Week 7 Practice Questions with Solutions

1] You have a DRAM module with bus width of 64 bits, clock speed of 1 GHz, and operating in DDR (double-data-rate or two values per clock cycle) mode. What is the maximum bandwidth (in Giga-bytes per second) of data transfer achievable with this module?

1. 8 GigaBytes/s
2. 16 GigaBytes/s
3. 24 GigaBytes/s
4. None of the above

Answer : Option 2.

Solution: 64 (bus-width) x 2 (DDR) x 1 (GHz) = 128 Gbps = 16 GigaBytes/s.

2] A magnetic disk operating at 7200 rpm is being used to store data. The disk can only spin in one direction at a constant speed of 7200 revolutions per minute. If the operating system sends a request to the disk controller to fetch data from the disk, what is the worst case latency before it can start retrieving data? (NAT)

Answer: 8.33 milliseconds.

Solution: In the worst case, the data is in the part of the disk that has just passed under the read head. This means it will have to wait till that part comes under the read head again (one full rotation) before it can access the data. Since the disk is turning at 7200rpm, the time for one rotation is 60s/7200rpm = 8.33 milliseconds. This is the worst case latency.

3] You have two search functions, one of which takes time t1(N) = 1000N+200 nanoseconds, while the other takes t2(N) = N^3 + 5 nanoseconds to operate on an input of size N. Which function is better if you are sure that the input size N is always less than 10?

1. t1(N)
2. t2(N)
3. Both will take same time.
4. cannot be decided.

Answer: Option 2.

Answer: use the second algorithm. Though it is cubic, it is faster for N less than 10.

4] Your application is such that most of the time you need to look up a database entry given the first name of a person. Which of the following indexes will be helpful?

1. Index on Rollno
2. Index on Firstname
3. Index on (Lastname,Firstname)
4. Index on (Firstname,Lastname)

Answer: Option 2 and Option 4.

Solution: The most helpful index will be index on Firstname followed by Index on (Firstname,Lastname).

5] Which of the following types of columns is it most difficult to create an index for?

1. varchar
2. integer
3. BLOB
4. timestamp

Answer: Option 3.

Solution: BLOB - this is general binary data and may be difficult to even find a suitable sorting function - searching such objects in general is difficult.

6] To store photos of users in a database, what type of field would be used?

1. int
2. varchar
3. blob
4. timestamp

Answer: Option 3.

Solution: BLOB is used to store photos in the database.

7] If a database server runs completely from RAM and does not store any data on permanent storage like HDD, then which ACID condition will it not be able to fulfill?

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

Answer: Option 4.

Solution: D - durability since this requires saving data against power outages also.

8] Which of the following is better suited for storing connection information in a social network?

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

Answer: Option 3.

Solution: Graphs are good at capturing connections between people in social networks.

9] You have a datacenter where each server has a 1 gigabit per second network connection, but the overall datacenter has a 10 gigabit per second connection. As your app becomes more popular, you start getting 10,000 requests per second, and each request needs a 50 Kbyte response. Which of the following is a better option?

1) scale up on a single server
2) scale out to multiple servers in the datacenter

1. Option 1
2. Option 2
3. Both will produce similar results.
4. None of the two given

Answer: Option 2.

Solution: The total response bandwidth is more than can be handled by a single server, so you have no option but to scale out.

10] SQL injection refers to ___

1. feeding SQL queries through a web form.
2. hacking into servers of a foreign country.
3. processing SQL queries in a NoSQL database.
4. None of the above

Answer: Option 1.

Solution: SQL injection refers to feeding SQL queries through a web form.

11] Sanitizing data in the context of SQL queries refers to ___

1. making sure invalid data or symbols are not allowed in the query.
2. applying Covid protocols to the datacenter.
3. cleaning up HTML forms so only essential data is submitted from the web page.
4. using compression to reduce the amount of data transmitted.

Answer: Option 1.

Solution: Sanitizing data does not refer to medical sanitization. Cleaning HTML forms and compressing files are not sufficient to ensure invalid data cannot reach the DB.

12] Sanitizing data of an SQL query is the responsibility of ___.

1. end user of application
2. application developer
3. database administrator
4. data center operator

Answer: Option 2

Solution: App developer must ensure invalid data is filtered out before going to the DB - other parts of the chain do not have enough information to know what is acceptable and what is not.