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| **SQL SERVER INTERVIEW QUESTIONS**  w/ Answers  10/6/2017  Steven Peterson |

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# What is normalization? Explain different levels of normalization?

* + Check out the article Q100139 from Microsoft knowledge base and of course, there's much more information available in the net. It'll be a good idea to get a hold of any RDBMS fundamentals text book, especially the one by C. J. Date. Most of the times, it will be okay if you can explain till third normal form.

# What is denormalization and when would you go for it?

* + As the name indicates, denormalization is the reverse process of normalization. It's the controlled introduction of redundancy in to the database design. It helps improve the query performance as the number of joins could be reduced.

# How do you implement one-to-one, one-to-many and many-to-many relationships while designing tables?

* + One-to-One relationship can be implemented as a single table and rarely as two tables with primary and foreign key relationships. One-to-Many relationships are implemented by splitting the data into two tables with primary key and foreign key relationships. Many-to-Many relationships are implemented using a junction table with the keys from both the tables forming the composite primary key of the junction table. It will be a good idea to read up a database designing fundamentals text book.

# What's the difference between a primary key and a unique key?

* + Both primary keys and unique constraints enforce uniqueness of the column on which they are defined. But by default primary key creates a clustered index on the column, where are unique creates a nonclustered index by default. Another major difference is that, primary key doesn't allow NULLs, but unique key allows one NULL only.

# How can you tell if a table is missing a Primary Key?

# Can the primary key and clustered index be different columns?

# What are user defined data types and when you should go for them?

* + User defined data types let you extend the base SQL Server data types by providing a descriptive name, and format to the database. Take for example, in your database, there is a column called Flight\_Num which appears in many tables. In all these tables it should be varchar(8). In this case you could create a user defined data type called Flight\_num\_type of varchar(8) and use it across all your tables. See sp\_addtype, sp\_droptype in books online.

# What is bit data type and what's the information that can be stored inside a bit column?

* + Bit data type is used to store Boolean information like 1 or 0 (true or false). Until SQL Server 6.5 bit data type could hold either a 1 or 0 and there was no support for NULL. But from SQL Server 7.0 onwards, bit data type can represent a third state, which is NULL.

# Define candidate key, alternate key, and composite key.

* + A candidate key is one that can identify each row of a table uniquely. Generally a candidate key becomes the primary key of the table. If the table has more than one candidate key, one of them will become the primary key, and the rest are called alternate keys. A key formed by combining at least two or more columns is called composite key.

# What are defaults? Is there a column to which a default can't be bound?

* + A default is a value that will be used by a column, if no value is supplied to that column while inserting data. IDENTITY columns and timestamp columns can't have defaults bound to them. See CREATE DEFAULT in books online.

# What is a transaction and what are ACID properties?

* + A transaction is a logical unit of work in which, all the steps must be performed or none. ACID stands for Atomicity, Consistency, Isolation, and Durability. These are the properties of a transaction. For more information and explanation of these properties, see SQL Server books online or any RDBMS fundamentals text book. Explain different isolation levels an isolation level determines the degree of isolation of data between concurrent transactions. The default SQL Server isolation level is Read Committed. Here are the other isolation levels (in the ascending order of isolation): Read Uncommitted, Read Committed, Repeatable Read, and Serializable. See SQL Server books online for an explanation of the isolation levels. Be sure to read about SET TRANSACTION ISOLATION LEVEL, which lets you customize the isolation level at the connection level. Read Committed - A transaction operating at the Read Committed level cannot see changes made by other transactions until those transactions are committed. At this level of isolation, dirty reads are not possible but non-repeatable reads and phantoms are possible. Read Uncommitted - A transaction operating at the Read Uncommitted level can see uncommitted changes made by other transactions. At this level of isolation, dirty reads, non-repeatable reads, and phantoms are all possible. Repeatable Read - A transaction operating at the Repeatable Read level is guaranteed not to see any changes made by other transactions in values it has already read. At this level of isolation, dirty reads and non-repeatable reads are not possible but phantoms are possible. Serialize-able - A transaction operating at the Serialize-able level guarantees that all concurrent transactions interact only in ways that produce the same effect as if each transaction were entirely executed one after the other. At this isolation level, dirty reads, non-repeatable reads, and phantoms are not possible.

# CREATE INDEX myIndex ON myTable(myColumn). What type of Index will get created after executing the above statement?

* + Non-clustered index. Important thing to note: By default a clustered index gets created on the primary key, unless specified otherwise.

# What's the maximum size of a row?

* + 8060 bytes. Don't be surprised with questions like 'what is the maximum number of columns per table'. 1024 columns per table. Check out SQL Server books online for the page titled: "Maximum Capacity Specifications". Explain Active/Active and Active/Passive cluster configurations. Hopefully you have experience setting up cluster servers. But if you don't, at least be familiar with the way clustering works and the two clustering configurations Active/Active and Active/Passive. SQL Server books online has enough information on this topic and there is a good white paper available on Microsoft site. Explain the architecture of SQL Server This is a very important question and you better be able to answer it if consider yourself a DBA. SQL Server books online is the best place to read about SQL Server architecture. Read up the chapter dedicated to SQL Server Architecture.

# What is lock escalation?

* + Lock escalation is the process of converting a lot of low level locks (like row locks, page locks) into higher level locks (like table locks). Every lock is a memory structure too many locks would mean, more memory being occupied by locks. To prevent this from happening, SQL Server escalates the many fine-grain locks to fewer coarse-grain locks. Lock escalation threshold was definable in SQL Server 6.5, but from SQL Server 7.0 onwards it's dynamically managed by SQL Server.

# What's the difference between DELETE TABLE and TRUNCATE TABLE commands?

* + DELETE TABLE is a logged operation, so the deletion of each row gets logged in the transaction log, which makes it slow. TRUNCATE TABLE also deletes all the rows in a table, but it won't log the deletion of each row, instead it logs the de-allocation of the data pages of the table, which makes it faster. Of course, TRUNCATE TABLE can be rolled back. TRUNCATE TABLE is functionally identical to DELETE statement with no WHERE clause: both remove all rows in the table. But TRUNCATE TABLE is faster and uses fewer system and transaction log resources than DELETE. The DELETE statement removes rows one at a time and records an entry in the transaction log for each deleted row. TRUNCATE TABLE removes the data by de-allocating the data pages used to store the table's data, and only the page de-allocations are recorded in the transaction log. TRUNCATE TABLE removes all rows from a table, but the table structure and its columns, constraints, indexes and so on remain. The counter used by an identity for new rows is reset to the seed for the column. If you want to retain the identity counter, use DELETE instead. If you want to remove table definition and its data, use the DROP TABLE statement. You cannot use TRUNCATE TABLE on a table referenced by a FOREIGN KEY constraint; instead, use DELETE statement without a WHERE clause. Because TRUNCATE TABLE is not logged, it cannot activate a trigger. TRUNCATE TABLE may not be used on tables participating in an indexed view

# Explain the storage models of OLAP

* + Check out MOLAP, ROLAP and HOLAP in SQL Server books online for more information.

# What are the new features introduced in SQL Server 2000 (or the latest release of SQL Server at the time of your interview)? What changed between the previous version of SQL Server and the current version?

* + This question is generally asked to see how current your knowledge is. Generally there is a section in the beginning of the books online titled "What's New", which has all such information. Of course, reading just that is not enough, you should have tried those things to better answer the questions. Also check out the section titled "Backward Compatibility" in books online which talks about the changes that have taken place in the new version.

# What are constraints? Explain different types of constraints.

* + Constraints enable the RDBMS enforce the integrity of the database automatically, without needing you to create triggers, rule or defaults. Types of constraints: NOT NULL, CHECK, UNIQUE, PRIMARY KEY, FOREIGN KEY. For an explanation of these constraints see books online for the pages titled: "Constraints" and "CREATE TABLE", "ALTER TABLE"

# What is an index? What are the types of indexes? How many clustered indexes can be created on a table? I create a separate index on each column of a table. What are the advantages and disadvantages of this approach?

* + Indexes in SQL Server are similar to the indexes in books. They help SQL Server retrieve the data quicker. Indexes are of two types. Clustered indexes and non-clustered indexes. When you create a clustered index on a table, all the rows in the table are stored in the order of the clustered index key. So, there can be only one clustered index per table. Non-clustered indexes have their own storage separate from the table data storage. Non-clustered indexes are stored as B-tree structures (so do clustered indexes), with the leaf level nodes having the index key and its row locater. The row located could be the RID or the Clustered index key, depending up on the absence or presence of clustered index on the table. If you create an index on each column of a table, it improves the query performance, as the query optimizer can choose from all the existing indexes to come up with an efficient execution plan. At the same time, data modification operations (such as INSERT, UPDATE, DELETE) will become slow, as every time data changes in the table, all the indexes need to be updated. Another disadvantage is that, indexes need disk space, the more indexes you have, more disk space is used.

# What is RAID and what are different types of RAID configurations?

* + RAID stands for Redundant Array of Inexpensive Disks, used to provide fault tolerance to database servers. There are six RAID levels 0 through 5 offering different levels of performance, fault tolerance. MSDN has some information about RAID levels and for detailed information, check out the RAID advisory board's homepage

# What are the steps you will take to improve performance of a poor performing query?

* + This is a very open ended question and there could be a lot of reasons behind the poor performance of a query. But some general issues that you could talk about would be: No indexes, table scans, missing or out of date statistics, blocking, excess recompilations of stored procedures, procedures and triggers without SET NOCOUNT ON, poorly written query with unnecessarily complicated joins, too much normalization, excess usage of cursors and temporary tables. Some of the tools/ways that help you troubleshooting performance problems are: SET SHOWPLAN\_ALL ON, SET SHOWPLAN\_TEXT ON, SET STATISTICS IO ON, SQL Server Profiler, Windows NT /2000 Performance monitor, Graphical execution plan in Query Analyzer. Download the white paper on performance tuning SQL Server from Microsoft web site. Don't forget to check out sql-server-performance.com

# What are the steps you will take, if you are tasked with securing an SQL Server?

* + Again this is another open ended question. Here are some things you could talk about: Preferring NT authentication, using server, database and application roles to control access to the data, securing the physical database files using NTFS permissions, using an un-guessable SA password, restricting physical access to the SQL Server, renaming the Administrator account on the SQL Server computer, disabling the Guest account, enabling auditing, using multiprotocol encryption, setting up SSL, setting up firewalls, isolating SQL Server from the web server etc. Read the white paper on SQL Server security from Microsoft website. Also check out My SQL Server security best practices

# What is a deadlock and what is a live lock? How will you go about resolving deadlocks?

* + Deadlock is a situation when two processes, each having a lock on one piece of data, attempt to acquire a lock on the other's piece. Each process would wait indefinitely for the other to release the lock, unless one of the user processes is terminated. SQL Server detects deadlocks and terminates one user's process. A live lock is one, where a request for an exclusive lock is repeatedly denied because a series of overlapping shared locks keeps interfering. SQL Server detects the situation after four denials and refuses further shared locks. A live lock also occurs when read transactions monopolize a table or page, forcing a write transaction to wait indefinitely. Check out SET DEADLOCK\_PRIORITY and "Minimizing Deadlocks" in SQL Server books online. Also check out the article Q169960 from Microsoft knowledge base.

# What is blocking and how would you troubleshoot it?

* + Blocking happens when one connection from an application holds a lock and a second connection requires a conflicting lock type. This forces the second connection to wait, blocked on the first. Read up the following topics in SQL Server books online: Understanding and avoiding blocking, Coding efficient transactions. Explain CREATE DATABASE syntax many of us are used to creating databases from the Enterprise Manager or by just issuing the command: CREATE DATABAE Midi.

# But what if you have to create a database with two filegroups, one on drive C and the other on drive D with log on drive E with an initial size of 600 MB and with a growth factor of 15%?

* + That's why being a DBA you should be familiar with the CREATE DATABASE syntax. Check out SQL Server books online for more information.

# How to restart SQL Server in single user mode? How to start SQL Server in minimal configuration mode?

* + SQL Server can be started from command line, using the SQLSERVR.EXE. This EXE has some very important parameters with which a DBA should be familiar with. -m is used for starting SQL Server in single user mode and -f is used to start the SQL Server in minimal configuration mode. Check out SQL Server books online for more parameters and their explanations.

# As a part of your job, what are the DBCC commands that you commonly use for database maintenance?

* + DBCC CHECKDB, DBCC CHECKTABLE, DBCC CHECKCATALOG, DBCC CHECKALLOC, DBCC SHOWCONTIG, DBCC SHRINKDATABASE, DBCC SHRINKFILE etc. But there are a whole load of DBCC commands which are very useful for DBAs. Check out SQL Server books online for more information.

# What are statistics, under what circumstances they go out of date, and how do you update them?

* + Statistics determine the selectivity of the indexes. If an indexed column has unique values then the selectivity of that index is more, as opposed to an index with non-unique values. Query optimizer uses these indexes in determining whether to choose an index or not while executing a query. Some situations under which you should update statistics: 1) If there is significant change in the key values in the index 2) If a large amount of data in an indexed column has been added, changed, or removed (that is, if the distribution of key values has changed), or the table has been truncated using the TRUNCATE TABLE statement and then repopulated 3) Database is upgraded from a previous version. Look up SQL Server books online for the following commands: UPDATE STATISTICS, STATS\_DATE, DBCC SHOW\_STATISTICS, CREATE STATISTICS, DROP STATISTICS, sp\_autostats, sp\_createstats, sp\_updatestats

# What are the different ways of moving data/databases between servers and databases in SQL Server?

* + There are lots of options available, you have to choose your option depending upon your requirements. Some of the options you have are: BACKUP/RESTORE, detaching and attaching databases, replication, DTS, BCP, log shipping, INSERT...SELECT, SELECT...INTO, creating INSERT scripts to generate data.

# Explain different types of BACKUPs available in SQL Server? Given a particular scenario, how would you go about choosing a backup plan?

* + Types of backups you can create in SQL Server 7.0+ are Full database backup, differential database backup, transaction log backup, file group backup. Check out the BACKUP and RESTORE commands in SQL Server books online. Be prepared to write the commands in your interview. Books online also has information on detailed backup/restore architecture and when one should go for a particular kind of backup.

# What is database replication? What are the different types of replication you can set up in SQL Server?

* + Replication is the process of copying/moving data between databases on the same or different servers. SQL Server supports the following types of replication scenarios: · Snapshot replication · Transactional replication (with immediate updating subscribers, with queued updating subscribers) · Merge replication See SQL Server books online for in-depth coverage on replication. Be prepared to explain how different replication agents function, what are the main system tables used in replication etc.

# How to determine the service pack currently installed on SQL Server?

* + The global variable @@Version stores the build number of the sqlservr.exe, which is used to determine the service pack installed. To know more about this process visit SQL Server service packs and versions.

# What are cursors? Explain different types of cursors. What are the disadvantages of cursors? How can you avoid cursors?

* + Cursors allow row-by-row processing of the result sets. Types of cursors: Static, Dynamic, Forward-only, Keyset-driven. See books online for more information. Disadvantages of cursors: Each time you fetch a row from the cursor, it results in a network roundtrip, where as a normal SELECT query makes only one roundtrip, however large the result set is. Cursors are also costly because they require more resources and temporary storage (results in more IO operations). Further, there are restrictions on the SELECT statements that can be used with some types of cursors. Most of the times, set based operations can be used instead of cursors. Here is an example: If you have to give a flat hike to your employees using the following criteria: Salary between 30000 and 40000 -- 5000 hike Salary between 40000 and 55000 -- 7000 hike Salary between 55000 and 65000 -- 9000 hike. In this situation many developers tend to use a cursor, determine each employee's salary and update his salary according to the above formula. But the same can be achieved by multiple update statements or can be combined in a single UPDATE statement as shown below:
  + UPDATE tbl\_emp SET salary = CASE WHEN salary BETWEEN 30000 AND 40000 THEN salary + 5000 WHEN salary BETWEEN 40000 AND 55000 THEN salary + 7000 WHEN salary BETWEEN 55000 AND 65000 THEN salary + 10000 END
  + Another situation in which developers tend to use cursors: You need to call a stored procedure when a column in a particular row meets certain condition. You don't have to use cursors for this. This can be achieved using WHILE loop, as long as there is a unique key to identify each row. For examples of using WHILE loop for row by row processing, check out the 'My code library' section of my site or search for WHILE. Write down the general syntax for a SELECT statements covering all the options. Here's the basic syntax: (Also checkout SELECT in books online for advanced syntax).
  + SELECT select\_list [INTO new\_table\_] FROM table\_source [WHERE search\_condition] [GROUP BY group\_by\_expression] [HAVING search\_condition] [ORDER BY order\_expression [ASC | DESC] ]
  + Example

/\* Use DECLARE @local\_variable, DECLARE CURSOR and SET. \*/  
DECLARE @MyVariable CURSOR  
  
DECLARE MyCursor CURSOR FOR  
SELECT LastName FROM Northwind.dbo.Employees  
  
SET @MyVariable = MyCursor  
  
/\* Use DECLARE @local\_variable and SET \*/  
DECLARE @MyVariable CURSOR  
  
SET @MyVariable = CURSOR SCROLL KEYSET FOR  
SELECT LastName FROM Northwind.dbo.Employees

DEALLOCATE @MyCursor

# What is a join and explain different types of joins.

* + Joins are used in queries to explain how different tables are related. Joins also let you select data from a table depending upon data from another table. Types of joins: INNER JOINs, OUTER JOINs, CROSS JOINs. OUTER JOINs are further classified as LEFT OUTER JOINS, RIGHT OUTER JOINS and FULL OUTER JOINS. For more information see pages from books online titled: "Join Fundamentals" and "Using Joins".

# Can you have a nested transaction?

* + Yes, very much. Check out BEGIN TRAN, COMMIT, ROLLBACK, SAVE TRAN and @@TRANCOUNT

# What is an extended stored procedure? Can you instantiate a COM object by using T-SQL?

* + An extended stored procedure is a function within a DLL (written in a programming language like C, C++ using Open Data Services (ODS) API) that can be called from T-SQL, just the way we call normal stored procedures using the EXEC statement. See books online to learn how to create extended stored procedures and how to add them to SQL Server. Yes, you can instantiate a COM (written in languages like VB, VC++) object from T-SQL by using sp\_OACreate stored procedure. Also see books online for sp\_OAMethod, sp\_OAGetProperty, sp\_OASetProperty, sp\_OADestroy. For an example of creating a COM object in VB and calling it from T-SQL, see 'My code library' section of this site.
* **What is the system function to get the current user's user id?** 
  + USER\_ID(). Also check out other system functions like USER\_NAME(), SYSTEM\_USER, SESSION\_USER, CURRENT\_USER, USER, SUSER\_SID(), HOST\_NAME().
* **What are triggers? How many triggers you can have on a table? How to invoke a trigger on demand?** 
  + Triggers are special kind of stored procedures that get executed automatically when an INSERT, UPDATE or DELETE operation takes place on a table. In SQL Server 6.5 you could define only 3 triggers per table, one for INSERT, one for UPDATE and one for DELETE. From SQL Server 7.0 onwards, this restriction is gone, and you could create multiple triggers per each action. But in 7.0 there's no way to control the order in which the triggers fire. In SQL Server 2000 you could specify which trigger fires first or fires last using sp\_settriggerorder. Triggers can't be invoked on demand. They get triggered only when an associated action (INSERT, UPDATE, and DELETE) happens on the table on which they are defined. Triggers are generally used to implement business rules, auditing. Triggers can also be used to extend the referential integrity checks, but wherever possible, use constraints for this purpose, instead of triggers, as constraints are much faster. Till SQL Server 7.0, triggers fire only after the data modification operation happens. So in a way, they are called post triggers. But in SQL Server 2000 you could create pre triggers also. Search SQL Server 2000 books online for INSTEAD OF triggers. Also check out books online for 'inserted table', 'deleted table' and COLUMNS\_UPDATED()
  + Example: Trigger with remainder e-mail message
  + USE pubs  
    IF EXISTS (SELECT name FROM sysobjects  
          WHERE name = 'reminder' AND type = 'TR')  
       DROP TRIGGER reminder  
    GO  
    CREATE TRIGGER reminder  
    ON titles  
    FOR INSERT, UPDATE, DELETE   
    AS  
       EXEC master..xp\_sendmail 'MaryM',   
          'Don''t forget to print a report for the distributors.'  
    GO

  There is a trigger defined for INSERT operations on a table, in an OLTP system. The trigger is written to instantiate a COM object and pass the newly inserted rows to it for some custom processing. What do you think of this implementation? Can this be implemented better?

* + Instantiating COM objects is a time consuming process and since you are doing it from within a trigger, it slows down the data insertion process. Same is the case with sending emails from triggers. This scenario can be better implemented by logging all the necessary data into a separate table, and have a job which periodically checks this table and does the needful.

# What are the trigger limitations?

* + The CREATE TRIGGER statement must be the first statement in the batch. All other statements that follow in that batch are interpreted as part of the definition of the CREATE TRIGGER statement.
  + Permission to create triggers defaults to the table owner, who cannot transfer it to other users.
  + You can create a trigger only in the current database, although a trigger can reference objects outside of the current database.
  + A trigger cannot be created on a temporary or system table, although triggers can reference temporary tables.
  + INSTEAD OF DELETE and INSTEAD OF UPDATE triggers cannot be defined on a table that has a foreign key defined with a DELETE or UPDATE action.
  + Although a TRUNCATE TABLE statement is like a DELETE statement without a WHERE clause (it deletes all rows), it does not cause DELETE triggers to fire because the TRUNCATE TABLE statement is not logged.
  + The WRITETEXT statement does not cause the INSERT or UPDATE triggers to fire.

# What is a self-join? Explain it with an example.

* + Self-join is just like any other join, except that two instances of the same table will be joined in the query. Here is an example: Employees table which contains rows for normal employees as well as managers. So, to find out the managers of all the employees, you need a self-join.
  + CREATE TABLE emp ( empid int, mgrid int, empname char(10) )
  + INSERT emp SELECT 1,2,'Vyas' INSERT emp SELECT 2,3,'Mohan' INSERT emp SELECT 3,NULL,'Shobha' INSERT emp SELECT 4,2,'Shridhar' INSERT emp SELECT 5,2,'Sourabh'
  + SELECT t1.empname [Employee], t2.empname [Manager] FROM emp t1, emp t2 WHERE t1.mgrid = t2.empid Here's an advanced query using a LEFT OUTER JOIN that even returns the employees without managers (super bosses)
  + SELECT t1.empname [Employee], COALESCE(t2.empname, 'No manager') [Manager] FROM emp t1 LEFT OUTER JOIN emp t2 ON t1.mgrid = t2.empid

# What is the difference between stored procedure and functions?

* + Stored procedures are different from function in that they do not return values in place of their names and they cannot be used directly in an expression.

# Mention some capacity specification of SQL Server 2012/2016.

# How would you upgrade an existing database server to the next or latest version of SQL Server?

# Where is the best place to keep and maintain documentation?

# Ideal SQL Server hardware configuration?

# Ideal SQL Server hardware configuration on VM?

# Explain AlwaysOn and how to set it up.

# AlwaysOn Overview:

* First introduced in 2012 with enhancements made to 2016
* High availability / Disaster Recovery
* Synchronous replicas
* There are two types of secondary replicas within an AG -- asynchronous and synchronous
* Two-phase commit
* 2016 Optimized log transport
* Listeners vs direct connections
* Group Managed Service Accounts (MSA – Security)

# 2016 Database engine object capacity