Week 7 Graded Questions with Solutions

1] You write an algorithm to sort N numbers (stored in an array a[0] to a[N-1]) as follows:

Algorithm steps:

i. Search through the list of numbers to find the lowest number - say it is position

ii. Move a[i-1] to a[i], a[i-2] to a[i-1] etc, till a[0] to a[1]

iii. Place the original a[i] in position 0

iv. Repeat the above steps but now starting from position 1 to N-1, then 2 to N-1 etc till all numbers are in the correct places.

What is the running complexity of this algorithm?

1. linear
2. quadratic
3. cubic
4. exponential

Answer: Option 2.

Solution: Step 1 can take O(N) time in worst case (search through all elements). Then step 2 will also take O(N) time (if i is close to end of the list). But this is total 2N which is still O(N). This is done once for each of N numbers, so total algorithm is O(N*N) or quadratic.

2] Balancing a binary tree is done in order to__.

1. reduce the height of the tree
2. ensure logarithmic searching time
3. make the search time linear
4. reduce the space required for storage.

Answer: Option 1 and 2.

Solution: Reducing the height of the tree and ensuring logarithmic searching time do not have any impact on storage.

3] A binary tree of height H can store a maximum of how many values?

1. 2^H - 1
2. 2^H + 1
3. H^2 - 1
4. H^2 + 1

Answer: Option 1.

Solution: 2^H - 1 (for example, height 5 means 5 steps to root, there will be 16 at the lowest level, 8 above that, 4 above that, 2 above that and then the root).

4] A binary tree is used to store an index of names of people (table NAME). Which of the following queries will be able to make use of the index to speed up the response?

1. NAME LIKE 'RA%';
2. NAME = 'RAHUL' ;
3. NAME LIKE '%DR%';
4. ROLLNO LIKE 'EE%';

Answers: Option 1 and 2.

Solution: The queries NAME LIKE 'RA%' and NAME = 'RAHUL' will make use of the index to speed up the response.

5] If our main interest is in scaling out a database by adding more distributed servers, then which of the ACID conditions is most difficult to meet?

1. A
2. C
3. I
4. D

Answer: Option 2.

Solution: consistency - all the other can be done more easily on a distributed system. consistency is hard because there are multiple servers

6] You want to create an app where students can log in and download halltickets. To make this more efficient, you want to have some very quick way to check whether a given user has already downloaded their hallticket or not. Which kind of database will you prefer?

1. RDBMS
2. Doc-oriented database
3. Graph database
4. Key-value store

Answer: Option 4.

Solution: Key-Value stores are usually kept in memory and are very fast at answering Yes/No questions like whether a person has already downloaded their hallticket

7] Which type of database will be worst at scaling out to large number of servers?

1. RDBMS
2. Doc-oriented database
3. Graph database
4. Key-value store

Answer: Option 1.

Solution: RDBMS are usually designed for consistency and do not scale out easily.