a) List two primary differences between Hadoop version-2 and Hadoop version-3

Solution:

Any two difference among these is correct-
Major difference :
In Hadoop 2 Fault tolerance is ensured using **Replication** whereas in Hadoop-3 it is ensured using **Erasure Coding**. (Due to replication overhead is 200 percent in Hadoop-2 and due to erasure coding, Hadoop-3 overhead is 50% only).

Hadoop 2 supports one standby Name-Node whereas Hadoop-3 supports **multiple standby Name-Nodes** .

Other differences (that shall be considered)

For Haddop-2 , Java-7 is the minimum compatible version whereas for Hadoop-3 it is **Java - 8**.

For balancing disks load inside a Data-Node **Intra data node balancer** is provisioned in Hadoop-3. Where as Hadoop-2 only allows Inter data node balancing using HDFS balancer.

Hadoop-3, **Improve the YARN time line service** - with improving scalability and reliability of this service. In Hadoop-2 YARN Timeline Service has scalability issues

Improved Scalability :Hadoop-2 can scale up to 10 thousands cluster nodes where Hadoop-3 can have more than 10 thousands nodes in the cluster

Hadoop 3 has additional library **support for Amazon S3**.

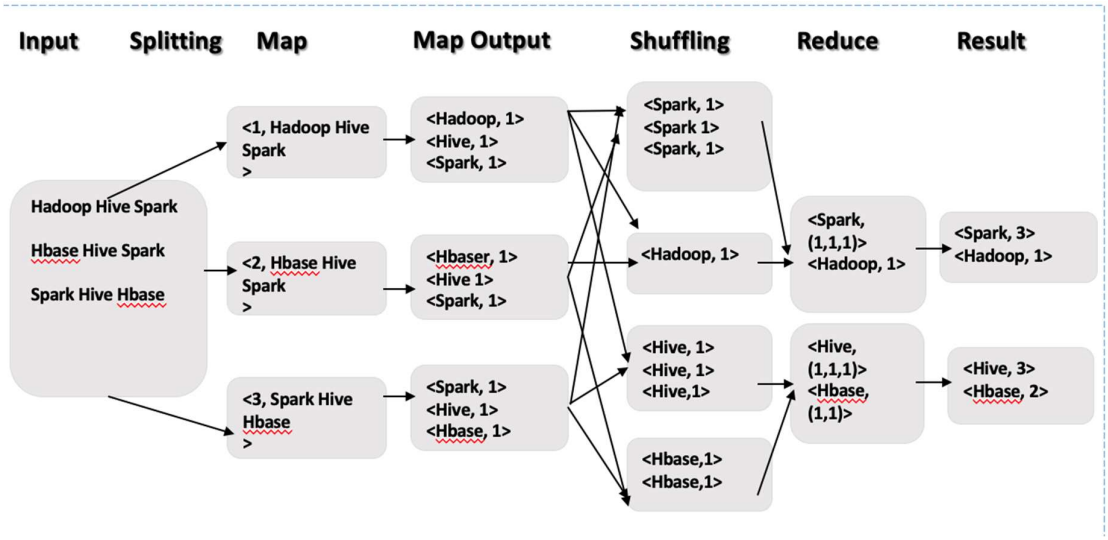
In Haddop-2 **Linux ephemeral port range** (32768-61000)Is being used as default which would sometimes fail to bind to the port due to a conflict with another application. In Hadoop-3 These **conflicting ports have been moved out** of the ephemeral range

b) What is Hive metastore? Can NoSQL Database- HBase can be configured as hive metastore?

Hive-Metastore is the central repository of Hive Metadata. It is service that mainly **stores the meta data for Hive tables** and relations. For example, Schema and Locations etc.

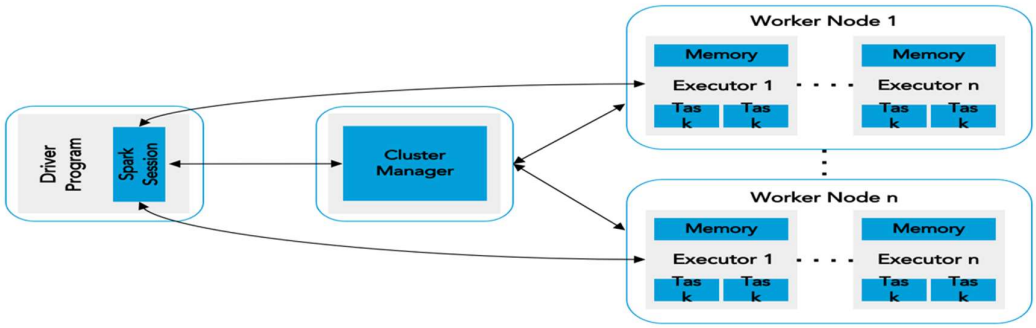
Yes. HBases can be configured as Hive -Metastore. In fact, HBase is preferred metastore service for highly scalable production systems.

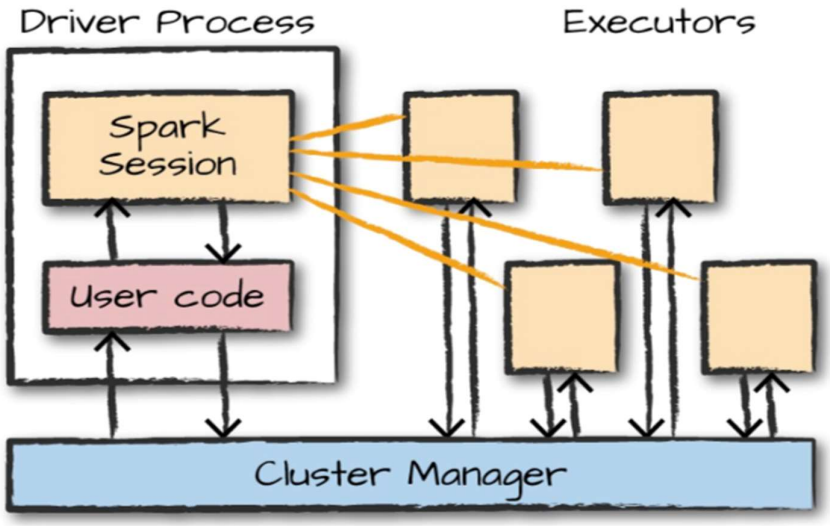
c) Using an example, depict how MapReduce computes word count.



d) Draw and explain various components of Spark architecture.

Any of the below figure type would be fine





Components of Spark Architecture are :

1. **Driver program/process** :
   - Is the central co-ordinator,
   - Runs main function,
   - Manage/Maintain information about spark application,
   - Respond to user program/input,
   - Analyze/schedule/distribute work across executor,
   - listen for and accept incoming connections from its executors

2. **Executor Process**:
   - Executes tasks/code that driver assigns them,
   - Reports execution state back to driver

3. **Cluster Manager**
   - Keeps track of available resources
   - Allocates Worker Nodes
   - Supported cluster managers are – Hadoop YARN, Apache Mesos, Kubernetes and Standalone

4. **Worker Node**
   - Physical machine on which executor runs,
   - one or more Executor runs on Worker Node.

e) What is cap theorem ? Where does MongoDB stands in cap theorem

CAP theorem says, A distributed database system can only have 2 of the below 3 properties:

1. **Consistency** : All nodes/clients see the same data at the same time. *read* operation will return the value of the most recent *write.* entire transaction gets rolled back if there is an error during any stage in the process.

2. **Availability** : Every request gets a response on success/failure. the system remains operational 100% of the time.
3. **Partition Tolerance** : A system that is partition-tolerant can sustain any amount of network failure that doesn't result in a failure of the entire network. Data records are sufficiently replicated across combinations of nodes and networks to keep the system up through intermittent outages.

MongoDB is a CP data store—it resolves network partitions by maintaining consistency, while compromising on availability

Section B

a) Write HDFC shell commands for the following

To Print Version of installed Hadoop

- **hadoop version**

To Copy 'file1.txt' from 'InputDir' to 'OutputDir' as file2.txt

- **hadoop fs -cp InputDir /file1.txt OutputDir/file2.txt**

To Delete an empty directory named as **XYZ.**

- **hadoop fs -rmdir XYZ**

To list the contents of folder named **SampleDir.**

- **hadoop fs -ls SampleDir**

To fetch the usage instructions of **mkdir** command

- **hadoop fs -help mkdir**

b) Write a Spark program psudocode to load a textile named as text.txt as spark RDD and compute its wordcounts.

```
sc = SparkContext("local)

# read data from text file and split each line into words
words = sc.textFile("test.txt".flatMap(lambda line: line.split(" "))

# count the occurrence of each word
wordCounts = words.map(lambda word: (word, 1).reduceByKey(lambda a,b: a +b)
```

```
# save the counts to output
wordCounts.saveAsTextFile("output")
```

c) Two hive tables are shown below. Write a hive query to perform an inner join on the Table1 and Table 2 on 'id' column

```
SELECT t1.Id, t1.NAME, t2.Name
FROM Table1 t1 JOIN Table2 t2
ON (t1.Id = t2.Id);
```

Or

```
SELECT Table1.*, Table1.*
FROM Table1 JOIN Table2 ON (Table1.Id = Table2.id);
```

Output order will be based on the query though should have these records

Joe,2,Tie
Hank,4, Coat

d) Write commands/query in MongoDB to

i. Create a collection named **orders**.

- db.createCollection(' **orders** ')

ii. Insert below record in orders.

{"order_id": 1,
"order_date": '2013-07-25 00:00:00.0',
"order_customer_id": 11599,
"order_status": "CLOSED" }

- **db.orders.insertOne(**

```
{
"order_id" : 1,
"order_date" : '2013-07-25 00:00:00.0',
"order_customer_id" : 11599,
"order_status" : "CLOSED"
}
```

iii. Fetch orders with **order_status** as COMPLETE.

- db.orders.aggregate(
  [
  {$match: {order_status: "COMPLETE"}}
  ]

iv. Compute count of orders with status COMPLETE and CLOSED.

- db.orders.aggregate(
  [
  {$match : {$or: [{order_status: {$eq: "COMPLETE"}}, {order_status: {$eq: "CLOSED"}}]} },
  {$group : {_id: {"status": "$order_status"}, "count": {$sum: 1}}}
  ]
)