                           |      95.9459 |      7326 |
| TECHNICAL ARCHITECT                                 |      95.9422 |      2908 |
| PROJECT LEAD                                        |      95.9374 |      2363 |
| SOFTWARE ENGINEER III                               |      95.9337 |      1328 |
| SOFTWARE ANALYST                                    |      95.8955 |      1072 |
```

CONCLUSION:

Therefore from the given dataset H1-B applicants within the years 2011-2016,which contained around 3 billion that is 3lakh records ,we have done a complete analysis on various factors which has predictive nature .This analysis on the H1-B VISA data set has resolved around finding top Occupation ,States,Employers,Industries the contribute to highest number of H1-B VISA . This clearly indicates the H1-B VISA filings which has a high correlation with the employer's rate.