CS561: Advanced Topics In Database Systems

Solution of Homework 3

Question 1

	Range-partition on Age	Hash-partition on entire record	Hash-partition on city
Q1	--Need to repartition the data over the city column --Every machine can use hash-based partitioning to create m partitions --After each machine gets all corresponding new partitions, the query can be evaluated over each new partition	Same as previous case	--Data is already partitioned on City column --Every partition will evaluate the query and reports the city and the Avg(age) based on its local data
Q2	--Since data is already partitioned on Age, we can evaluate the query locally on each partition --Each partition will get all records having the same age, and then divide them into subgroups based in the city value	--Need to re-partition the data either over the city only, the age only, or both. --After re-partitioning and re-distributing the data, the query can be evaluated over each new partition.	--Since data is already partitioned on City, we can evaluate the query locally on each partition --Each partition will get all records having the same city, and then divide them into subgroups based in the age value
Q3	--It is a filtering query that does not require any repartitioning --Since data is partitioned on age, and we have condition on age, then we select only the partitions having age > 30. Only these partitioned are scanned to evaluate the other conditions.	--It is a filtering query that does not require any repartitioning --Need to scan all partitions and evaluate the query (cannot skip partitions)	--It is a filtering query that does not require any repartitioning --Since data are partitioned on city, and we have a condition on city, then we hash the values 'Boston' and 'New York' and find which partitions to check. --Only these partitions will be scanned to evaluate the other condition on age.

Question 2

1- Apply the selection condition on R.x1 first (on R's site), then if the output is small, we can ship it directly to S's site. If the output is large, we can apply the standard semi-join on the output from R's side and S's side.

2- Apply the condition on S.z1 first. Since, the output is small, we can just ship the output to R's site and perform the join there.

3- There are many scenarios. One of them if the join column Y is large is size relative to the other columns. Another scenario, if one relation is too small and another one is large.

Question 3

1- Two-phase commit is a coordination protocol used in distributed databases to ensure "atomic" execution of distributed transactions, i.e., a distributed transaction is either executed entirely or none of its components is executed.

2- Since every one is ready to commit, then the transaction will commit. The crashed site, when recovered, needs to know whether T committed or not (remember the cite does not know whether the other sites wanted to commit or not). So, the recovered site will contact the coordinator and the coordinator will reply that T is committed. So the recovered site will commit T.

3- Since the coordinator crashed, then may have missed the replies from the other sites. The coordinator needs to send again "Prepare T" and gets the replies to decide whether to commit or abort T.