DATABASE 2(DB2)

The questions and answers that follow are intended for those with a working knowledge of DB2 as a "self-test".

1) What is DB2 (IBM Database 2)?

2) DB2 is a subsystem of the MVS operating system. It is a Database Management System (DBMS) for that operating system.

2) What is an access path?

3) The path that is used to get to data specified in SQL statements.

3) What is an alias?

A3) It is an alternate name that can be used in SQL statements to refer to a table or view in the same or remote DB2 subsystem.

4) Explain what a plan is?

A4) Plan is a DB2 object (produced during the bind process) that associates one or more database request modules with a plan name.

5) What is a DB2 bind?

A5) Bind is a process that builds "access paths" to DB2 tables. A bind uses the Database Request Modules(s) (DBRM(s)) from the DB2 pre-compile step as input and produces an application plan. It also checks the user's authority and validates the SQL statements in the DBRM(s).

6) What information is used as input to the bind process?

7) The database request module produced during the pre-compile. The SYSIBM.SYSSTMT table of the DB2 catalog.

7) What is meant by the attachment facility?

8) The attachment facility is an interface between DB2 and TSO, IMS/VS, CICS, or batch address spaces. It allows application programs to access DB2.

8) What is meant by AUTO COMMIT?

9) AUTO COMMIT is a SPUFI option that commits the effects of SQL statements automatically if they are successfully executed.

9) What is a base table?

10) A base table is a real table - a table that physically exists in that there are physical stored records.

10) What is the function of buffer manager?

11) The buffer manager is the DB2 component responsible for physically transferring data between an external medium and (virtual) storage (performs the actual I/O operations). It minimizes the amount of physical I/O actually performed with sophisticated buffering techniques(i.e., read-ahead buffering and look-aside buffering).

11) What is a buffer pool?

12) A buffer pool is main storage that is reserved to satisfy the buffering requirements for one or more tablespaces or indexes, and is made up of either 4K or 32K pages.

12) How many buffer pools are there in DB2?

13) There are four buffer pools: BP0, BP1, BP2, and BP32.

13) On the create tablespace, what does the CLOSE parameter do?

14) CLOSE physically closes the tablespace when no one is working on the object. DB2 (release 2.3) will

logically close tablespaces.

14) What is a clustering index?

15) It is a type of index that (1) locates table rows and (2) determines how rows are grouped together in the tablespace.

15) What will the COMMIT accomplish?

16) COMMIT will allow data changes to be permanent. This then permits the data to be accessed by other units of work. When a COMMIT occurs, locks are freed so other applications can reference the just committed data.

16) What is meant by concurrency?

17) Concurrency is what allows more than one DB2 application process to access the same data at essentially the same time. Problems may occur, such as lost updates, access to uncommitted data, and un-repeatable reads.

17) What is cursor stability?

18) It is cursor stability that "tells" DB2 that database values read by this application are protected only while they are being used. (Changed values are protected until this application reaches the commit point). As soon as a program moves from one row to another, other programs may read or the first row.

18) What is the function of the Data Manager?

19) The Data Manager is a DB2 component that manager the physical databases. It invokes other system components, as necessary, to perform detailed functions such as locking, logging, and physical I/O operations (such as search, retrieval, update, and index maintenance).

19) What is a Database Request Module(DBRM)?

20) A DBRM is a DB2 component created by the DB2 pre-compiler containing the SQL source statements extracted from the application program. DBRMs are input to the bind process.

20) What is a data page?

21) A data page is a unit of retrievable data, either 4K or 32K (depending on how the table is defined), containing user or catalog information.

21) What are data types?

22) They are attributes of columns, literals, and host variables. The data types are SMALLINT, INTEGER, FLOAT, DECIMAL, CHAR, VARCHAR, DATE and TIME.

22) What is Declaration Generator(DCLGEN)?

23) DCLGEN is a facility that is used to generate SQL statements that describe a table or view. These table or view descriptions are then used to check the validity of other SQL statements at precompile time. The table or view declares are used by the DB2I utility DCLGEN to build a host language structure, which is used by the DB2 precompiler to verify that correct column names and data types have been specified in the SQL statement.

23) What does DSNDB07 database do?

24) DSNDB07 is where DB2 does its sorting. It includes DB2's sort work area and external storage.

24) What will the FREE command do to a plan?

25) It will drop(delete) that existing plan.

25) What is a host variable?

26) This is a data item that is used in an SQL statement to receive a value or to supply a value. It must be preceded by a colon (:) to tell DB2 that the variable is not a column name.

26) What will the DB2 optimizer do?

27) The optimizer is a DB2 component that processes SQL statements and selects the access paths.

27) What is a page?

28) This is the unit of storage within a table space or indexspace that is accessed by DB2.

28) What is pagespace?

29) Pagespace refers to either to an unpartitioned table, to an index space, or to a single partition of a partitioned table of index space.

29) What is a predicate?

30) A predicate is an element of a search condition that expresses or implies a comparison operation.

30) What is a recovery log?

31) A recovery log is a collection of records that describes the sequence of events that occur in DB2. The information is needed for recovery in the event of a failure during execution.

31) What is a Resource Control Table(RCT)? Describe its characteristics.

32) The RCT is a table that is defined to a DB2/CICS region. It contains control characteristics which are assembled via the DSNCRCT macros. The RCT matches the CICS transaction ID to its associated DB2 authorization ID and plan ID(CICS attachment facility).

32) Where are plans stored?

33) Each plan is defined uniquely in the SYSIBM.SYSPLANS table to correspond to the transaction (s) that are to execute that plan.

33) What is meant by repeatable read?

34) When an application program executes with repeatable read protection, rows referenced by the program can't be changed by other programs until the program reaches a commit point.

34) Describe what a storage group(STOGROUP) is?

35) A STOGROUP is a named collection of DASD volumes to be used by tablespaces and index spaces of databases. The volumes of STOGROUP must be of the same device type.

35) How would you move a tablespace (using STOGROUP) to a different DASD volume allocated to that tablespace?

36) If the tablespace used is only allocated to that STOGROUP:

- ALTER STOGROUP - add volume (new) delete volume(old)
- REORG TABLESPACE or RECOVER TABLESPACE

Create a new STOGROUP that points to the new volume. ALTER the tablespace and REORG or RECOVER the tablespace.

36) What is the format (internal layout) of "TIMESTAMP"?

37) This is a seven part value that consists of a date (yymmdd) and time(hhmmss and microseconds).

37) What is meant by a unit of recovery?

38) This is a sequence of operations within a unit of work(i.e., work done between commit points).

38) Can DASD types assigned to storage groups be intermixed(i.e., 3350s and 3380s)?

39) No

39) What are the three types of page locks that can be held?

40) Exclusive, update, and share.

40) Can DB2 be accessed by TSO users? If yes, which command is used to invoke DB2?

41) DB2 can be invoked by TSO users by using the DSN RUN command.

41) How are write I/Os from the buffer pool executed?
42) Asynchronously.

42) What is a DB2 catalog?
43) The DB2 catalog is a set of tables that contain information about all of the DB2 objects(tables, views, plans etc.).

43) In which column of which DB2 catalog would you find the length of the rows for all tables?
44) In the RECLENGTH column of SYSIBM.SYSTABLES

44) What information is held in SYSIBM.SYSCOPY?
45) The SYSIBM.SYSCOPY table contains information about image copies made of the tablespaces.

45) What information is contained in a SYSCOPY entry?
46) Included is the name of the database, the table space name, and the image copy type(full or incremental etc.,) as well as the date and time each copy was made.

46) What information can you find in SYSIBM.SYSLINKS table?
47) The SYSIBM.SYSLINKS table contains information about the links between tables created by referential constraints.

47) Where would you find information about the type of database authority held by the user?
48) SYSIBM.SYSDBAUTH.

48) Where could you look if you had a question about whether a column has been defined as an index?
49) This information can be found in SYSIBM.SYSINDEXES.

49) Once you create a view, where would information about the view be stored?
50) When a view is created, system information about the view is stored in SYSIBM.SYSVIEWS.

50) What is the SQL Communications Area and what are some of its key fields?
51) It is a data structure that must be included in any host-language program using SQL. It is used to pass feedback about the sql operations to the program. Fields are return codes, error messages, handling codes and warnings.

51) What is DCLGEN?
52) DCLGEN stands for declarations generator; it is a facility to generate DB2 sql data structures in COBOL or PL/I programs.

52) How do you leave the cursor open after issuing a COMMIT? (for DB2 2.3 or above only)
53) Use WITH HOLD option in DECLARE CURSOR statement. But, it has not effect in psuedo-conversational CICS programs.

53) Give the COBOL definition of a VARCHAR field.
54) A VARCHAR column REMARKS would be defined as follows:

```
...
10 REMARKS.
        49 REMARKS-LEN    PIC S9(4) USAGE COMP.
        49 REMARKS-TEXT   PIC X(1920).
```

54) What is the physical storage length of each of the following DB2 data types: DATE, TIME, TIMESTAMP?
55) DATE: 4bytes

TIME: 3bytes
TIMESTAMP: 10bytes

55) What is the COBOL picture clause of the following DB2 data types: DATE, TIME, TIMESTAMP?
56) DATE: PIC X(10)
TIME : PIC X(08)
TIMESTAMP: PIC X(26)

56) What is the COBOL picture clause for a DB2 column defined as DECIMAL(11,2)? - GS
57) PIC S9(9)V99 COMP-3.
Note: In DECIMAL(11,2), 11 indicates the size of the data type and 2 indicates the precision.

57) What is DCLGEN ? - GS
58) DeCLarations GENerator: used to create the host language copy books for the table definitions. Also creates the DECLARE table.

58) What are the contents of a DCLGEN? - GS
59) EXEC SQL DECLARE TABLE statement which gives the layout of the table/view in terms of DB2 datatypes.
A host language copy book that gives the host variable definitions for the column names.

59) Is it mandatory to use DCLGEN? If not, why would you use it at all? - GS
60) It is not mandatory to use DCLGEN. Using DCLGEN, helps detect wrongly spelt column names etc. during the pre-compile stage itself (because of the DECLARE TABLE). DCLGEN being a tool, would generate accurate host variable definitions for the table reducing chances of error.

60) Is DECLARE TABLE in DCLGEN necessary? Why it used?
61) It not necessary to have DECLARE TABLE statement in DCLGEN. This is used by the pre-compiler to validate the table-name, view-name, column name etc., during pre-compile.

61) Will precompile of an DB2-COBOL program bomb, if DB2 is down?
62) No. Because the precompiler does not refer to the DB2 catalogue tables.

62) How is a typical DB2 batch program executed ?
63) There are two methods of executing a DB2-batch program
1. Use DSN utility to run a DB2 batch program from native TSO. An example is shown:
DSN SYSTEM(DSP3)
RUN PROGRAM(EDD470BD) PLAN(EDD470BD) LIB('EDGS01T.OBJ.LOADLIB')
END
2. Use IKJEFT01 utility program to run the above DSN command in a JCL.

63) Assuming that a site's standard is that pgm name = plan name, what is the easiest way to find out which
programs are affected by change in a table's structure?
63) Query the catalogue tables SYSPLANDEP and SYSPACKDEP.

64) Name some fields from SQLCA.
65) SQLCODE, SQLERRM, SQLERRD

65) How can you quickly find out the number of rows updated after an update statement?
66) Check the value stored in SQLERRD(3).

66) What is EXPLAIN? - GS
67) EXPLAIN is used to display the access path as determined by the optimizer for a SQL statement. It can be used in SPUFI (for single SQL statement) or in BIND step (for embedded SQL). The results of EXPLAIN is stored in U.PLAN_TABLE where U is the authorization id of the user

67) What do you need to do before you do EXPLAIN?
68) Make sure that the PLAN_TABLE is created under the AUTHID.

68) Where is the output of EXPLAIN stored? - GS
69) In USERID.PLAN_TABLE

69) EXPLAIN has output with MATCHCOLS = 0. What does it mean? - GS
70) A nonmatching index scan if ACCESSTYPE = I.

70) How do you do the EXPLAIN of a dynamic SQL statement?
71) There are two methods to achieve this:
    1. Use SPUFI or QMF to EXPLAIN the dynamic SQL statement
    2. Include EXPLAIN command in the embedded dynamic SQL statements

71) How do you simulate the EXPLAIN of an embedded SQL statement in SPUFI/QMF? Give an example with a host variable in WHERE clause)
72) Use a question mark in place of a host variable (or an unknown value). For instance,
    SELECT EMP_NAME FROM EMP WHERE EMP_SALARY > ?

72) What are the isolation levels possible ? - GS
73) CS: Cursor Stability
    RR: Repeatable Read

73) What is the difference between CS and RR isolation levels?
74) CS: Releases the lock on a page after use
    RR: Retains all locks acquired till end of transaction

74) When do you specify the isolation level? How?
75) During the BIND process(ISOLATION LEVEL is a parameter for the bind process). ISOLATION (CS/RR)...

75) I use CS and update a page. Will the lock be released after I am done with that page?
76) No.

76) What are the various locking levels available?
77) PAGE, TABLE, TABLESPACE

77) How does DB2 determine what lock-size to use?
78) There are three methods to determine the lock-size. They are:
    1. Based on the lock-size given while creating the tablespace
    2. Programmer can direct the DB2 what lock-size to use
    3. If lock-size ANY is specified, DB2 usually choses a lock-size of PAGE

78) What are the disadvantages of PAGE level lock?
79) High resource utilization if large updates are to be done

79) What is lock escalation?
80) Promoting a PAGE lock-size to table or tablespace lock-size when a transaction has aquired more locks than specified in NUMLKTS. Locks should be taken on objects in single tablespace for escalation to occur.

80) What are the various locks available?
81) SHARE, EXCLUSIVE, UPDATE

81) Can I use LOCK TABLE on a view?
82) No. To lock a view, take lock on the underlying tables.

82) What is ALTER ? - GS
83) SQL command used to change the definition of DB2 objects.

83) What is a DBRM, PLAN ?
84) DBRM: Data Base Request Module, has the SQL statements extracted from the host language program by the pre-compiler. PLAN: A result of the BIND process. It has the executable code for the SQL statements in the DBRM.

84) What is ACQUIRE/RELEASE in BIND?
85) Determine the point at which DB2 acquires or releases locks against table and tablespaces, including intent locks.

85) What else is there in the PLAN apart from the access path? - GS
86) PLAN has the executable code for the SQL statements in the host program

86) What happens to the PLAN if index used by it is dropped?
87) Plan is marked as invalid. The next time the plan is accessed, it is rebound.

87) What are PACKAGES ? - GS
88) They contain executable code for SQL statements for one DBRM.

88) What are the advantages of using a PACKAGE?
89) The advantages of using PACKAGE are:
    1. Avoid having to bind a large number of DBRM members into a plan
    2. Avoid cost of a large bind
    3. Avoid the entire transaction being unavailable during bind and automatic rebind of a plan
    4. Minimize fallback complexities if changes result in an error.

89) What is a collection?
90) A user defined name that is the anchor for packages. It has not physical existence. Main usage is to group packages.

90) In SPUFI suppose you want to select maximum of 1000 rows, but the select returns only 200 rows. What are the 2 SQLCODEs that are returned? - GS
91) +100 (for successful completion of the query), 0 (for successful COMMIT if AUTOCOMMIT is set to Yes).

91) How would you print the output of an SQL statement from SPUFI? - GS
92) Print the output dataset.

92) Lot of updates have been done on a table due to which indexes have gone haywire. What do you do?
93) Looks like index page split has occurred. DO a REORG of the indexes.

93) What is dynamic SQL? - GS
94) Dynamic SQL is a SQL statement created at program execution time.

94) When is the access path determined for dynamic SQL? - GS
95) At run time, when the PREPARE statement is issued.

95) Suppose I have a program which uses a dynamic SQL and it has been performing well till now. Off late, I find that the performance has deteriorated. What happened? - GS
96) There may be one of the following reasons:
    Probably RUN STATS is not done and the program is using a wrong index due to incorrect stats.

Probably RUNSTATS is done and optimizer has chosen a wrong access path based on the latest statistics.

96) How does DB2 store NULL physically?
97) As an extra-byte prefix to the column value. Physically, the null prefix is Hex '00' if the value is present and Hex 'FF' if it is not.

97) How do you retrieve the data from a nullable column? - GS
98) Use null indicators. Syntax ... INTO :HOSTVAR:NULLIND

98) What is the picture clause of the null indicator variable? - GS
99) S9(4) COMP.

99) What does it mean if the null indicator has -1, 0, -2? - GS
100) -1 : the field is null; 0 : the field is not null; -2 : the field value is truncated

100) How do you insert a record with a nullable column?
101) To insert a NULL, move -1 to the null indicator, To insert a valid value, move 0 to the null indicator

101) What is RUNSTATS? - GS
102) A DB2 utility used to collect statistics about the data values in tables which can be used by the optimizer to decide the access path. It also collects statistics used for space management. These statistics are stored in DB2 catalog tables.

102) When will you chose to run RUNSTATS?
103) After a load, or after mass updates, inserts, deletes, or after REORG.

103) Give some example of statistics collected during RUNSTATS?
104) Number of rows in the table, Percent of rows in clustering sequence, Number of distinct values of indexed column, Number of rows moved to a nearby/fairway page due to row length increase

104) What is REORG? When is it used?
105) REORG reorganizes data on physical storage to reclutser rows, positioning overflowed rows in their proper sequence, to reclaim space, to restore free space. It is used after heavy updates, inserts and delete activity and after segments of a segmented tablespace have become fragmented.

105) What is IMAGECOPY ? - GS
106) It is full backup of a DB2 table which can be used in recovery.

106) When do you use the IMAGECOPY? - GS
107) To take routine backup of tables, After a LOAD with LOG NO and After REORG with LOG NO

107) What is COPY PENDING status?
108) A state in which, an image copy on a table needs to be taken, In this status, the table is available only for queries. You cannot update this table. To remove the COPY PENDING status, you take an image copy or use REPAIR utility.

108) What is CHECK PENDING ?
109) When a table is LOADed with ENFORCE NO option, then the table is left in CHECK PENDING status. It means that the LOAD utility did not perform constraint checking.

109) What is QUIESCE?
110)A QUIESCE flushes all DB2 buffers on to the disk. This gives a correct snapshot of the database and should be used before and after any IMAGECOPY to maintain consistency.

110)What is a clustering index ? - GS
111)Causes the data rows to be stored in the order specified in the index. A mandatory index defined on a partitioned table space.

111)How many clustering indexes can be defined for a table?
112)Only one.

112)What is the difference between primary key & unique index ?
113)Primary Key: a relational database constraint. Primary key consists of one or more columns that uniquely identify a row in the table. For a normalized relation, there is one designated primary key.
Unique index: a physical object that stores only unique values. There can be one or more unique indexes on a table.

113)What is sqlcode -922 ?
114)Authorization failure

114)What is sqlcode -811?
115)SELECT statement has resulted in retrieval of more than one row.

115)What does the sqlcode of -818 pertain to? - GS
116)This is generated when the consistency tokens in the DBRM and the load module are different.

116)Are views updatable ?
117)Not all of them. Some views are updatable e.g. single table view with all the fields or mandatory fields. Examples of non-updatable views are views which are joins, views that contain aggregate functions (such as MIN), and views that have GROUP BY clause.

117)If I have a view which is a join of two or more tables, can this view be updatable? - GS
118)No.

118)What are the 4 environments which can access DB2 ?
119)TSO, CICS, IMS and BATCH

119)What is an inner join, and an outer join ?
120) Inner Join: combine information from two or more tables by comparing all values that meet the search criteria in the designated column or columns of one table with all the values in corresponding columns of the other table or tables. This kind of join which involve a match in both columns are called inner joins.

Outer join : Is one in which you want both matching and non matching rows to be returned. DB2 has no specific operator for outer joins, it can be simulated by combining a join and a correlated sub query with a UNION.

120) What is FREEPAGE and PCTFREE in TABLESPACE creation?
121) PCTFREE: percentage of each page to be left free
FREEPAGE: Number of pages to be loaded with data between each free page

121) What are simple, segmented and partitioned table spaces ?
122) Simple Tablespace: Can contain one or more tables. Rows from multiple tables can be interleaved on a page
under the DBA's control and maintenance
Segmented Tablespace: Can contain one or more tables. Tablespace is divided into segments of 4 to 64 pages in
increments of 4 pages. Each segment is dedicated to single table. A table can occupy

multiple segments

Partitioned Tablespace: Can contain one table. Tablespace is divided into parts and each part is put in a separate

VSAM dataset.

122) What is filter factor?
123) One divided by the number of distinct values of a column.

123) What is index cardinality? - GS
124) The number of distinct values a column or columns contain.

124) What is a synonym ?
125) Synonym is an alternate name for a table or view used mainly to hide the leading qualifier of a table or view.. A synonym is accessible only by the creator.

125) What is the difference between SYNONYM and ALIAS?
126) SYNONYM : is dropped when the table or tablespace is dropped. Synonym is available only to the creator.

ALIAS : is retained even if table or tablespace is dropped. ALIAS can be created even if the table does

not exist. It is used mainly in distributed environment to hide the location information from

programs. Alias is a global object & is available to all.

126) What do you mean by NOT NULL WITH DEFAULT? When will you use it?
127) This column cannot have nulls and while insertion, if no value is supplied then it will have zeroes, spaces or date/time depending on whether it is numeric, character or date/time.Use it when you do not want to have nulls but at the same time cannot give values all the time you insert this row.

127) What do you mean by NOT NULL? When will you use it?
128) The column cannot have nulls. Use it for key fields.

128) When would you prefer to use VARCHAR?
129) When a column which contains long text, e.g. remarks, notes, may have in most cases less than 50% of the maximum length.

129) What are the disadvantages of using VARCHAR?
130) Can lead to high space utilization if most of the values are close to maximum.
Positioning of VARCHAR column has to be done carefully as it has performance implications.
Relocation of rows to different pages can lead to more I/Os on retrieval.

130) How do I create a table MANAGER (EMP-NO, MANAGER) where MANAGER is a foreign key which references to EMP-NO in the same table? Give the exact DDL.
131) First CREATE MANAGER table with EMP-NO as the primary key. Then ALTER it to define the foreign key.

131) When is the authorization check on DB2 objects done - at BIND time or run time?
132) At run time.

132) What is auditing?
133) Recording SQL statements that access a table. Specified at table creation time or through alter.

133) max number of columns in a db2 table
134) 224

134) I need to view the number of tables existing under one particular Owner. Is it possible? If so, pl give the SQL query for this?
135) The query SELECT * FROM SYSIBM.SYSTABLES WHERE CREATOR = 'owner id' This displays the table names with that If you want only the number of tables give the following query. SELECT COUNT(*) FROM SYSIBM.SYSTABLES WHERE CREATOR = 'owner id' Make sure that you are in correct subsystem.

135) I need to view the number of tables existing under one particular Owner. Is it possible? If so, pl give the SQL query for this?
136) The query SELECT * FROM SYSTABLES WHERE OWNER= should work.

136) I need to view the number of tables existing under one particular Owner. Is it possible? If so, pl give the SQL query for this?
137) Db2 records information for its operation in a catalog which is actually a group of tables. So we can use the SYSTABLES to get answer to ur query.

137) What is JOIN and different types of JOIN.
138) The ability to join rows and combine data from two or more tables is one of the most powerful features of relational system. Three type of joins:1. Equi-join 2.Non-equijoin 3.self-join

138) can I alter a table (e.g. adding a column) when other user is selecting some columns or updating some columns from the same table?
139) yes possible. until the updation or selection is committed db2 table will not be restructured. new column definition will be there but it will not be included until all the tasks on the table are committed.

139) How many sub queries can you combine together ?
140) Total 16 queries and sub queries are 15

140) What are the different methods of accessing db2 from tso? How is the connection established between TSO & DB2?
141) There are three ways in establishing tso/db2 connection 1. SPUFI 2. QMF 3. CATALOG VISIBILITY B. A thread between TSO & DB2 is established while attempting to make connection between tso & db2.

141) How many buffer pools are available in db2?
142) Ten 32k size buffer pools and fifty 4k size buffer pools (bp0 to bp49)default buffer pools are bp0,bp1,bp2 & bp32

142) B37 abend during SPUFI
143) The b37 abend in the SPUFI is because of space requirements , the query has resulted in so many rows that the SPUFI. out file is not large enough to handle it, increase the space allocation of SPUFI out file.

143) How many Buffer pools are there in DB2 and what are they?
144) There are 4 Buffer pools. They are BP0,BP1,BP2 and BP32.

144) What is the command used by TSO users to invoke DB2?
145) DSN RUN

145) What is the error code -803 ?
146) unique index violation

146) How do you filter out the rows retrieved from a Db2 table ?
147) one way is to use The SQL WHERE clause.

147) what is a collection?

148) collection is something that every programmer should assign/Specify for every package. this about 1-18 characters long.

148) What is Skeleton cursor table (SKCT)?

149) The Executable form of a Plan. This is stored in sysibm.sct02 table.

149) what's the equivalent Cobol Data type for Decimal(x,y) in DB2? what does the current SQLID register contain?

150) Pic s9(x-y)V9(Y) Comp-3; the current SQLID contains the current authorization ID.

150) Can we declare DB2 HOST variable in COBOL COPY book?

151) NO. If we declare DB2 host variable in COBOL COPY book, at the time of Pre-compilation we get the host variable not defined, because pre-compiler will not expand COBOL COPY book. So we declare it either in DCLGEN with EXEC SQL INCLUDE DCLGEN name END-EXEC or we directly hardcode it in the working storage section.

151) What should be specified along with a cursor in order to continue updating process after commit?

152) With Hold option.

152) what is the name of the default db2 catalog database?

153) DSNDB06

153) When Can you be sure that a query will return only one row?

154) When you use the primary key and only the primary key in the where clause.

154) what is the difference between join and union?

155) join is used to retrieve data from different tables using a single sql statement. union is used to combine the results of two or more sql queries.

155) What is a correlated sub query?

156) In a sub query, if the outer query refers back to the outcome of inner query it is called correlated sub query. That's why the outer query is evaluated first unlike an ordinary sub query

156) What are the functions of Bind?

157) BIND mainly performs two things syntax checking and authorization checking.It binds together all packages into an application plan hence the name BIND.Apart from this bind has optimiser as a subcomponent.Its function is to determine the optimum access strategy.

157) Max. No of rows per page

158) 127

158) The only place of VSAM KSDS in DB2 is?

159) BSDS is a VSAM KSDS.

159) Can All Users Have The Privilege To Use The SQL Statement Select * (DML)?

160) No the user should be granted privilege to use it.

160) What is the size of a data page?

161) 4K to 8K

161) what's the best lock size that you could use when you create a tablespace?

162) The answer is Locksize = ANY. Unless you are Sure what's the Purpose of tablespace ie., Read-only or R/W. If you use lock size =any, Db2 would automatically determine what type of locks it should use.

162) what's the error code for Unique Index Violation?
163) -803

163) Can you define an Index if the table size less than 10 PAGES?
164) NO

164) What's the Maximum Length of SQLCA and what's the content of SQLCABC?
165) The Max length is 136. and the SQLCABC has the Value of SQLCA.

165) What's the maximum number of volumes that can be added to a STOGROUP?
166) The answer is 133.Usually it will be difficult monitor more than 3 or 4 volumes to a Stogroup.

166) What's the maximum number of characters that a tablename can have?
167) The answer is 18 characters.

167) What is the meaning of -805 SQL return code?
168) Program name not in plan. Bind the plan and include the DBRM for the program named as part of the plan.

168) when does the SQL statement gets executed when you use cursor in the application programming ?
169) SQL statement gets executed when we open cursor

169) What does CURRENTDATA option in bind indicate
170) CURRENTDATA option ensures block fetch while selecting rows from a table. In DB2V4 the default has been changed to NO. Therefore it is necessary to change all the bind cards with CURRENTDATA(YES) which is default in DB2V3 & earlier to CURRENTDATA(NO).

170) What is the difference between TYPE 1 index & TYPE 2 index
171) TYPE 1 & TYPE 2 are specified when an index is created on the table. TYPE 2 index is the option which comes with DB2V4. With TYPE 2 index data can be retrieved faster as only the data pages are locked and not the index pages. Hence TYPE 2 index is recommended.

171) What are the levels of isolation available with DB2V4
172) CS RR UR(added new for DB2V4 which stands for uncommitted read which allows to retrieve records from the space which has exclusive locks also but data integrity will be affected if this option is used)The best available option for data integrity & data concurrency is CS.

172) How do u achieve record level locking in DB2 versions when record level locking is not allowed?
173) By having the length of the record greater than that of a page!

173) In a DB2-CICS program which is acts as co-ordinator and which is participant?
174) DB2 - participant CICS- coordinator

174) What does DML stand for and what are some examples of it?
175) Data Manipulation Language. Some examples are SELECT, INSERT, DELETE, REPLACE.

175) How to define the data items to receive the fetch items for the SQL?
176) Using the DSECT, followed by lines of - 'data items DS datatype'.

176) How will you delete duplicate records from a table?
177) Delete From Table1Where Id In (Select Id From Table1 As Temp Group By Id Having Count(*) >1)

177) What is the difference between Where and Having Clause
178) WHERE is for Rows and HAVING is for Groups

178) How to see the structure of db2 table??
179) Using QMF.

179) How do you declare a host variable (in COBOL) for an attribute named emp-name of type VARCHAR(25) ?
180) 01 EMP-GRP. 49 E-LEN PIC S9(4) COMP. 49 E-NAME PIC X(25).

180) What is the maximum number of tables that can be stored on a Partitioned Table Space ?
181) ONE

181) Name the different types of Table spaces.
182) Simple Table Space, Segmented Table Space and Partitioned Table Space

182) what are the max. & min. no. of partitions allowed in a partition tablespace?
183) minimum is 4. maximum is 64.

183) what is the maximum number of tables that can be joined ?
184) fifteen

184) What technique is used to retrieve data from more than one table in a single SQL statement?
185) The Join statement combines data from more that two tables

185) Explain the use of the WHERE clause.
186) It directs DB2 to extract data from rows where the value of the column is the same as the current value of the host variable.

186) What is a DB2 bind?
187) DB2 bind is a process that builds an access path to DB2 tables.

187) What is a DB2 access path?
188) An access path is the method used to access data specified in DB2 SQL statements.

188) What is a DB2 plan?
189) An application plan or package is generated by the bind to define an access path.

189) What is normalization and what are the five normal forms?
190) Normalization is a design procedure for representing data in tabular format. The five normal forms are progressive rules to represent the data with minimal redundancy.

190) What are foreign keys?
191) These are attributes of one table that have matching values in a primary key in another table, allowing for relationships between tables.
192) Describe the elements of the SELECT query syntax?
193) SELECT element FROM table WHERE conditional statement.

192) Explain the use of the WHERE clause?
193) WHERE is used with a relational statement to isolate the object element or row.

193) What techniques are used to retrieve data from more than one table in a single SQL statement?
194) Joins, unions and nested selects are used to retrieve data.

194) What do the initials DDL and DML stand for and what is their meaning?
195) DDL is data definition language and DML is data manipulation language. DDL statements are CREATE, ALTER, TRUNCATE. DML statements are SELECT, INSERT, DELETE and

UPDATE.

195) What is a view? Why use it?
196) A view is a virtual table made up of data from base tables and other views, but not stored separately.

196) Explain an outer join?
197) An outer join includes rows from tables when there are no matching values in the tables.

197) What is a subselect? Is it different from a nested select?
198) A subselect is a select which works in conjunction with another select. A nested select is a kind of subselect where the inner select passes to the where criteria for the outer select.

198) What is the difference between group by and order by?
199) Group by controls the presentation of the rows, order by controls the presentation of the columns for the results of the SELECT statement.

199) Explain the EXPLAIN statement?
200) The explain statement provides information about the optimizer's choice of access path of the sql.

200) What is tablespace?
201) Tables are stored in tablespaces (hence the name)! There are three types of tablespaces: simple, segmented and partitioned.

201) What is a cursor and what is its function?
202) An embedded SQL statement may return a number of rows while the programming language can only access one row at a time. The programming device called a cursor controls the position of the row.

202) What is referential integrity?
203) Referential integrity refers to the consistency that must be maintained between primary and foreign keys, i.e. every foreign key value must have a corresponding primary key value.

203) Usually, which is more important for DB2 system performance - CPU processing or I/O access?
204) I/O operations are usually most critical for DB2 performance (or any other database for that matter).

204) Is there any advantage to denormalizing DB2 tables?
205) Denormalizing DB2 tables reduces the need for processing intensive relational joins and reduces the number of foreign keys.

205) What is the database descriptor?
206) The database descriptor, DBD is the DB2 component that limits access to the database whenever objects are created, altered or dropped.

206) What is lock contention?
207) To maintain the integrity of DB2 objects the DBD permits access to only on object at a time. Lock contention happens if several objects are required by contending application processes simultaneously.

207) What is SPUFI?
208) SPUFI stands for SQL processing using file input. It is the DB2 interactive menu-driven tool used by developers to create database objects.

208) What is the significance of DB2 free space and what parameters control it?
209) The two parameters used in the CREATE statement are the PCTFREE which specifies the percentage of free space for each page and FREEPAGE which indicates the number of pages to be loaded with data between each free page. Free space allows room for the insertion of new rows.

209) What is a NULL value? What are the pros and cons of using NULLS?
210) A NULL value takes up one byte of storage and indicates that a value is not present as opposed to a space or zero value. It's the DB2 equivalent of TBD on an organizational chart and often correctly portrays a business situation. Unfortunately, it requires extra coding for an application program to handle this situation.

210) What is a synonym? How is it used?
211)A synonym is used to reference a table or view by another name. The other name can then be written in the application code pointing to test tables in the development stage and to production entities when the code is migrated. The synonym is linked to the AUTHID that created it.

211)What is an alias and how does it differ from a synonym?
212) An alias is an alternative to a synonym, designed for a distributed environment to avoid having to use the location qualifier of a table or view. The alias is not dropped when the table is dropped.

212) What is a LIKE table and how is it created?
213) A LIKE table is created by using the LIKE parameter in a CREATE table statement. LIKE tables are typically created for a test environment from the production environment.

213) If the base table underlying a view is restructured, eg. attributes are added, does the application code accessing the view need to be redone?
214) No. The table and its view are created anew, but the programs accessing the view do not need to be changed if the view and attributes accessed remain the same.

214) Under what circumstances will DB2 allow an SQL statement to update more than one primary key value at a time?
215) Never. Such processing could produce duplicate values violating entity integrity. Primary keys must be updated one at a time.

215) What is the cascade rule and how does it relate to deletions made with a subselect?
216) The cascade rule will not allow deletions based on a subselect that references the same table from which the deletions are being made.

216) What is the self-referencing constraint?
217) The self-referencing constraint limits in a single table the changes to a primary key that the related foreign key defines. The foreign key in a self referencing table must specify the DELETE CASCADE rule.

217) What are delete-connected tables?
218) Tables related with a foreign key are called delete-connected because a deletion in the primary key table can affect the contents of the foreign key table.

218) When can an insert of a new primary key value threaten referential integrity?
219) Never. New primary key values are not a problem. However, the values of foreign key inserts must have corresponding primary key values in their related tables. And updates of primary key values may require changes in foreign key values to maintain referential integrity.

219) In terms of DB2 indexing, what is the root page?
220) The simplest DB2 index is the B-tree and the B-tree's top page is called the root page. The root page entries represent the upper range limits of the index and are referenced first in a search.

220) How does DB2 use multiple table indexes?
221) DB2 use the multiple indexes to satisfy multiple predicates in a SELECT statement that are joined by an AND or OR.

221) What are some characteristics of columns that benefit from indexes?
222) Primary key and foreign key columns; columns that have unique values; columns that have aggregates computed frequently and columns used to test the existence of a value.

222) What is a composite index and how does it differ from a multiple index?
223) A multiple index is not one index but two indexes for two different columns of a table. A composite index is one index made up of combined values from two columns in a table. If two columns in a table will often be accessed together a composite index will be efficient.

223) What is meant by index cardinality?
224) The number of distinct values for a column is called index cardinality. DB2's RUNSTATS utility analyzes column value redundancy to determine whether to use a tablespace or index scan to search for data.

224) What is a clustered index?
225) For a clustered index DB2 maintains rows in the same sequence as the columns in the index for as long as there is free space. DB2 can then process that table in that order efficiently.

225) What keyword does an SQL SELECT statement use for a string search?
226) The LIKE keyword allows for string searches. The % sign is used as a wildcard.

226) What are some SQL aggregates and other built-in functions?
227) The common aggregate, built-in functions are AVG, SUM, MIN, MAX, COUNT and DISTINCT.

227) How is the SUBSTR keyword used in sql?
228) SUBSTR is used for string manipulation with column name, first position and string length used as arguments. E.g. SUBSTR (NAME, 1 3) refers to the first three characters in the column NAME.

228) What are the three DB2 date and time data types and their associated functions?
229) The three data types are DATE, TIME and TIMESTAMP. CHAR can be used to specify the format of each type. The DAYS function calculates the number of days between two dates. (It's Y2K compliant).

229) Explain transactions, commits and rollbacks in DB2.
230) In DB2 a transaction typically requires a series of updates, insertions and deletions that represent a logical unit of work. A transaction puts an implicit lock on the DB2 data. Programmers can use the COMMIT WORK statement to terminate the transaction creating smaller units for recovery. If the transaction fails DB2 uses the log to roll back values to the start of the transaction or to the preceding commit point.

230) What is deadlock?
231) Deadlock occurs when transactions executing at the same time lock each other out of data that they need to complete their logical units of work.

231) What are the four lockable units for DB2?
232) DB2 imposes locks of four differing sizes: pages, tables, tablespace and for indexes subpage.

232) What are the three lock types?
233) The three types are shared, update and exclusive. Shared locks allow two or more programs to read simultaneously but not change the locked space. An exclusive lock bars all other users from accessing the space. An update lock is less restrictive; it allows other transactions to read or

acquire shared locks on the space.

233) What is isolation level?
234) SQL statements may return any number of rows, but most host languages deal with one row at a time by declaring a cursor that presents each row at a unique isolation level.

234) What is an intent lock?
235) An intent lock is at the table level for a segmented tablespace or at the tablespace level for a non-segmented tablespace. They indicate at the table or tablespace level the kinds of locks at lower levels.

235) What is the difference between static and dynamic SQL?
236) Static SQL is hard-coded in a program when the programmer knows the statements to be executed. For dynamic sql the program must dynamically allocate memory to receive the query results.

236) What is cursor stability?
237) Cursor stability means that DB2 takes a lock on the page the cursor is accessing and releases the lock when the cursor moves to another page.

237) What is the significance of the CURSOR WITH HOLD clause in a cursor declaration?
238) The clause avoids closing the cursor and repositioning it to the last row processed when the cursor is reopened.

238) What is the SQL Communications Area and what are some of its key fields?
239) It is a data structure that must be included in any host-language program using SQL. It is used to pass feedback about the SQL operations to the program. Fields are return codes, error messages, handling codes and warnings.

239) What is the purpose of the WHENEVER statement?
240) The WHENEVER statement is coded once in the host program to control program actions depending on the SQL-CODE returned by each sql statement within the program.

240) What is the FREE command?
241) The FREE command can be used to delete plans and/or packages no longer needed.

241) DB2 can implement a join in three ways using a merge join, a nested join or a hybrid join. Explain the differences?
242) A merge join requires that the tables being joined be in a sequence; the rows are retrieved with a high cluster ratio index or are sorted by DB2. A nested join does not require a sequence and works best on joining a small number of rows. DB2 reads the outer table values and each time scans the inner table for matches. The hybrid join is a nested join that requires the outer table be in sequence.

242) Compare a subselect to a join?
243) Any subselect can be rewritten as a join, but not vice versa. Joins are usually more efficient as join rows can be returned immediately, subselects require a temporary work area for inner selects results while processing the outer select.

243) What is the difference between IN subselects and EXISTS subselect?
244) If there is an index on the attributes tested an IN is more efficient since DB2 uses the index for the IN. (IN for index is the mnemonic).

244) What is a Cartesian product?
245) A Cartesian product results from a faulty query. It is a row in the results for every combination in the join tables.

245) DB2 What is the difference between a package and a plan? How does one bind 2 versions of a CICS transaction with the same module name in two different CICS regions that share the same DB2 subsystem?

246) Package and plan are usually used synonymously, as in this site. Both contain optimized code for SQL statements - a package for a single program, module or subroutine contained in the database request module (DBRM) library. A plan may contain multiple packages and pointers to packages. The one CICS module would then exist in a package that could be referenced in two different plans.

246) What is an asychronous write?

247) It is a write to disk that may occur before or long after a commit. The write is controlled by the buffer manager.

247) What is a lock?

248) A lock is the mechanism that controls access to data pages and tablespaces.

248) What is meant by isolation level?

249) This is a key concept for any relational database. Isolation level is the manner in which locks are applied and released during a transaction. For DB@ a 'repeatable read' holds all locks untile the transaction completes or a syncpoint is issued. For transactions using 'cursor stability' the page lock releases are issued as the cursor 'moves', i.e. as the transaction releases addressability to the records.

249) What are leaf pages?

250) They are the opposite of root pages. Leaf pages are the lowest level index pages – the pages that contain index entries and information to the corresponding table rows.

250) What is a precompiler?

251) It is a DB2 facility for static SQL statements - it replaces these statements with calls to the DB2 language interface module.

251) What is a root page?

252) The opposite of a leaf page; it is the highest level index page. An index can contain only the one root page; all other index pages are associated to the root.

252) What is a thread?

253) A thread is the connection between DB2 and some other subsystem, such as CICS or IMS/DC.

253) Which transaction use a command thread ?

254) Only the DSNC transaction uses a command thread.

254) What is the purpose of the DSNC transaction ?

255) The DSNC transaction is used for controlling the CICS Call Attach Facility(CAF) and for Displaying CAF statistics.

DB2 Utilities

255) What does the CHECK Utility do ?

256) The CHECK Utility checks the referential integrity of table relations and checks the integrity of the indexes by matching index column values to table column values.

256) what types of copies can be made with the COPY Utility ?

257) The copy Utility can make a full image copy or an incremental image copy .

257) Why might full image copies be faster to implement than an incremental image copy?
258) Because an incremental image copy has to search for changed data and cannot make use of sequential pre fetch. Conversely, a full image copy has no checking to do as it takes advantage of sequential pre fetch.

258) How could one combine a set of incremental image copies into a single copy?
259) By using the MERGECOPY Utility.

259) What is the purpose of the QUIESE Utility?
260) The QUIESE Utility prevents the start of any new table space activity while it gives active threads a chance to finish their tasks. Once all thread are inactive, it records information to establish a point of consistency for future recovery.

260) What does the REORG Utility do?
261) The REORG Utility will sort the index space and table space to conform with the primary index or clustering index specified in the DDL. It will also reclaim the space from dropped simple table spaces.

261) What can the SET option of the Repair Utility accomplish?
262) The set option of the Repair utility can reset a copy pending, check pending, and recover pending flags.

262) What can the Locate option of the Repair Utility accomplish?
263) The Locate option of the Repair Utility can delete a row from a table space, repair broken table space pages, and replace data as specific locations in a table space or index.

263) What does the RUNSTATS Utility do?
264) The RUNSTATS Utility collects statistical information for DB2 table spaces, partitions, indexes, tables and columns and stores this data in the DB2 Catalog.

264) Why use RUNSTAT Utility?
265) Because the DB2 Optimizer need accurate data in order to formulate the most efficient access path given the state of the environment and because the information will help the DBA to monitor the condition of the object in the DB2 subsystem.

265) What statistic will tell the DBA how must space can be reclaimed from dropped table spaces on the next reorg run?
266) The DBA can see this in the PERCDROP column of the SYSIBM.SYSTABLEPART catalog table.

266) What DB2 Catalog column tell you when an index needs table reorganized ?
267) The FAROFFPOS column of the SYSIBM.SYSINDEXPART table.

267) What is the STOSPACE Utility used for?
268) The STOSPACE Utility updates the DB2 catalog with the DASD utilization of the table space and index space data sets.

268) What is a SELECT statement?
269) A select statement is an SQL statement that retrieves data from a table or view.

269) What is the syntax of SELECT statement when embedded in a COBOL program?
270) Exec SQL

```
        SELECT      col_name1,col_name2,col_name3
        INTO        hos:_var1,hos_var2,hos_var3
        FROM         owner.tablename
        WHERE       condition
END_EXEC.
```

270) What are column-name qualifiers used?
271) Column-name qualifier are used as table designator to avoid ambiguity when the column names referenced exist in more than one table used in the SQL statement. Column-name qualifiers are used in correlated references.

271) What is correlation names?
272) IT is a special type of column designator that connects specific column in the various levels of a multilevel SQL query.

272) How do you define a correlated name?
273) A correlated name can be defined in the FROM clause of a query and in the first clause of an UPDATE or DELETE statement.

273) What is subquery ?
274) A subquery is a query that is written as part of another query's WHERE clause. For example :

```
SELECT    col_name1,col_name2
FROM      table_A
WHERE     col_name3   <      (   SELECT Avg(col_name)
                                 FROM table_A
                                      WHERE  col_name4 = 'constant'   )
```

274) What is correlated subquery?
275) A correlated subquery is one that has a correlation name as a table or view designator in the FROM clause of the outer query and the same correlation name as a qualifier of a search condition in the WHERE clause of the subquery. For example:

```
SELECT    col_name1,col_name2
FROM      table_A  x1
WHERE     col_name3     <
          (  SELECT    Avg(column_name3
             FROM      table_A
             WHERE     col_name4   =   x1.col_name4  )
```

275) How does the processing of a correlated subquery differ from a non correlated subquery?
276) The subquery in a correlated subquery is reevaluated for every row of the table or view named in the outer query, while the subquery of a non correlated subquery is evaluated only once.

276) What is a result table?
277) A result table is the product of a query against one or more tables or views (i.e. it is the place that holds the results of a query).

277) What is a cursor?
278) A cursor is a named control structure used to make a set of rows available to a program.

278) What is the syntax required for the creation of a cursor?
279)

```
EXEC SQL
DECLARE cur_name  CURSOR for
          SELECT  col1,col2
          FROM    table1
          WHERE   col1 = search_condition
END-EXEC.
```

279) When is the results table for the query in a DECLARE CURSOR statement created?
280) The results table for a query specified in a DECLARE CURSOR statement of a cursor is created

during the execution of the OPEN CURSOR statement.

280) What is read-only cursor?
281) A read-only cursor is one in which the result table was created by a query containing one of the following :

- a DISTINCT keyword
- a UNION operator
- a column or scalar function
- a GROUP BY clause
- a ORDER BY clause
- a HAVING clause
- a read-only view in the FROM clause
- a FROM clause identifying more than one table or view

DB2 Catalog

281) Which DB2 catalog tables are used to produce a list of table column by table for all tables in a database?
282) The catalog tables to use are the SYSIBM.SYSTABLES and the SYSIBM.SYSCOLUMNS.

282) Which catalog tables contain authorization information?
283) The SYSIBM table that contain authorization information are SYSCOLAUTH, SYSDBAUTH, SYSPLANAUTH, SYSTABAUTH and SYSUSERAUTH.

283) Which catalog table stores referential constraints?
284) The SYSIBM.SYSRELS table.

DB2 Directory

284) What Utility is used to migrate DB2 from one release to the next?
285) The DUMPCAT Utility.

285) How would one remove old reorg information from the DB2 catalog?
286) Run the MODIFY RECOVERY Utility.

286) What happens to a tablespace when its recovery infromation has been removed and a full recovery is no longer possible?
287) The tablespace is put into copy pending status.

287) Where is the access path logic created by the DB2 Optimizer stored?
288) The access path logic is stored as skeleton cursor tables in the SCT02 Directory table.

288) When is the skeleton cursor table created?
289) During the execution of the BIND PLAN command.

289) How does one remove entries from the SCT02 table?
290) Run the FREE PLAN command.

290) When one binds a PACKAGE (of a plan) what package information is stored and where it is stored?
291) The access path information for the PACKAGE is stored as skeleton package tables in the SPT01

table.

291) Where besides the DB2 catalog is database object information stored by DB2?
292) DB2 also stores information about DB2 objects as database descriptors (DBDs) in the DBD Directory table.

292) Can you access the DB2 Directory table using SQL?
293) No. These tables are exclusively accessed by internal DB2 processes.

DB2 Commands

293) Which DB2 command is used to retrieve environmental information?
294) The DISPLAY command can return the following environmental data: DATABASE info, RLIMIT info, THREAD info, TRACE info, and UTILITY info.

294) Which command is issued to establish the Boot Strap Data Set after an I/O failure?
295) The DBA would issue a RECOVER BSDS command.

295) How is the status of a utility reset after it has been stopped by DB2 ?
296) By issuing the START RLIMIT command.

296) How can one determine the status of a tablespace?
297) By using the DISPLAY DATABASE command.

The following is the checklist to complete a DB2 batch or on-line program....

Batch DB2 COBOL program....

1. If the program is main program it should have both DBB and DPK components.

2. If the program is linked (called) program it should have only DPK component. But the package generated should be binded in Calling program DBB component.

For example the **DBB** component looks like ....

```
BIND PLAN(????????)    -          **********>>>    ENTER PLAN NAME
 PKLIST(SEALAND.????????, -       **********>>>    ENTER MEMBER NAME
        SEALAND.????????, -       **********>>>     (MULTIPLE MEMBERS
        SEALAND.????????) -       **********>>>      FOR EACH PLAN)
  QUALIFIER(TEST)     -           **********>>>    MUST ALWAYS BE TEST
  OWNER(????)         -           **********>>>    ENTER YOUR TSO ID
  ACTION(REPLACE)     -
  RETAIN              -
  VALIDATE(BIND)      -
  ISOLATION(CS)       -
  FLAG(I)             -
  ACQUIRE(USE)        -
  RELEASE(COMMIT)     -
  EXPLAIN(YES)

  ********************************************************************
```

```
*         THIS IS A SAMPLE DBB CARD FOR DB2 PACKAGING                *
*                                                                    *
*            IF MULTIPLE MEMBERS ARE ENTERED IN PKLIST,              *
*            THERE MUST BE A DPK CARD FOR EACH ONE.                  *
**********************************************************************
```

The following is the format of the **DPK** card....

```
BIND PACKAGE(SEALAND) -
MEMBER(????????)     -        ***********>>>    ENTER MEMBER NAME
VALIDATE(BIND)       -
OWNER(????)          -        ***********>>>    ENTER YOUR TSO ID
EXPLAIN(NO)          -
QUALIFIER(TEST)               ***********>>>    MUST ALWAYS BE TEST

**********************************************************************
*                                                                    *
*             THIS IS A SAMPLE DPK CARD FOR DB2 PACKAGING            *
*                                                                    *
*                                                                    *
**********************************************************************
```

3. As we are all aware that RCT is a concept of CICS. So batch DB2 program will not have any RCT entry.
4. To run this DB2 program the following the is the model JCL...

```
//TESTXXX  JOB  (AAAA),'ACCOUNTS PAYABLE',CLASS=A,
//   USER=XXXX,MSGCLASS=H,REGION=4096K
/*JOBPARM SYSAFF=B158
//JOBLIB    DD DSN=TEST.JOBLIB,DISP=SHR
/*
//STEP010   EXEC PGM=IKJEFT01,DYNAMNBR=20
//STEPLIB   DD DSN=DB2T.DSNEXIT,DISP=SHR
//          DD DSN=DB2T.DSNLOAD,DISP=SHR
//          DD DSN=TEST.JOBLIB,DISP=SHR
//INPUT1    DD DSN=XYZ.ABC.DBF,DISP=SHR
//OUTPUT1   DD DSN=XYZ.BCD.LEY,
//             DISP=(NEW,CATLG,DELETE),
//             DCB=(RECFM=FB,LRECL=122,BLKSIZE=2440),UNIT=SYSDA,
//             SPACE=(CYL,(10,2),RLSE)
//SYSPRINT  DD SYSOUT=*
//SYSTSPRT  DD SYSOUT=*
//SYSOUT    DD SYSOUT=*
//SYSERR    DD SYSOUT=*
//SYSDUMP   DD SYSOUT=*
//TESTDUMP  DD SYSOUT=*
//SYSMSG    DD SYSOUT=*
//SYSTSIN   DD *
DSN SYSTEM(DB2T)
RUN PROG(TESTPROG) PLAN(TESTPLAN)
END
//*
```

As shown in above JCL program IKJEFT01 is used to run DB2 program (TESTPROG in our example).
In the above JCL program name and plan names are specified in SYSTSIN dataset as in-stream data.

The following is the check list to complete CICS(on-line) DB2 program...

1. If the program is main program it should have both DBB and DPK components.

2. If the program is LINKed, XCTLed program it should have only DPK component. But the package generated
should be binded in Calling program DBB component.
3. RCT entry has to be created if the program is main program(which consists of TRANSID). If the program is
LINKed or XCTLed it need not have a RCT entry. RCT entry basically used to attach CICS system to DB2
system.
4. No JCL business here because it is on-line.
5. The DBB and DPK s shown for batch program are also applicable to this.

1 What does SQLCODE +100 means
2 What does the SQLCODE +818 means
3 What are the pars of a SELECT statement
4 What is DB2 etc....,

SQL(Structured Query Language):

Structured Query Language (SQL) provides the ability to create and define relational database objects. After these objects are defined, the language permits one to add data to these objects. Once data has been added, one can modify, retrieve, or delete that data. The language provides the capability of defining what type of authority one might have when accessing the data.

Data Definition Language

As the name implies, there is a group of SQL statements that allows one to define the relational structures that will manage the data placed in them. The "CREATE" statements brings Relational Database Management System (RDMS) objects into existence. The types of objects one can create are STOGROUP, Database, Table space, Table, Index, View, Synonym, and Alias. The definitions of these objects are as follows:

STOGROUP: A storage group is a list of disk volume names to which one can assign a name. One defines the list of disk volumes and assigns the STOGROUP name with the Create STOGROUP statement.

Database: A database is a logical structure in which tables and indexes are later created. The database is defined and associated with a STOGROUP with a Create Database statement.

Tablespace: A tablespace is an area on disk that is allocated and formatted by the Create Table space statement.

Table: A table is an organizational structure which is defined in a Create Table statement. In this statement, the data attributes are defined by column, giving each column its own unique name within the table.

Index: A index is used in conjuction with the "Primary Key" parameter of the Create Table statement. It is made with the Create Index statement and provides the duplicate record-checking necessary for a unique key.

View: A view is an alternative perspective of the data present in a database. It is made with the Create View statement and can represent a subset of the columns defined in a table. It can also represents a set of columns combined from more than one table.

Synonym: The Create Synonym statement defines an unqualified name for a table or a view.

Alias: The Create Alias statement defines an alternate qualified name for a table or a view.

After a table is created, additional columns may be added with an Alter Table statement. Any RDMS object that was made with a create statement can be removed with a drop statement.

In order to define RDMS objects, one needs various levels of authority. The following is a list of authority levels that can be granted to a user ID to operate on a designated database.

DBADM	Database administrator authority
DBCTRL	Database control authority
DBMAINT	Database maintenance authority
CREATETS	Create Table space Authority
CREATETAB	Create Table authority
DROP	Drop authority on a database or subordinate objects

Data Manipulation Language

There are four SQL data manipulation statements(DML) available: Insert, Select, Update, and Delete. After tables are defined, they are ready to store data. Data is added to tables through the SQL Insert statement. Once data has been inserted into a table, it can be retrieved by the use of the Select statement. Data stored in a table can be modified by executing the SQL Update statement. Data can be deleted from a table by using the SQL Delete statement.

The SQL statements perform RDMS operations that can affect only one row at a time if desired. The same statements can, if required, affect many or all of the rows in a table. It is possible to select one row and insert it into another with one statement. It is also just as easy to select all of the rows from one table and insert all of them into another with a single statement. The same scope of operation applied to the update and delete statements. The scope of operation is controlled by the use of the WHERE clause. The operation will affect only the rows that satisfy the search condition. When no search condition specified, the entire table is affected.

There are additional language elements available that provide the ability to process the table data while it is being retrieved. In addition, there are a variety of functions that modify the value of the data that is returned in a query. There are column functions that act on all of the values of the selected rows for a specified column and return a single answer. There are also scalar functions that return a specific answer for each row that satisfies the search condition.

As mentioned previously, SQL provides the ability to filter what data is retrieved in a select statement by including the WHERE clause. The WHERE clause specifies a variety of comparisons between two values. The values could be column values or the result of an operation involving more than one column or a constant. The comparison operation are the same as those used in COBOL, with the exception of two additional operators. The first is the IN operator that compares a single value has a match in the specified list of values. The other is the LIKE operator, in which you can specify a value string that includes “wildcard” characters in such a manner that you can select rows of a table where column values are similar to the extent you require.

SQL provides four arithmetic operations : addition, subtraction, multiplication, and division. An arithmetic expression may involve any combination of column name or numbers. The arithmetic expression may itself be used as a column name or in a Select, Insert, Update, or Delete statement.

SQL provides the ability to sort the data retrieved from a table via the ORDER BY clause. In this clause, you can specify one or more sort column names as well as if each sort key is ascending or descending.

SQL also provides the ability to perform set manipulation operations. Using SQL, one can SELECT the intersection of two or more sets of data by coding a JOIN. A JOIN is any SELECT statement that has more than one DBMS object listed in its FROM clause. One can combine different sets of data by using the UNION operator. Other set manipulations can be executed by combining different operators and search conditions.

The Following are the most frequently asked questions....

1) What RDMS objects are created with the SQL CREATE statements?

2) The SQL CREATE statements are used to create the following objects:

STOGROUP	A storage group
DATABASE	A logical collection of tables
TABLESPACE	An area that stores tables
TABLE	A data structure organized by a specified columns
INDEX	An alternate path to a table data

VIEW	An alternate representation of one or more tables
SYNONYM	An alternate name for local table or view
ALIAS	An alternate name for a table definition which may be local or remote, existence or nonexistent

2) What RDMS objects are required before you can create a table?

3) Before you can create a table, you need an existing database and tablespace.

3) In what RDMS object does one first list column names?

4) One first uses the column name in the CREATE TABLE statement.

4) What is the syntax for a CREATE TABLE statement?

5) CREATE TABLE table name
(column name list
primary key (column name))
in database-name, tablespace-name.

5) Can one add columns to a table after it has been defined?

6) Yes, one can add column to a table after it has been defined by using the SQL ALTER TABLE statement.

6) Where in a table are added columns located?

7) The new columns are added to the end of the table.

7) After a table is defined, can columns be removed?

8) The only way to remove columns from an existing table involves a migration program that extracts only the desired
columns of data, redefining the table without the unwanted columns, then populating the new table. One have to handle
all the old table's dependents programmatically.

8) Which RDMS objects can you change with the SQL ALTER statements?

9) The SQL ALTER statement can change a table index, a table, a tablespace, or a STOGROUP.

9) What authority is required to create a table?

10) In order to create tables, one needs CREATETAB privileges.

10) What is minimum authority required for one to create a tablespace?

11) In order to create tablespaces, one needs CREATETS privileges.

11) When is it necessary to create a table index?

12) It is necessary to create a table index whenever you want to enforce the uniqueness of the table's primary key.

12) What is a synonym?

13) A synonym is an unqualified alternative name for a table or view.

13) What is a foreign key?

14) A foreign key is the key defined in one table to reference the primary key of a reference table. This foreign key must
have the same structure as the reference table's primary key.

14) What is referential integrity?

15) Referential integrity is the automatic enforcement of referential constraints that exist between a reference table and a

referencing table. When referential integrity is enforced, the value of a foreign key exists as a primary key value in the reference table. In other words, when referential integrity is enforced, all of the foreign key values in, for example, the "department code" column in an "employee" table exist as primary key values in a "department" table.

15) What are the column name qualifiers?

16) A column name qualifier are used as a table designator to avoid ambiguity when the column names referenced exists in more than one table used in the SQL statement. Column name qualifiers are also used in correlated references.

16) What is a correlation name?

17) A correlation name is a special type of column designator that connects specific columns in the various levels of a multilevel SQL query.

17) What is a results table?

18) A result table is the product of a query against one or more tables or views (i.e., it is the place that holds the results of a query).

18) What is a cursor?

19) A cursor is a named control structure used to make a set of rows available to a program. DB2 is the relational database system that runs in an MVS environment. It was developed by IBM and interfaces with SQL. With the use of SQL DB2, databases can be accessed by a wide range of host languages. SQL is the relational database " application language " that interfaces with DB2. Because of its capabilities, SQL and, in turn, DB2 have gained considerable acceptance. Thus, a working knowledge of DB2 increases one's marketability.

19) What is the basic difference between a join and a union?

20) A join selects columns from 2 or more tables. A union selects rows.

20) What is normalization and what are the five normal forms?

21) Normalization is a design procedure for representing data in tabular format. The five normal forms are progressive rules to represent the data with minimal redundancy.

21) What are foreign keys?

22) These are attributes of one table that have matching values in a primary key in another table, allowing for relationships between tables.

22) Describe the elements of the SELECT query syntax?

23) SELECT element FROM table WHERE conditional statement.

23) Explain the use of the WHERE clause?

24) WHERE is used with a relational statement to isolate the object element or row.

24) What techniques are used to retrieve data from more than one table in a single SQL statement?

25) Joins, unions and nested selects are used to retrieve data.

25) What is a view? Why use it?
26) A view is a virtual table made up of data from base tables and other views, but not stored separately.

26) Explain an outer join?

27) An outer join includes rows from tables when there are no matching values in the tables.

27) What is a subselect? Is it different from a nested select?
28) A subselect is a select which works in conjunction with another select. A nested select is a kind of subselect where the
inner select passes to the where criteria for the outer select.

28) What is the difference between group by and order by?
29) Group by controls the presentation of the rows, order by controls the presentation of the columns for the results of the
SELECT statement.

29) What keyword does an SQL SELECT statement use for a string search?
30) The LIKE keyword allows for string searches. The % sign is used as a wildcard.

30) What are some SQL aggregates and other built-in functions?
31) The common aggregate, built-in functions are AVG, SUM, MIN, MAX, COUNT and DISTINCT.

31) How is the SUBSTR keyword used in SQL?
32) SUBSTR is used for string manipulation with column name, first position and string length used as arguments. E.g.
SUBSTR (NAME, 1 3) refers to the first three characters in the column NAME.

32) Explain the EXPLAIN statement?

33) The explain statement provides information about the optimizer's choice of access path of the SQL.

33) What is referential integrity?
34) Referential integrity refers to the consistency that must be maintained between primary and foreign keys, i.e. every
foreign key value must have a corresponding primary key value.

34) What is a NULL value? What are the pros and cons of using NULLS?
35) A NULL value takes up one byte of storage and indicates that a value is not present as opposed to a space or zero
value. It's the DB2 equivalent of TBD on an organizational chart and often correctly portrays a business situation.
Unfortunately, it requires extra coding for an application program to handle this situation.

35) What is a synonym? How is it used?
36) A synonym is used to reference a table or view by another name. The other name can then be written in the
application code pointing to test tables in the development stage and to production entities when the code is migrated.
The synonym is linked to the AUTHID that created it.

36) What is an alias and how does it differ from a synonym?
37) An alias is an alternative to a synonym, designed for a distributed environment to avoid having to use the location
qualifier of a table or view. The alias is not dropped when the table is dropped.

37) When can an insert of a new primary key value threaten referential integrity?
38) Never. New primary key values are not a problem. However, the values of foreign key inserts must have
corresponding primary key values in their related tables. And updates of primary key values may require changes in
foreign key values to maintain referential integrity.

38) What is the difference between static and dynamic SQL?
39) Static SQL is hard-coded in a program when the programmer knows the statements to be executed. For dynamic SQL
the program must dynamically allocate memory to receive the query results.

39) Compare a subselect to a join?
40) Any subselect can be rewritten as a join, but not vice versa. Joins are usually more efficient as join rows can be
returned immediately, subselects require a temporary work area for inner selects results while processing the outer
select.

40) What is the difference between IN subselects and EXISTS subselect?
41) If there is an index on the attributes tested an IN is more efficient since DB2 uses the index for the IN. (IN for index is
the mnemonic).

41) What is a Cartesian product?
42) A Cartesian product results from a faulty query. It is a row in the results for every combination in the join tables.

42) What is a tuple?
43) A tuple is an instance of data within a relational database.

43) What is the difference between static and dynamic SQL?
44) Static SQL is compiled and optimized prior to its execution; dynamic is compiled and optimized during execution.

44) Any SQL implementation covers data types in couple of main categories. Which of the following are those data
types ? (Check all that apply)
A). NUMERIC
B). CHARACTER
C). DATE AND TIME
D). BLOBS E. BIT
44) A,B,C. Not all SQL implementations have a BLOB or a BIT data types.

45) We have a table with a CHARACTER data type field. We apply a ">" row comparison between this field and
another CHARACTER field in another table. What will be the results for records with field value of NULL?
(Check one that applies the best)
A. TRUE
B. B. FALSE
C. C. UNKNOWN
D. D. Error.
E. E. Those records will be ignored
45) C. NULL in a row when compared will give an UNKNOWN result.

46) Any database needs to go through a normalization process to make sure that data is represented only once. This

will eliminate problems with creating or destroying data in the database. The normalization process is done

usually in three steps which results in first, second and third normal forms. Which best describes the process to

obtain the third normal form? (Check one that applies the best)

A. Each table should have related columns.
B. Each separate table should have a primary key.
C. We have a table with multi-valued key. All columns that are dependent on only one or on some of the keys should be moved in a different table.
D. If a table has columns not dependent on the primary keys, they need to be moved in a separate table.
E. E. Primary key is always UNIQUE and NOT NULL.

46) D. All columns in a table should be dependent on the primary key. This will eliminate transitive dependencies in

which A depends on B, and B depends on C, but we're not sure how C depends on A.

47) SQL can be embedded in a host program that uses a relational database as a persistent data repository. Some of

the most important pre-defined structures for this mechanism are SQLDA ("SQL Descriptor Area") and

SQLCA ("SQL Communications Area") SQLCA contains two structures - SQLCODE and SQLSTATE.

SQLSTATE is a standard set of error messages and warnings in which the first two characters defines the class

and the last three defines the subclass of the error. Which of the following SQLSTATE codes is interpreted as

"No data returned"?(Check one that applies the best)

A). 00xxx
B). 01xxx
C). 02xxx
D). 22xxx
E). 2Axxx

47) C. 00 - is successful completion, 01 - warnings, 22 - is data exception and 2A is syntax error. The SQLSTATE code

format returned for "No data returned" is "02xxx".

48) What are common SQL abend codes? (e.g. : 0,100 etc.,)

49) -818 time stamp mismatch

-180 wrong data moved into date field

49) What is meant by dynamic SQL?

50) Dynamic SQL are SQL statements that are prepared and executed within a program while the program is executing.

The SQL source is contained in host variables rather than being hard coded into the program. The SQL statement may

change from execution to execution.

50) What is meant by embedded SQL?

51) They are SQL statements that are embedded with in application program and are prepared during the program

preparation process before the program is executed. After it is prepared, the statement itself does not change(although

values of host variables specified within the statement might change).

51) What is meant by entity integrity?

52) Entity integrity is when the primary key is in fact unique and not null.

52) What will EXPLAIN do?

53) EXPLAIN obtains information (which indexes are used, whether sorting is necessary, which level of locking is applied) about how SQL statements in the DBRM will be executed, inserting this information into the "X".PLAN.TABLE where the "X" is the authorization ID of the owner of the plan.

53) What is the foreign key?

54) A foreign key is a column (or combination of columns) in a table whose values are required to match those of the primary key in some other table.

54) What will GRANT option do?

55) It will grant privileges to a list of one or more users. If the GRANT option is used in conjunction with the "PUBLIC" option, then all users will be granted privileges. Also you can grant privileges by objects and types.

55) What does the term "grant privileges" mean?

56) Grant privileges means giving access/authority to DB2 users.

56) What is an image copy?

57) It is an exact reproduction of all or part of a tablespace. DB2 provides utility programs to make full-image copies (to copy the entire tablespace) or incremental image copies to copy only those pages that have been modified since the last image copy.

57) What is meant by an index?

58) An index is a set of row identifiers (RIDs) or pointers that are logically ordered by the values of a column that has been specified as being an index. Indexes provide faster access to data and can enforce uniqueness on the row in a table.

58) What is an index key?

59) It is a column or set of columns in a table used to determine the order of index entries.

59) What is a join?

60) A join is a relational operation that allows retrieval of data from two or more tables based on matching columns values.

60) What is meant by locking?

61) Locking is a process that is used to ensure data integrity. It also prevents concurrent users from accessing inconsistent data. The data (row) is locked until a commit is executed to release the updated data.

61) What is meant by null?

62) This is a special value that indicates the absence of data in a column. This value is indicated by a negative value, usually -1.

62) What is an object?

63) An object is anything that is managed by DB2 (that is databases, table spaces, tables, views, indexes or synonyms), but
not the data itself.

63) Describe referential integrity?

64) Referential integrity refers to a feature in DB2 that is used to ensure consistency of the data in the database.

64) Describe a primary key?

65) A primary key is a key that is unique, non-null, and is part of the definition of a table. A table must have a primary key
to be defined as a parent.

65) How would you find out the total number of rows in a table? - GS

66) Use SELECT COUNT(*) ...

66) How do you eliminate duplicate values in SELECT? - GS

67) Use SELECT DISTINCT ...

67) How do you select a row using indexes? - GS

68) Specify the indexed columns in the WHERE clause.

68) What are aggregate functions?

69) Bulit-in mathematical functions for use in SELECT clause.

69) How do you find the maximum value in a column? - GS

70) Use SELECT MAX(...

70) Can you use MAX on a CHAR column?

71) YES.

71) My SQL statement SELECT AVG(SALARY) FROM EMP-TABLE yields inaccurate results. Why?

72) Because SALARY is not declared to have Null's and the employees for whom the salary is not known are also
counted.

72) How do you retrieve the first 5 characters of FIRSTNAME column of EMP table?

73) SELECT SUBSTR(FIRSTNAME,1,5) FROM EMP;

73) How do you concatenate the FIRSTNAME and LASTNAME from EMP table to give a complete name?

74) SELECT FIRSTNAME || ' ' || LASTNAME FROM EMP;

74) What is the use of VALUE function?

75) Avoid negative SQLCODEs by handling nulls and zeroes in computations.
Substitute a numeric value for any nulls used in computation.

75) What is UNION,UNION ALL? - GS

76) UNION eliminates duplicates
UNION ALL: retains duplicates
Both these are used to combine the results of different SELECT statements.

76) Suppose I have five SQL SELECT statements connected by UNION/UNION ALL, how many times should I

specify UNION to eliminate the duplicate rows? - GS

76) Once.

77) What is the restriction on using UNION in embedded SQL?

78) It has to be in a CURSOR.

78) In the WHERE clause what is BETWEEN and IN? - GS

79) BETWEEN supplies a range of values while IN supplies a list of values.

79) Is BETWEEN inclusive of the range values specified? - GS

80) Yes.

80) What is 'LIKE' used for in WHERE clause? What are the wildcard characters? - GS

81) LIKE is used for partial string matches. '%' (for a string of any character) and '_' (for any single character) are the
two wild card characters.

81) When do you use a LIKE statement?

82) To do partial search e.g. to search employee by name, you need not specify the complete name; using LIKE, you can
search for partial string matches.

82) What is the meaning of underscore ('_') in the LIKE statement? - GS

83) Match for any single character.

83) What do you accomplish by GROUP BY ... HAVING clause? - GS

84) GROUP BY partitions the selected rows on the distinct values of the column on which you group by. HAVING selects
GROUPs which match the criteria specified

**84) Consider the employee table with column PROJECT nullable. How can you get a list of employees who are not
assigned to any project?**

84) SELECT EMPNO FROM EMP WHERE PROJECT IS NULL;

85) What is the result of this query if no rows are selected:
SELECT SUM(SALARY) FROM EMP WHERE QUAL='MSC';

85) NULL

86) Why SELECT * is not preferred in embedded SQL programs?

For three reasons:
If the table structure is changed (a field is added), the program will have to be modified
Program might retrieve the columns which it might not use, leading on I/O over head.
The chance of an index only scan is lost.

87) What are correlated subqueries? - GS

A subquery in which the inner (nested) query refers back to the table in the outer query. Correlated subqueries must be evaluated for each qualified row of the outer query that is referred to.

88) What is a cursor? Why should it be used? - GS

Cursor is a programming device that allows the SELECT to find a set of rows but return them one at a time. Cursor should be used because the host language can deal with only one row at a time.

89) How would you retrieve rows from a DB2 table in embedded SQL? - GS

Either by using the single row SELECT statements,or by using the CURSOR.

90) Apart from cursor, what other ways are available to you to retrieve a row from a table in embedded SQL? - GS

Single row SELECTs.

91) How do you specify and use a cursor in a COBOL program? - GS

Use DECLARE CURSOR statement either in working storage or in procedure division (before open cursor),
to specify the SELECT statement. Then use OPEN, FETCH rows in a loop and finally CLOSE.

92) What happens when you say OPEN CURSOR?

If there is an ORDER BY clause, rows are fetched, sorted and made available for the FETCH statement. Other wise simply the cursor is placed on the first row.

93) Is DECLARE CURSOR executable?

No.

94) Can you have more than one cursor open at any one time in a program ? - GS

Yes.

95) When you COMMIT, is the cursor closed?

Yes.

1. What is SQLCA and SQLDA?
2. What is 2 phase commit?

DB2

1.How would you find out the total number of rows in a table? -

Use SELECT COUNT(*) ...

2.How do you eliminate duplicate values in SELECT? -

Use SELECT DISTINCT ...

3.How do you select a row using indexes? -

Specify the indexed columns in the WHERE clause.

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Bulit-in mathematical functions for use in SELECT clause.

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Use SELECT MAX(...

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YES.

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```

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11.What is UNION,UNION ALL? -

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Both these are used to combine the results of different SELECT statements.

12.Suppose I have five SQL SELECT statements connected by UNION/UNION ALL, how many times should I specify UNION to eliminate the duplicate rows? -

Once.

13.What is the restriction on using UNION in embedded SQL?

It has to be in a CURSOR.

14.In the WHERE clause what is BETWEEN and IN? -

BETWEEN supplies a range of values while IN supplies a list of values.

15.Is BETWEEN inclusive of the range values specified? -

Yes.

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LIKE is used for partial string matches. '%' (for a string of any character) and '_' (for any single character) are the two wild card characters.

17.When do you use a LIKE statement?

To do partial search e.g. to search employee by name, you need not specify the complete name; using LIKE, you can search for partial string matches.

18.What is the meaning of underscore ('_') in the LIKE statement? -

Match for any single character.

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GROUP BY partitions the selected rows on the distinct values of the column on which you group by.

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```

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FROM EMP

WHERE QUAL='MSC';
```

NULL

22.Why SELECT * is not preferred in embedded SQL programs?

For three reasons:

- If the table structure is changed (a field is added), the program will have to be modified
- Program might retrieve the columns which it might not use, leading on I/O over head.

- The chance of an index only scan is lost.

.What are correlated subqueries? -

A subquery in which the inner (nested) query refers back to the table in the outer query. Correlated subqueries must be evaluated for each qualified row of the outer query that is referred to.

23.What are the issues related with correlated subqueries? -

24.What is a cursor? why should it be used? -

Cursor is a programming device that allows the SELECT to find a set of rows but return them one at a time.

Cursor should be used because the host language can deal with only one row at a time.

25.How would you retrieve rows from a DB2 table in embedded SQL?

Either by using the single row SELECT statements,or by using the CURSOR.

26.Apart from cursor, what other ways are available to you to retrieve a row from a table in embedded SQL? -

Single row SELECTs.

27.Where would you specify the DECLARE CURSOR statement? -

See answer to next question.

28.How do you specify and use a cursor in a COBOL program? -

Use DECLARE CURSOR statement either in working storage or in procedure division(before open cursor), to specify the SELECT statement. Then use OPEN, FETCH rows in a loop and finally CLOSE.

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30.Is DECLARE CURSOR executable?

No.

31.Can you have more than one cursor open at any one time in a program ? -

Yes.

32.When you COMMIT, is the cursor closed?

Yes.

33.How do you leave the cursor open after issuing a COMMIT? (for DB2 2.3 or above only)

Use WITH HOLD option in DECLARE CURSOR statement. But, it has not effect in psuedo-conversational CICS programs.

34.Give the COBOL definition of a VARCHAR field.

A VARCHAR column REMARKS would be defined as follows:

```
...

10 REMARKS.

49 REMARKS-LEN PIC S9(4) USAGE COMP.

49 REMARKS-TEXT PIC X(1920).
```

35.What is the physical storage length of each of the following DB2 data types:

DATE, TIME, TIMESTAMP?

DATE: 4bytes

TIME: 3bytes

TIMESTAMP: 10bytes

36.What is the COBOL picture clause of the following DB2 data types:

DATE, TIME, TIMESTAMP?

DATE: PIC X(10)

TIME : PIC X(08)

TIMESTAMP: PIC X(26)

37.What is the COBOL picture clause for a DB2 column defined as DECIMAL(11,2)? -

PIC S9(9)V99 COMP-3.

Note: In DECIMAL(11,2), 11 indicates the size of the data type and 2 indicates the precision.

38.What is DCLGEN ? -

DeCLarations GENerator: used to create the host language copy books for the table definitions. Also creates the DECLARE table.

39.What are the contents of a DCLGEN? -

1. EXEC SQL DECLARE TABLE statement which gives the layout of the table/view in terms of DB2 datatypes.

2. A host language copy book that gives the host variable definitions for the column names.

40.Is it mandatory to use DCLGEN? If not, why would you use it at all? -

It is not mandatory to use DCLGEN.

Using DCLGEN, helps detect wrongly spelt column names etc. during the pre-compile stage itself (because of the DECLARE TABLE). DCLGEN being a tool, would generate accurate host variable definitions for the table reducing chances of error.

41.Is DECLARE TABLE in DCLGEN necessary? Why it used?

It not necessary to have DECLARE TABLE statement in DCLGEN. This is used by the pre-compiler to validate the table-name, view-name, column name etc., during pre-compile.

42.Will precompile of an DB2-COBOL program bomb, if DB2 is down?

No. Because the precompiler does not refer to the DB2 catalogue tables.

43.How is a typical DB2 batch pgm executed ?

1. Use DSN utility to run a DB2 batch program from native TSO. An example is shown:

```
DSN SYSTEM(DSP3)

RUN PROGRAM(EDD470BD) PLAN(EDD470BD) LIB('EDGS01T.OBJ.LOADLIB')

END
```

2. Use IKJEFT01 utility program to run the above DSN command in a JCL.

44.Assuming that a site's standard is that pgm name = plan name, what is the easiest way to find out which pgms are affected by change in a table's structure ?

Query the catalogue tables SYSPLANDEP and SYSPACKDEP.

45.Name some fields from SQLCA.

SQLCODE, SQLERRM, SQLERRD

46.How can you quickly find out the # of rows updated after an update statement?

Check the value stored in SQLERRD(3).

47.What is EXPLAIN? -

EXPLAIN is used to display the access path as determined by the optimizer for a SQL statement. It can be used in SPUFI (for single SQL statement) or in BIND step (for embedded SQL).

48.What do you need to do before you do EXPLAIN?

Make sure that the PLAN_TABLE is created under the AUTHID.

49.Where is the output of EXPLAIN stored? -

In userid.PLAN_TABLE

50.EXPLAIN has output with MATCHCOLS = 0. What does it mean? -

a nonmatching index scan if ACCESSTYPE = I.

51.How do you do the EXPLAIN of a dynamic SQL statement?

1. Use SPUFI or QMF to EXPLAIN the dynamic SQL statement

2. Include EXPLAIN command in the embedded dynamic SQL statements

52.How do you simulate the EXPLAIN of an embedded SQL statement in SPUFI/QMF? Give an example with a host variable in WHERE clause.)

Use a question mark in place of a host variable (or an unknown value). e.g.

```
SELECT EMP_NAME

FROM EMP

WHERE EMP_SALARY > ?
```

53.What are the isolation levels possible ? -

CS: Cursor Stability

RR: Repeatable Read

54.What is the difference between CS and RR isolation levels?

CS: Releases the lock on a page after use

RR: Retains all locks acquired till end of transaction

55.Where do you specify them ?

ISOLATION LEVEL is a parameter for the bind process.

56.When do you specify the isolation level? How?

During the BIND process. ISOLATION (CS/RR)...

57.I use CS and update a page. Will the lock be released after I am done with that page?

No.

58.What are the various locking levels available?

PAGE, TABLE, TABLESPACE

59.How does DB2 determine what lock-size to use?

1. Based on the lock-size given while creating the tablespace

2. Programmer can direct the DB2 what lock-size to use

3. If lock-size ANY is specified, DB2 usually choses a lock-size of PAGE

60.What are the disadvantages of PAGE level lock?

Hig resource utilization if large updates are to be done

61.What is lock escalation?

Promoting a PAGE lock-size to table or tablespace lock-size when a transaction has aquired more locks than specified in NUMLKTS. Locks should be taken on objects in single tablespace for escalation to occur.

62.What are the various locks available?

SHARE, EXCLUSIVE, UPDATE

63.Can I use LOCK TABLE on a view?

No. To lock a view, take lock on the underlying tables.

64.What is ALTER ? -

SQL command used to change the definition of DB2 objects.

65.What is a DBRM, PLAN ?

DBRM: DataBase Request Module, has the SQL statements extracted from the host language program by the pre-compiler.

PLAN: A result of the BIND process. It has the executable code for the SQL statements in the DBRM.

66.What is ACQUIRE/RELEASE in BIND?

Determine the point at which DB2 acquires or releases locks against table and tablespaces, including intent locks.

67.What else is there in the PLAN apart from the access path? -

PLAN has the executable code for the SQL statements in the host program

68.What happens to the PLAN if index used by it is dropped?

Plan is marked as invalid. The next time the plan is accessed, it is rebound.

69.What are PACKAGES ? -

They contain executable code for SQL statements for one DBRM.

70.What are the advantages of using a PACKAGE?

1. Avoid having to bind a large number of DBRM members into a plan

2. Avoid cost of a large bind

3. Avoid the entire transaction being unavailable during bind and automatic rebind of a plan

4. Minmize fallback complexities if changes result in an error.

71.What is a collection?

a user defined name that is the anchor for packages. It has not physical existence. Main usage is to group packages.

72.In SPUFI suppose you want to select max. of 1000 rows , but the select returns only 200 rows. What are the 2 sqlcodes that are returned? -

100 (for successful completion of the query), 0 (for successful COMMIT if AUTOCOMMIT is set to Yes).

73.How would you print the output of an SQL statement from SPUFI? -

Print the output dataset.

74.How do you pull up a query which was previously saved in QMF ? -

??

75.Lot of updates have been done on a table due to which indexes have gone haywire. What do you do? -

Looks like index page split has ocured. DO a REORG of the indexes.

76.What is dynamic SQL? -

Dynamic SQL is a SQL statement created at program execution time.

77.When is the access path determined for dynamic SQL? -

At run time, when the PREPARE statement is issued.

78.Suppose I have a program which uses a dynamic SQL and it has been performing well till now. Off late, I find that the performance has deteriorated. What happened? -

Probably RUN STATS is not done and the program is using a wrong index due to incorrect stats.

Probably RUNSTATS is done and optimizer has chosen a wrong access path based on the latest statistics.

79.How does DB2 store NULL physically?

as an extra-byte prefix to the column value. physically, the nul prefix is Hex '00' if the value is present and Hex 'FF' if it is not.

80.How do you retrieve the data from a nullable column? -

Use null indicators. Syntax ... INTO :HOSTVAR:NULLIND

81.What is the picture clause of the null indicator variable? -

S9(4) COMP.

82.What does it mean if the null indicator has -1, 0, -2? -

-1 : the field is null

0 : the field is not null

-2 : the field value is truncated

83.How do you insert a record with a nullable column?

To insert a NULL, move -1 to the null indicator

To insert a valid value, move 0 to the null indicator

84.What is RUNSTATS? -

A DB2 utility used to collect statistics about the data values in tables which can be used by the optimizer to decide the access path. It also collects statistics used for space management. These statistics are stored in DB2 catalog tables.

85.When will you chose to run RUNSTATS?

After a load, or after mass updates, inserts, deletes, or after REORG.

86.Give some example of statistics collected during RUNSTATS?

# of rows in the table

Percent of rows in clustering sequence

# of distinct values of indexed column

# of rows moved to a nearby/farway page due to row length increase

87.What is REORG? When is it used?

REORG reorganizes data on physical storage to positioning oveflowed rows in their proper sequence, to reclaim space, to restore free space. It is used after heavy updates, inserts and delete activity and after segments of a segmented tablespace have become fragemented.

88.What is IMAGECOPY ? -

It is full backup of a DB2 table which can be used in recovery.

89.When do you use the IMAGECOPY? -

To take routine backup of tables

After a LOAD with LOG NO

After REORG with LOG NO

90.What is COPY PENDING status?

A state in which, an image copy on a table needs to be taken, In this status, the table is available only for queries. You cannot update this table. To remove the COPY PENDING status, you take an image copy or use REPAIR utility.

91.What is CHECK PENDING ?

When a table is LOADed with ENFORCE NO option, then the table is left in CHECK PENDING status. It means that the LOAD utility did not perform constraint checking.

92.What is QUIESCE?

A QUIESCE flushes all DB2 buffers on to the disk. This gives a correct snapshot of the database and should be used before and after any IMAGECOPY to maintain consistency.

93.What is a clustering index ? -

Causes the data rows to be stored in the order specified in the index. A mandatory index defined on a partitioned table space.

94.How many clustering indexes can be defined for a table?

Only one.

95.What is the difference between primary key & unique index ?

Primary : a relational database constraint. Primary key consists of one or more columns that uniquely identify a row in the table. For a normalized relation, there is one designated primary key.

Unique index: a physical object that stores only unique values. There can be one or more unique indexes on a table.

96.What is sqlcode -922 ?

Authorization failure

97.What is sqlcode -811?

SELECT statement has resulted in retrieval of more than one row.

98.What does the sqlcode of -818 pertain to? -

This is generated when the consistency tokens in the DBRM and the load module are different.

99.Are views updatable ?

Not all of them. Some views are updatable e.g. single table view with all the fields or mandatory fields. Examples of non-updatable views are views which are joins, views that contain aggregate functions(such as MIN), and views that have GROUP BY clause.

100.If I have a view which is a join of two or more tables, can this view be updatable? -

No.

101.What are the 4 environments which can access DB2 ?

TSO, CICS, IMS and BATCH

102.What is an inner join, and an outer join ?

Inner Join: combine information from two or more tables by comparing all values that meet the search criteria in hte designated column or columns of on etable with all the calues in corresponding columns of the other table or tables. This kind of join which involve a match in both columns are called inner joins.

Outer join is one in which you want both matching and non matching rows to be returned.

103.What is FREEPAGE and PCTFREE in TABLESPACE creation?

PCTFREE: percentage of each page to be left free

FREEPAGE: Number of pages to be loaded with data between each free page

104.What are simple, segmented and partitioned table spaces ?

Simple Tablespace:

Can contain one or more tables

Rows from multiple tables can be interleaved on a page under the DBAs control and maintenance

Segmented Tablespace:

Can contain one or more tables

Tablespace is divided into segments of 4 to 64 pages in increments of 4 pages. Each segment is dedicated to single table. A table can occupy multiple segments

Partitioned Tablespace:

Can contain one table

Tablespace is divided into parts and each part is put in a separate VSAM dataset.

105.What is filter factor?

one divided by the number of distinct values of a column.

106.What is index cardinality? -

The number of distinct values a column or columns contain.

107.What is a synonym ?

Synonym is an alternate name for a table or view used mainly to hide the leading qualifier of a table or view.. A synonym is accessible only by the creator.

108.What is the difference between SYNONYM and ALIAS?

SYNONYM: is dropped when the table or tablespace is dropped. Synonym is available only to the creator.

ALIAS: is retained even if table or tablespace is dropped. ALIAS can be created even if the table does not exist. It is used mainly in distributed environment to hide the location info from programs. Alias is a global object & is available to all.

109.What do you mean by NOT NULL WITH DEFAULT? When will you use it?

This column cannot have nulls and while insertion, if no value is supplied then it wil have zeroes, spaces or date/time depending on whether it is numeric, character or date/time.

Use it when you do not want to have nulls but at the same time cannot give values all the time you insert this row.

110.What do you mean by NOT NULL? When will you use it?

The column cannot have nulls. Use it for key fields.

111.When would you prefer to use VARCHAR?

When a column which contains long text, e.g. remarks, notes, may have in most cases less than 50% of the maximum length.

112.What are the disadvantages of using VARCHAR?

1. Can lead to high space utilization if most of the values are close to maimum.

2. Positioning of VARCHAR column has to be done carefully as it has performance implications.

3. Relocation of rows to different pages can lead to more I/Os on retrieval.

113.How do I create a table MANAGER (EMP#, MANAGER) where MANAGER is a foreign key which references to EMP# in the same table? Give the exact DDL.

First CREATE MANAGER table with EMP# as the primary key. Then ALTER it to define the foreign key.

114.When is the authorization check on DB2 objects done - at BIND time or run time?

At run time.

115.What is auditing?

Recording SQL statements that access a table. Specified at table creation time or thru alter.

TOPIC: DB2

Q: What is JOIN and what are the different types of JOIN.
A: The ability to join rows and combine data from two or more tables is one of the most powerful features of relational system. There are three types of joins: 1. Equi-join; 2.Non-equijoin; 3.self-join
When the tables are joined together using equality of values in one or more Columns, they make EQUI JOIN

Q: Which is the most widely used batch performance monitor for DB2?
A: DB2PM

Q: Can I alter a table (like adding a column) when other user is selecting some columns or updating some columns from the same table?
A: Yes. It is possible until the updating or selection is committed, DB2 table will not be restructured. New column definition will be there but it will not be included until all the tasks on the table are committed.

Q: How many sub queries can you combine together?
A: Total 16 queries and sub queries are 15

Q: What are the different methods of accessing DB2 from TSO? How is the connection established between TSO & DB2?
A: There are three ways in establishing TSO/DB2 connection 1. SPUFI 2. QMF 3. CATALOG VISIBILITY; A thread between TSO & DB2 is established while attempting to make connection between TSO & DB2.

Q: How many buffer pools are available in DB2?
A: Ten 32K size buffer pools and fifty 4K size buffer pools (BP0 to BP49). Default buffer pools are BP0, BP1, BP2 & BP32

Q: What is B37 ABEND during SPUFI?
A: The B37 ABEND in the SPUFI is because of space requirements. The query has resulted in so many rows that the SPUFI.OUT file is not large enough to handle it; one possible solution is to increase the space allocation of SPUFI.OUT file.

Q: What is the command used by TSO users to invoke DB2?
A: DSN RUN

Q: What is the error code -803?
A: Unique Index violation

Q: How do you filter out the rows retrieved from a DB2 table?
A: One way is to use the SQL WHERE clause.

Q: What is Skeleton Cursor Table (SKCT)?
A: The Executable form of a Plan. This is stored in SYSIBM.SCT02 table.

Q: What is the equivalent Cobol Data type for Decimal (x,y) in DB2? What does the current SQLID register contain?
A: PIC S9(X-Y)V9(Y) COMP-3; The current SQLID contains the current authorization ID.

Q: Can we declare DB2 HOST variable in COBOL COPY book?
A: NO. If we declare DB2 host variable in COBOL COPY book, at the time of Pre-compilation we get the host variable not defined, because pre-compiler will not expand COBOL COPY book. So we declare it either in DCLGEN with
EXEC SQL INCLUDE
DCLGEN NAME

END-EXEC
or we directly hardcode it in the working storage section.

DB2 TABLE DECLARATIONS (DCLGENS)

DCLGENs are DB2 table declarations automatically generated using the DB2 DCLGEN facility. There is one DCLGEN for each DB2 table. A DCLGEN consists of an SQL DECLARE statement for the table and a matching COBOL record description.

When designing your applications, you can refer to the DCLGENs for the structure of the table you are working with, as well as the data type of each column. The DCLGENs will reflect the table structures, which are being used by the programmers; this should also be the most current layout of the tables.

The DCLGENs already contain COBOL record definitions for each DB2 table, eliminating the need for you to code that aspect of your program. This record layout will also have the correct COBOL data format for each column in the DB2 table.

To include the declarations produced by DCLGEN in your COBOL application program, you need to use the SQL INCLUDE statement in the Working-Storage Section of the Data Division:

```
EXEC SQL
    INCLUDE  member-name
END-EXEC
```

The DB2 precompiler will include the SQL DECLARE statement and the matching COBOL record description when it precompiles your program.

Q: What should be specified along with a cursor in order to continue updating process after COMMIT?
A: With Hold option.

Q: What is the name of the default DB2 catalog database?
A: DSNDB06

Q: When can you be sure that a query will return only one row?
A: When you use the primary key and only the primary key in the WHERE clause.

Q: What is the difference between JOIN and UNION?

A: JOIN is used to retrieve data from different tables using a single SQL statement. UNION is used to combine the results of two or more SQL queries.

Q: What is a correlated subquerry?
A: In a subquerry, if the outer query refers back to the outcome of inner query it is called correlated subquerry. That's why the outer query is evaluated first unlike an ordinary subquerry

Q: What are the functions of Bind?
A: BIND mainly performs two things: Syntax checking and Authorization checking. It binds together all packages into an application plan hence the name BIND. Apart from this bind has optimizer as a subcomponent. Its function is to determine the optimum access strategy.

Q: What is the maximum number of rows retrieved per page?
A: 127

Q: What is the only place of VSAM KSDS in DB2?
A: BSDS is a VSAM KSDS.

Q: Can all users have the privilege to use the SQL statement SELECT * (DML)?
A: No. The users should be granted privilege to use it.

Q: What is the size of a data page?
A: 4K to 8K

Q: What's the best locksize that you could use when you create a tablespace?
A: The answer is LOCKSIZE = ANY. Unless you are sure what's the Purpose of tablespace ie.,Read-only or Read/Write. If you use LOCKSIZE = ANY, DB2 would automatically determine what type of locks it should use.

Q: Can you define an Index if the table size is less than 10 PAGES?
A: NO

Q: What's the maximum Length of SQLCA and what's the content of SQLCABC?
A: The maximum length is 136 and the SQLCABC has the Value of SQLCA.

Q: What's the maximum number of volumes that can be added to a STOGROUP?
A: The answer is 133. Usually it will be difficult to monitor more than 3 or 4 volumes to a Stogroup.

Q: What's the maximum number of characters that a tablename can have?
A: The answer is 18 characters.

Q: What is the meaning of -805 SQL return code?
A: Program name not in plan. Bind the plan and include the DBRM for the program named as part of the plan.

Q: When does the SQL statement gets executed when you use cursor in the application programming?
A: SQL statement gets executed when we open cursor

Q: What does CURRENTDATA option in bind indicate
A: CURRENTDATA option ensures block fetch while selecting rows from a table. In DB2V4 the default has been changed to NO. Therefore it is necessary to change all the bind cards with CURRENTDATA(YES) which is default in DB2V3 & earlier to CURRENTDATA (NO).

Q: What is the difference between TYPE 1 index & TYPE 2 index
A: TYPE 1 & TYPE 2 are specified when an index is created on the table. TYPE 2 index is the option, which comes with DB2V4. With TYPE 2 index data can be retrieved faster as only the data pages are locked and not the index pages. Hence TYPE 2 index is recommended.

Q: What are the levels of isolation available with DB2V4?
A: CS RR UR (added new for DB2V4 which stands for uncommitted read which allows to retrieve records from the space which has exclusive locks also but data integrity will be affected if this option is used). The best available option for data integrity and data concurrency is CS.

Q: How do you achieve record locking in DB2 in the versions which do not support record level locking?
A: By having the record length more than half of the page size

Q: In a DB2-CICS program which acts as co-ordinator and which is the participant?
A: DB2 acts as the participant and CICS acts as a co-ordinator

Q: What does DML stand for and what are some examples of it?

A: Data Manipulation Language. Some examples are SELECT, INSERT, DELETE, REPLACE.

Q: How to define the data items to receive the fetch items for the SQL?
A: Using the DSECT, followed by lines of - 'dataitems DS datatype'.

Q: What is the difference between WHERE and HAVING Clause?
A: WHERE is for Rows and HAVING is for Groups

Q: How to see the structure of DB2 table?
A: Using QMF.

Q: What is the maximum number of tables that can be stored on a Partitioned Table Space?
A: ONE

Q: Name the different types of Table spaces.
A: 1. Simple Table Space; 2. Segmented Table Space and 3. Partitioned Table Space

Q: What is the maximum and minimum number of partitions allowed in a partitioned tablespace?
A: Minimum is 4 and Maximum is 64.

Q: What is the maximum number of tables that can be joined?
A: Fifteen

Q: What technique is used to retrieve data from more than one table in a single SQL statement?
A: The JOIN statement combines data from more that two tables

Q: What is a foreign key?
A: It identifies a related row in another table and establishes a logical relationship between rows in two tables.

Q: Explain the use of the WHERE clause.
A: It directs DB2 to extract data from rows where the value of the column is the same as the current value of the host variable.

Q: What is EXPLAIN in DB2

A: EXPLAIN is used to detail the access paths chosen by DB2 optimizer for SQL statement. This command is used to monitor the performance of SQL statement used in a program.

Q. How would you find out the total number of rows in a table? - GS
A. Use SELECT COUNT(*) ...

Q. How do you eliminate duplicate values in SELECT? - GS
A. Use SELECT DISTINCT ...

Q. How do you select a row using indexes? - GS
A.Specify the indexed columns in the WHERE clause.

Q. What are aggregate functions?
A. Bulit-in mathematical functions for use in SELECT clause.

Q. How do you find the maximum value in a column? - GS
A. Use SELECT MAX(...

Q. Can you use MAX on a CHAR column?
A. YES.

Q. My SQL statement SELECT AVG(SALARY) FROM EMP yields inaccurate results. Why?
A. Because SALARY is not declared to have NULLs and the employees for whom the salary is not known are also counted.

Q. How do you retrieve the first 5 characters of FIRSTNAME column of EMP table?
A. SELECT SUBSTR(FIRSTNAME,1,5) FROM EMP;

Q. How do you concatenate the FIRSTNAME and LASTNAME from EMP table to give a complete name?
A. SELECT FIRSTNAME || ' ' || LASTNAME FROM EMP;

Q. What is the use of VALUE function?
A. 1. Avoid -ve SQLCODEs by handling nulls and zeroes in computations
2. Substitute a numeric value for any nulls used in computation

Q. What is UNION,UNION ALL? - GS
A. UNION : eliminates duplicates
UNION ALL: retains duplicates

Both these are used to combine the results of different SELECT statements.

Q. Suppose I have five SQL SELECT statements connected by UNION/UNION ALL, how many times should I specify UNION to eliminate the duplicate rows? - GS
A. Once.

Q. What is the restriction on using UNION in embedded SQL?
A. It has to be in a CURSOR.

Q. In the WHERE clause what is BETWEEN and IN? - GS
A. BETWEEN supplies a range of values while IN supplies a list of values.

Q. Is BETWEEN inclusive of the range values specified? - GS
A. Yes.

Q. What is 'LIKE' used for in WHERE clause? What are the wildcard characters? - GS
A. LIKE is used for partial string matches. '%' (for a string of any character) and '_' (for any single character) are the two wild card characters.

Q. When do you use a LIKE statement?
A. To do partial search e.g. to search employee by name, you need not specify the complete name; using LIKE, you can search for partial string matches.

Q. What is the meaning of underscore ('_') in the LIKE statement? - GS
A. Match for any single character.

Q. What do you accomplish by GROUP BY ... HAVING clause? - GS
A.GROUP BY partitions the selected rows on the distinct values of the column on which you group by.
HAVING selects GROUPs which match the criteria specified

Q. Consider the employee table with column PROJECT nullable. How can you get a list of employees who are not assigned to any project?
A. SELECT EMPNO
FROM EMP
WHERE PROJECT IS NULL;

Q. What is the result of this query if no rows are selected:
A. SELECT SUM(SALARY)
FROM EMP
WHERE QUAL='MSC';
NULL

Q.Why SELECT * is not preferred in embedded SQL programs?
A. For three reasons:

- If the table structure is changed (a field is added), the program will have to be modified
- Program might retrieve the columns which it might not use, leading on I/O over head.
- The chance of an index only scan is lost.

Q. What are correlated subqueries? - GS
A. subquery in which the inner (nested) query refers back to the table in the outer query. Correlated subqueries must be evaluated for each qualified row of the outer query that is referred to.

Q. What are the issues related with correlated subqueries? - GS
???

Q. What is a cursor? why should it be used? - GS
A. Cursor is a programming device that allows the SELECT to find a set of rows but return them one at a time.
Cursor should be used because the host language can deal with only one row at a time.

Q. How would you retrieve rows from a DB2 table in embedded SQL? - GS
A. Either by using the single row SELECT statements,or by using the CURSOR.

Q. Apart from cursor, what other ways are available to you to retrieve a row from a table in embedded SQL? - GS
A. Single row SELECTs.

Q. Where would you specify the DECLARE CURSOR statement? - GS
A. See answer to next question.

Q. How do you specify and use a cursor in a COBOL program? - GS
A. Use DECLARE CURSOR statement either in working storage or in procedure division(before open cursor), to specify the SELECT statement. Then use OPEN, FETCH rows in a loop and finally CLOSE.

Q. What happens when you say OPEN CURSOR?
A. If there is an ORDER BY clause, rows are fetched, sorted and made available for the FETCH statement. Other wise simply the cursor is placed on the first row.

Q. Is DECLARE CURSOR executable?
A. No.

Q. Can you have more than one cursor open at any one time in a program ? - GS
A. Yes.

Q. When you COMMIT, is the cursor closed?
A. Yes.

Q. How do you leave the cursor open after issuing a COMMIT? (for DB2 2.3 or above only)

A.Use WITH HOLD option in DECLARE CURSOR statement. But, it has not effect in psuedo-conversational CICS programs.

Q. Give the COBOL definition of a VARCHAR field.
A. VARCHAR column REMARKS would be defined as follows:
...
10 REMARKS.
49 REMARKS-LEN PIC S9(4) USAGE COMP.
49 REMARKS-TEXT PIC X(1920).

MDBC9002

This module returns the number of characters in a text field excluding trailing spaces. This is used primarily for processing data associated with variable-length columns (VARCHAR). In the DEBES database, character fields greater than 30 characters are defined as VARCHAR. Those fields 30 characters or less are defined as character (CHAR) type fields.

Variable Length Columns (VARCHAR)
In DB2, VARCHAR fields have three data names in the DCLGEN host variable. For example, the field associated with the certification question text on the table XADEBT66CERTQUEST has the DCLGEN definition:

```
10 CERT-QSTN-TXT.
  49 CERT-QUEST-TXT-LEN          PIC S9(4) COMP.
  49 CERT-QUEST-TXT-TEXT         PIC X(480).
```

DCLGEN uses the name of the column for the group item (CERT-QSTN-TXT). Then, it appends-LEN and -TEXT to the column name to form the names for the length and data components. In any SQL statement that uses a variable length column, the group item that contains the length and the text components should be used. A SELECT or FETCH statement will pass the length of the column's value in the length field (CERT-QUEST-TXT-LEN) and returns exactly that number of characters in the text field (CERT-QUEST-TXT-TEXT). DB2 requires that both the length and text fields be set properly before issuing an INSERT or DELETE.

This module is called to determine the length of any character field. The calling module will pass a variable containing the maximum length of the string (PIC S9(4) COMP), and a character field that actually contains the string. The longest string this module can evaluate is 480 bytes long.

Q. What is the physical storage length of each of the following DB2 data types:
DATE, TIME, TIMESTAMP?
A. DATE: 4bytes
TIME: 3bytes
TIMESTAMP: 10bytes

Q.What is the COBOL picture clause of the following DB2 data types:
DATE, TIME, TIMESTAMP?
A. DATE: PIC X(10)
TIME : PIC X(08)
TIMESTAMP: PIC X(26)

Q. What is the COBOL picture clause for a DB2 column defined as DECIMAL(11,2)? - GS
A. PIC S9(9)V99 COMP-3.

Note: In DECIMAL(11,2), 11 indicates the size of the data type and 2 indicates the precision.

Q. What is DCLGEN ? - GS
A. DeCLarations GENerator: used to create the host language copy books for the table definitions. Also creates the DECLARE table.

Q. What are the contents of a DCLGEN? - GS
A. 1. EXEC SQL DECLARE TABLE statement which gives the layout of the table/view in terms of DB2 datatypes.
2. A host language copy book that gives the host variable definitions for the column names.

Q. Is it mandatory to use DCLGEN? If not, why would you use it at all? - GS
A. It is not mandatory to use DCLGEN.
Using DCLGEN, helps detect wrongly spelt column names etc. during the pre-compile stage itself (because of the DECLARE TABLE). DCLGEN being a tool, would generate accurate host variable definitions for the table reducing chances of error.

Create the table layout ('include' member) by using the DCLGEN facility (option 2) in DB2I. The DCLGEN includes a DECLARE statement and a cobol layout for the table.

Q. Is DECLARE TABLE in DCLGEN necessary? Why it used?
A. It not necessary to have DECLARE TABLE statement in DCLGEN. This is used by the pre-compiler to validate the table-name, view-name, column name etc., during pre-compile.

Q. Will precompile of an DB2-COBOL program bomb, if DB2 is down?
A. No. Because the precompiler does not refer to the DB2 catalogue tables.

Q. How is a typical DB2 batch pgm executed ?
A.1. Use DSN utility to run a DB2 batch program from native TSO. An example is shown:

```
DSN SYSTEM(DSP3)
  RUN PROGRAM(EDD470BD) PLAN(EDD470BD)
LIB('EDGS01T.OBJ.LOADLIB')
END
```

2. Use IKJEFT01 utility program to run the above DSN command in a JCL.

Q. Assuming that a site's standard is that pgm name = plan name, what is the easiest way to find out which pgms are affected by change in a table's structure ?
A. Query the catalogue tables SYSPLANDEP and SYSPACKDEP.

Q. Name some fields from SQLCA.
A. SQLCODE, SQLERRM, SQLERRD

Q. How can you quickly find out the # of rows updated after an update statement?
A. Check the value stored in SQLERRD(3).

Q. What is EXPLAIN? - GS
A. EXPLAIN is used to display the access path as determined by the optimizer for a SQL statement. It can be used in SPUFI (for single SQL statement) or in BIND step (for embedded SQL).

Q. What do you need to do before you do EXPLAIN?
A. Make sure that the PLAN_TABLE is created under the AUTHID.

Q. Where is the output of EXPLAIN stored? - GS
A. In userid.PLAN_TABLE

Q. EXPLAIN has output with MATCHCOLS = 0. What does it mean? - GS
A. a nonmatching index scan if ACCESSTYPE = I.

Q. How do you do the EXPLAIN of a dynamic SQL statement?
A. 1. Use SPUFI or QMF to EXPLAIN the dynamic SQL statement
2. Include EXPLAIN command in the embedded dynamic SQL statements

Q. How do you simulate the EXPLAIN of an embedded SQL statement in SPUFI/QMF? Give an example with a host variable in WHERE clause.)
A. Use a question mark in place of a host variable (or an unknown value). e.g.

```
SELECT EMP_NAME
FROM EMP
WHERE EMP_SALARY > ?
```

Q. What are the isolation levels possible ? - GS
A. CS: Cursor Stability
RR: Repeatable Read

Q. What is the difference between CS and RR isolation levels?
A. CS:Releases the lock on a page after use
RR:Retains all locks acquired till end of transaction

Q. Where do you specify them ?
A. ISOLATION LEVEL is a parameter for the bind process.

Q. When do you specify the isolation level? How?
A. During the BIND process. ISOLATION (CS/RR)...

Q. I use CS and update a page. Will the lock be released after I am done with that page?
A. No.

Q. What are the various locking levels available?
A. PAGE, TABLE, TABLESPACE

Q. How does DB2 determine what lock-size to use?
A. 1. Based on the lock-size given while creating the tablespace
2. Programmer can direct the DB2 what lock-size to use
3. If lock-size ANY is specified, DB2 usually choses a lock-size of PAGE

Q. What are the disadvantages of PAGE level lock?
A. Hig resource utilization if large updates are to be done

Q. What is lock escalation?
A. Promoting a PAGE lock-size to table or tablespace lock-size when a transaction has aquired more locks than specified in NUMLKTS. Locks should be taken on objects in single tablespace for escalation to occur.

Q. What are the various locks available?
A. SHARE, EXCLUSIVE, UPDATE

Q. Can I use LOCK TABLE on a view?
A. No. To lock a view, take lock on the underlying tables.

Q. What is ALTER ? - GS
A. SQL command used to change the definition of DB2 objects.

Q. What is a DBRM, PLAN ?
A. DBRM: DataBase Request Module, has the SQL statements extracted from the host language program by the pre-compiler.
PLAN: A result of the BIND process. It has the executable code for the SQL statements in the DBRM.

Q. What is ACQUIRE/RELEASE in BIND?
A. Determine the point at which DB2 acquires or releases locks against table and tablespaces, including intent locks.

Q.What else is there in the PLAN apart from the access path? - GS
A. PLAN has the executable code for the SQL statements in the host program

Q. What happens to the PLAN if index used by it is dropped?
A. Plan is marked as invalid. The next time the plan is accessed, it is rebound.

Q.What are PACKAGES ? - GS
A. They contain executable code for SQL statements for one DBRM.

Q. What are the advantages of using a PACKAGE?
A. 1. Avoid having to bind a large number of DBRM members into a plan
2. Avoid cost of a large bind
3. Avoid the entire transaction being unavailable during bind and automatic rebind of a plan
4. Minmize fallback complexities if changes result in an error.

Q. What is a collection?
A. a user defined name that is the anchor for packages. It has not physical existence. Main usage is to group packages.

Q. In SPUFI suppose you want to select max. of 1000 rows , but the select returns only 200 rows. What are the 2 sqlcodes that are returned? - GS
A. 100 (for successful completion of the query), 0 (for successful COMMIT if AUTOCOMMIT is set to Yes).

Q. How would you print the output of an SQL statement from SPUFI? - GS
A. Print the output dataset.

Q. How do you pull up a query which was previously saved in QMF? - GS
A. ??

Q. Lot of updates have been done on a table due to which indexes have gone haywire. What do you do? - GS
A. Looks like index page split has ocured. DO a REORG of the indexes.

Q. What is dynamic SQL? - GS
A. Dynamic SQL is a SQL statement created at program execution time.

Q. When is the access path determined for dynamic SQL? - GS
A. At run time, when the PREPARE statement is issued.

Q. Suppose I have a program which uses a dynamic SQL and it has been performing well till now. Off late, I find that the performance has deteriorated. What happened? - GS
A. Probably RUN STATS is not done and the program is using a wrong index due to incorrect stats.
Probably RUNSTATS is done and optimizer has chosen a wrong access path based on the latest statistics.

Q. How does DB2 store NULL physically?
A. as an extra-byte prefix to the column value. physically, the nul prefix is Hex '00' if the value is present and Hex 'FF' if it is not.

Q. How do you retrieve the data from a nullable column? - GS

A. Use null indicators. Syntax ... INTO :HOSTVAR:NULLIND

Q. What is the picture clause of the null indicator variable? - GS
A. S9(4) COMP.

Q. What does it mean if the null indicator has -1, 0, -2? - GS
A. -1 : the field is null
0 : the field is not null
-2 : the field value is truncated

Q. How do you insert a record with a nullable column?
A. To insert a NULL, move -1 to the null indicator
To insert a valid value, move 0 to the null indicator

Q. What is RUNSTATS? - GS
A. A DB2 utility used to collect statistics about the data values in tables which can be used by the optimizer to decide the access path. It also collects statistics used for space management. These statistics are stored in DB2 catalog tables.

Q. When will you chose to run RUNSTATS?
A. After a load, or after mass updates, inserts, deletes, or after REORG.

Q. Give some example of statistics collected during RUNSTATS?
A. # of rows in the table
Percent of rows in clustering sequence
# of distinct values of indexed column
# of rows moved to a nearby/farway page due to row length increase

Q. What is REORG? When is it used?
A. REORG reorganizes data on physical storage to reclutser rows, positioning oveflowed rows in their proper sequence, to reclaim space, to restore free space. It is used after heavy updates, inserts and delete activity and after segments of a segmented tablespace have become fragemented.

Q. What is IMAGECOPY ? - GS
A. It is full backup of a DB2 table which can be used in recovery.

Q. When do you use the IMAGECOPY? - GS
A. To take routine backup of tables
After a LOAD with LOG NO
After REORG with LOG NO

Q.What is COPY PENDING status?
A .state in which, an image copy on a table needs to be taken, In this status, the table is available only for queries. You cannot update this table. To remove the COPY PENDING status, you take an image copy or use REPAIR utility.

Q. What is CHECK PENDING ?
A. When a table is LOADed with ENFORCE NO option, then the table is left in CHECK PENDING status. It means that the LOAD utility did not perform constraint checking.

Q. What is QUIESCE?
A . QUIESCE flushes all DB2 buffers on to the disk. This gives a correct snapshot of the database and should be used before and after any IMAGECOPY to maintain consistency.

Q. What is a clustering index ? - GS
A. Causes the data rows to be stored in the order specified in the index. A mandatory index defined on a partitioned table space.

Q. How many clustering indexes can be defined for a table?
A. Only one.

Q. What is the difference between primary key & unique index ?
A. Primary : a relational database constraint. Primary key consists of one or more columns that uniquely identify a row in the table. For a normalized relation, there is one designated primary key.
Unique index: a physical object that stores only unique values. There can be one or more unique indexes on a table.

Q.What is sqlcode -922 ?
A. Authorization failure

Q. What is sqlcode -811?
A. SELECT statement has resulted in retrieval of more than one row.

Q. What does the sqlcode of -818 pertain to? - GS
A. This is generated when the consistency tokens in the DBRM and the load module are different.

Q. Are views updatable ?
A. Not all of them. Some views are updatable e.g. single table view with all the fields or mandatory fields. Examples of non-updatable views are views which are joins, views that contain aggregate functions(such as MIN), and views that have GROUP BY clause.

Q. If I have a view which is a join of two or more tables, can this view be updatable? - GS
A. No.

Q.What are the 4 environments which can access DB2 ?

A. TSO, CICS, IMS and BATCH

Q. What is an inner join, and an outer join ?
A. Inner Join: combine information from two or more tables by comparing all values that meet the search criteria in hte designated column or columns of one table with all the calues in corresponding columns of the other table or tables. This kind of join which involve a match in both columns are called inner joins.

Outer join is one in which you want both matching and non matching rows to be returned. DB2 has no specific operator for outer joins, it can be simulated by combining a join and a correlated sub query with a UNION.

Q. What is FREEPAGE and PCTFREE in TABLESPACE creation?
A. PCTFREE: percentage of each page to be left free
FREEPAGE: Number of pages to be loaded with data between each free page

Q. What are simple, segmented and partitioned table spaces ?
A. Simple Tablespace:
Can contain one or more tables
Rows from multiple tables can be interleaved on a page under the DBAs control and maintenance
Segmented Tablespace:
Can contain one or more tables
Tablespace is divided into segments of 4 to 64 pages in increments of 4 pages. Each segment is dedicated to single table. A table can occupy multiple segments

Partitioned Tablespace:
Can contain one table
Tablespace is divided into parts and each part is put in a separate VSAM dataset.

Q. What is filter factor?
A. one divided by the number of distinct values of a column.

Q. What is index cardinality? - GS
A. The number of distinct values a column or columns contain.

Q. What is a synonym ?
A. Synonym is an alternate name for a table or view used mainly to hide the leading qualifier of a table or view.. A synonym is accessible only by the creator.

Q. What is the difference between SYNONYM and ALIAS?
A. SYNONYM: is dropped when the table or tablespace is dropped. Synonym is available only to the creator.

ALIAS: is retained even if table or tablespace is dropped. ALIAS can be created even if the table does not exist. It is used mainly in distributed environment to hide the location info from programs. Alias is a global object & is available to all.

Q. What do you mean by NOT NULL WITH DEFAULT? When will you use it?
A. This column cannot have nulls and while insertion, if no value is supplied then it wil have zeroes, spaces or date/time depending on whether it is numeric, character or date/time.
Use it when you do not want to have nulls but at the same time cannot give values all the time you insert this row.

Q. What do you mean by NOT NULL? When will you use it?
A. The column cannot have nulls. Use it for key fields.

Q. When would you prefer to use VARCHAR?
A. When a column which contains long text, e.g. remarks, notes, may have in most cases less than 50% of the maximum length.

Q. What are the disadvantages of using VARCHAR?
A. 1. Can lead to high space utilization if most of the values are close to maimum.
2. Positioning of VARCHAR column has to be done carefully as it has performance implications.
3. Relocation of rows to different pages can lead to more I/Os on retrieval.

Q. How do I create a table MANAGER (EMP#, MANAGER) where MANAGER is a foreign key which references to EMP# in the same table? Give the exact DDL.
A. First CREATE MANAGER table with EMP# as the primary key. Then ALTER it to define the foreign key.

Q. When is the authorization check on DB2 objects done - at BIND time or run time?
A. At run time.

Q.What is auditing?
A. Recording SQL statements that access a table. Specified at table creation time or thru alter

.
Q1. What is a DB2 **bind**?
A1. A DB2 **bind** is a process that builds an access path to DB2 tables.

Q2. What is a DB2 **access path**?
A2. An **access path** is the method used to access data specified in DB2 sql statements.

Q3. What is a DB2 **plan**?
A3. An application plan or package is generated by the bind to define an **access path**.

Q4. What is **normalization** and what are the **five normal forms**?

A4. Normalization is a design procedure for representing data in tabular format. The five normal forms are progressive rules to represent the data with minimal redundancy.

Q5. What are **foreign keys**?
A5. These are attributes of one table that have matching values in a **primary key** in another table, allowing for relationships between tables.

Q6. Describe the elements of the SELECT query syntax.
A6. SELECT element FROM table WHERE conditional statement.

Q7. Explain the use of the WHERE clause.
A7. WHERE is used with a relational statement to isolate the object element or row.

Q8. What techniques are used to retrieve data from more than one table in a single SQL statement?
A8. Joins, unions and **nested selects** are used to retrieve data.

Q9. What do the initials DDL and DML stand for and what is their meaning?
A9. DDL is data definition language and DML is data manipulation language. DDL statements are CREATE, ALTER, TRUNCATE. DML statements are SELECT, INSERT, DELETE and UPDATE.

Q10. What is a **view**? Why use it?
A10. A view is a virtual table made up of data from base tables and other views, but not stored separately.

Q11. Explain an **outer join**.
A11. An outer join includes rows from tables when there are no matching values in the tables.

Q12. What is a **subselect**? Is it different from a **nested select**?
A12. A **subselect** is a select which works in conjunction with another select. A **nested select** is a kind of subselect where the inner select passes to the where criteria for the outer select.

Q13. What is the difference between **group by** and **order by**?
A13. Group by controls the presentation of the rows, **order by** controls the presentation of the columns for the results of the SELECT statement.

Q14. Explain the EXPLAIN statement.
A14. The explain statement provides information about the optimizer's choice of access path of the sql.

Q15. What is **tablespace**?
A15. Tables are stored in **tablespaces** (hence the name)! There are three types of tablespaces: simple, segmented and partitioned.

Q16. What is **a cursor** and what is its function?
A16. An embedded sql statement may return a number of rows while the programming language can only access one row at a time. The programming device called a **cursor** controls the position of the row.

Q17. What is **referential integrity**?
A17. Referential integrity refers to the consistency that must be maintained between primary and foreign keys, ie every **foreign key** value must have a corresponding **primary key** value.

Q18. Usually, which is more important for DB2 system performance - CPU processing or I/O access?
A18. I/O operations are usually most critical for DB2 performance (or any other database for that matter).

Q19. Is there any advantage to **denormalizing** DB2 tables?
A19. Denormalizing DB2 tables reduces the need for processing intensive relational joins and reduces the number of foreign keys.

Q20. What is the database descriptor?
A20. The database descriptor, **DBD** is the DB2 component that limits access to the database whenever objects are created, altered or dropped.

Q21. What is **lock contention**?
A21. To maintain the integrity of DB2 objects the DBD permits access to only on object at a time. **Lock contention** happens if several objects are required by contending application processes simultaneously.

Q22. What is **SPUFI?**
A22. SPUFI stands for SQL processing using file input. It is the DB2 interactive menu-driven tool used by developers to create database objects.

Q23. What is the significance of DB2 **free space** and what parameters control it?
A23. The two parameters used in the CREATE statement are the **PCTFREE** which specifies the percentage of free space for each page and **FREEPAGE** which indicates the number of pages to be loaded with data between each free page. Free space allows room for the insertion of new rows.

Q24. What is a **NULL** value? What are the pros and cons of using NULLS?
A24. A **NULL** value takes up one byte of storage and indicates that a value is not present as opposed to a space or zero value. It's the DB2 equivalent of TBD on an organizational chart and often correctly portrays a business situation. Unfortunately, it requires extra coding for an application program to handle this situation.
Q25. What is a **synonym**? How is it used?
A25. A **synonym** is used to reference a table or view by another name. The other name can then be written in the application code pointing to test tables in the development stage and to production entities when the code is migrated. The synonym is linked to the AUTHID that created it.

Q26. What is an **alias** and how does it differ from a **synonym**?
A26. An **alias** is an alternative to a **synonym**, designed for a distributed environment to avoid having to use the location qualifier of a table or view. The alias is not dropped when the table is dropped.

Q27. What is a LIKE table and how is it created?
A27. A LIKE table is created by using the LIKE parameter in a CREATE table statement. LIKE tables are typically created for a test environment from the production environment.

Q28. If the base table underlying a view is restructured, eg. attributes are added, does the application code accessing the view need to be redone?
A28. No. The table and its view are created anew, but the programs accessing the view do not need to be changed if the view and attributes accessed remain the same.

Q29. Under what circumstances will DB2 allow an SQL statement to update more than one primary key value at a time?
A29. Never. Such processing could produce duplicate values violating entity integrity. Primary keys must be updated one at a time.

Q30. What is the **cascade rule** and how does it relate to deletions made with a subselect.
A30. The **cascade rule** will not allow deletions based on a subselect that references the same table from which the deletions are being made.

Q31. What is the **self-referencing constraint**?
A31. The **self-referencing** constraint limits in a single table the changes to a primary key that the related foreign key defines. The foreign key in a self referencing table must specify the DELETE CASCADE rule.

Q32. What are **delete-connected tables**?

A32. Tables related with a foreign key are called **delete-connected** because a deletion in the primary key table can affect the contents of the foreign key table.

Q33. When can an insert of a new primary key value threaten **referential integrity**?
A33. Never. New primary key values are not a problem. However, the values of foreign key inserts must have corresponding primary key values in their related tables. And updates of primary key values may require changes in foreign key values to maintain **referential integrity**.

Q34. In terms of DB2 indexing, what is the **root page**?
A34. The simplest DB2 index is the **B-tree** and the B-tree's top page is called the **root page**. The root page entries represent the upper range limits of the index and are referenced first in a search.

Q35. How does Db2 use **multiple table indexes**?
A35. DB2 use the **multiple indexes** to satisfy multiple predicates in a SELECT statement that are joined by an AND or OR.

Q36. What are some characteristics of columns that benefit from indexes?
A36. Primary key and **foreign key** columns; columns that have unique values; columns that have aggregates computed frequently and columns used to test the existence of a value.

Q37. What is a **composite index** and how does it differ from a **multiple index**?
A37. A **multiple index** is not one index but two indexes for two different columns of a table. A **composite index** is one index made up of combined values from two columns in a table. If two columns in a table will often be accessed together a **composite index** will be efficient.
Q38. What is meant by **index cardinality**?
A38. The number of distinct values for a column is called **index cardinality**. DB2's RUNSTATS utility analyzes column value redundancy to determine whether to use a tablespace or index scan to search for data.

Q39. What is a **clustered index**?
A39. For a **clustered index** DB2 maintains rows in the same sequence as the columns in the index for as long as there is free space. DB2 can then process that table in that order efficiently.

Q40. What keyword does an SQL SELECT statement use for a string search?
A40. The LIKE keyword allows for string searches. The % sign is used as a wildcard.

Q41. What are some sql **aggregates** and other **built-in functions**?
A41. The common **aggregate, built-in functions** are AVG, SUM, MIN, MAX, COUNT and DISTINCT.

Q42. How is the **SUBSTR** keyword used in sql?
A42. SUBSTR is used for string manipulation with column name, first position and string length used as arguments. Eg. SUBSTR (NAME, 1 3) refers to the first three characters in the column NAME.

Q43. What are the three DB2 date and time data types and their associated functions?
A43. The three data types are DATE, TIME and TIMESTAMP. CHAR can be used to specify the format of each type. The DAYS function calculates the number of days between two dates. (It's Y2K compliant).

Q44. Explain **transactions, commits** and **rollbacks** in DB2.
A44. In DB2 a transaction typically requires a series of updates, insertions and deletions that represent a **logical unit of work**. A transaction puts an **implicit lock** on the DB2 data. Programmers can use the COMMIT WORK statement to terminate the transaction creating smaller units for recovery. If the transaction fails DB2 uses the log to roll back values to the start of the transaction or to the preceding commit point.

Q45. What is **deadlock**?

A45. Deadlock occurs when transactions executing at the same time lock each other out of data that they need to complete their logical units of work.

deadlock

A deadlock is a situation in which two computer programs sharing the same resource are effectively preventing each other from accessing the resource, resulting in both programs ceasing to function.

The earliest computer operating systems ran only one program at a time. All of the resources of the system were available to this one program. Later, operating systems ran multiple programs at once, interleaving them. Programs were required to specify in advance what resources they needed so that they could avoid conflicts with other programs running at the same time. Eventually some operating systems offered dynamic allocation of resources. Programs could request further allocations of resources after they had begun running. This led to the problem of the deadlock. Here is the simplest example:

```
  Program 1 requests resource A and receives it.
  Program 2 requests resource B and receives it.
  Program 1 requests resource B and is queued up, pending the release of
B.
  Program 2 requests resource A and is queued up, pending the release of
A.
```

Now neither program can proceed until the other program releases a resource. The operating system cannot know what action to take. At this point the only alternative is to abort (stop) one of the programs.
Learning to deal with deadlocks had a major impact on the development of operating systems and the structure of databases. Data was structured and the order of requests was constrained in order to avoid creating deadlocks.

Q46. What are the four lockable units for DB2?
A46. DB2 imposes locks of four differing sizes: pages, tables, tablespace and for indexes subpage.

Q47. What are the three lock types?
A47. The three types are **shared, update** and **exclusive**. **Shared locks** allow two or more programs to read simultaneously but not change the locked space. An **exclusive lock** bars all other users from accessing the space. An **update lock** is less restrictive; it allows other transactions to read or acquire shared locks on the space.

Q48. What is **isolation level**?
A48. SQL statements may return any number of rows, but most host languages deal with one row at a time by declaring a **cursor** that presents each row at a unique **isolation level.**

Q49. What is an **intent lock**?
A49. An **intent lock** is at the table level for a segmented tablespace or at the tablespace level for a nonsegmented tablespace. They indicate at the table or tablespace level the kinds of locks at lower levels.

Q50. What is the difference between **static** and **dynamic sql**?
A50. Static sql is hard-coded in a program when the programmer knows the statements to be executed. For **dynamic sql** the program must dynamically allocate memory to receive the query results.

Q51. What is **cursor stability**?
A51. Cursor stability means that DB2 takes a lock on the page the cursor is accessing and releases the lock when the cursor moves to another page.

Q52. What is the significance of the CURSOR WITH HOLD clause in a cursor declaration?
A52. The clause avoids closing the cursor and repositioning it to the last row processed when the cursor is reopened.

Q53. What is the SQL Communications Area and what are some of its key fields?
A53. It is a data structure that must be included in any host-language program using SQL. It is used to pass feedback about the sql operations to the program. Fields are return codes, error messages, handling codes and warnings.

Q54. What is the purpose of the **WHENEVER** statement?
A54. The **WHENEVER** statement is coded once in the host program to control program actions depending on the SQL-CODE returned by each sql statement within the program.

Q55. What is **DCLGEN**?
A55. DCLGEN stands for declarations generator; it is a facility to generate DB2 sql data structures in COBOL or PL/I programs.

Q56. What is the **FREE** command?
A56. The **FREE** command can be used to delete **plans** and/or **packages** no longer needed.

Q57. DB2 can implement a join in three ways using a **merge join**, a **nested join** or a **hybrid join**. Explain the differences.
A57. A **merge join** requires that the tables being joined be in a sequence; the rows are retrieved with a high cluster ratio index or are sorted by DB2. A **nested join** does not require a sequence and works best on joining a small number of rows. DB2 reads the outer table values and each time scans the inner table for matches. The hybrid join is a nested join that requires the outer table be in sequence.

Q58. Compare a **subselect** to a **join.**
A58. Any subselect can be rewritten as a join, but not vice versa. Joins are usually more efficient as join rows can be returned immediately, subselects require a temporary work area for inner selects results while processing the outer select.

Q59. What is the difference between **IN subselects** and **EXISTS** subselect?
A59. If there is an index on the attributes tested an IN is more efficient since DB2 uses the index for the IN. (IN for index is the mnemonic).

Q60. What is a **Cartesian product**?
A60. A **Cartesian product** results from a faulty query. It is a row in the results for every combination in the join tables.

Q61. 4/99 Mail from **Joseph Howard**: **'Q:** DB2 What is the difference between a **package** and a **plan**? How does one bind 2 versions of a CICS transaction with the same module name in two different CICS regions that share the same DB2 subsystem?
A61. Package and plan are usually used synonomously, as in this site. Both contain optimized code for SQL statements - a package for a single program, module or subroutine contained in the datebase request module (**DBRM**) library. A plan may contain multiple packages and pointers to packages. The one CICS module would then exist in a package that could be referenced in two different plans.

Q62. What is an **asychronous write**?
A62. It is a write to disk that may occur before or long after a commit. The write is controlled by the buffer manager.

Q63. What is a **lock**?
A63. A **lock** is the mechanism that controls access to data pages and tablespaces.
Q64. What is meant by **isolation level**?

A64. This is a key concept for any relational database. Isolation level is the manner in which locks are applied and released during a transaction. For DB@ a 'repeatable read' holds all locks untile the transaction completes or a syncpoint is issued. For transactions using 'cursor stability' the page lock releases are issued as the cursor 'moves', i.e. as the transaction releases addressability to the records.
Q65. What are **leaf pages**?
A65. They are the opposite of **root pages**. **Leaf pages** are the lowest level index pages - the pages that contain index entries and information to the corresponding table rows.

Q66. What is a **precompiler**?
A66. It is a DB2 facility for static SQL statements - it replaces these statements with calls to the DB2 language interface module.

Q67. What is a **root page**?
A67. The opposite of a **leaf** page; it is the highest level index page. An index can contain only the one root page; all other index pages are associated to the root.

Q68. What is a **thread**?
A68. A **thread** is the connection between DB2 and some other subsystem, such as CICS or IMS/DC

```
1.What's Bind and why u want to do a bind operation?
  Bind is a process in which it takes DBRM as the input and generate
access strategies that is to be stored in a package as the output.
  Before accessing data, DB2 has to decide which way it wants to access
the data, this bind process stores the access strategies in a package
and asks DB2 to use it while accessing data.

2.what's commit?what happened to the locks when commit is issued???.
  Commit is guaranteeing the success of the logical unit of the work.
  The locks gets released when the Commit is issued.

3.what's DCLGEN?what's the use of it?.
  DCLGEN is a declaration generator and also the host language variables
generator for the columns of the DB2 table. This output is copied to a
pds
member.
  Dclgen member is copied to a source program thru the INCLUDE dclmem
statement. No need for the user to write the equivalent WS variables for
the columns of a table.
4.Explain various types of locks available in DB2?
 Share lock, Exclusive lock, Intent share lock, Intent Exclusive lock,
Intent none lock.

5.what's cursor and how to code in application program?.
  Cursor is to hold the multiple rows in a program.
  Declare, Open, Fetch, & Close statements are to be coded in the
program.

6.Explain SQL codes -818,-811,-805?.
 -818 = Timestamp Mismatch
 -811 = Cursor not declared becoz select clause is giving mulitiple
rows.
 -805 = program(Package) name not found in plan.

7.What's the difference between DCLGEN generated copy book & COBOL copy
book?.
```

DCLGEN generated copybook contains Declare table statement giving the table structure along with the equivalent COBOL variable declarations.

COBOL copybook contains only the variable declarions.

8.In SPUFI where u specify the output results?If u have 1000 rows in a table
and u want to select only 100 rows.how can u do this?

In SPUFI, for the edit output characterists, give yes and as soon as you enter the screen, there is an option where we can mention the number of rows to be viewed in the output.

9.In a table some 49 coloumns are there?.If u want to select all the coloumns
Which one u prefer either * or all the coloumn names in select statement?.

All the column names in the select clause.

10.What's bind parameters?.

- ISOLATION level-CS,RR,UR,RS
- ACQUIRE-(ALLOCATE,USE)
- RELEASE-(DEALLOCATE,COMMIT)
- VALIDATE(BIND,RUN)
- DEGREE(1,ANY) → I/O Parallelism.
- OWNER()
- QUALIFIER()
- EXPLAIN(YES,NO)
- BIND(ADD,REPLACE)

11. Differnciate static SQL and dynamic SQL?

In case of Static SQL, The functionality, table names, column names are known at the bind time, where as in Dynamic sql, all these are known at the Run time only.

In case of Static sql, it gets bound only once, where as the dynamic sql gets bound everytime whenever it gets executed.

12.what's lock escalation and promotion?
Lock Escalation is to Escalate the lock to the higher levels if there are more locks at the lower level. For ex. If there are more page locks, then DB2 will escalate it to the table lock if it is a segmented table space.
Lock Promotion is to make the UPDATE lock to be promoted to the Exclusive lock for updating the data in the table.
13.Types of table spaces and explain?
Three types of table Spaces-Simple, Segmented, Partitioned.
Simple table spaces will contain all the tables data mixed in all the pages of the table space. Can have multiple tables.
Segmented table space will contain the segments(a group of pages)which holds data pertaining to only one table and wont allow other tables data into the already assigned segments. Can have multiple tables.
Partitioned table space is to have only one big table and the data will the lying in the different partitions.
14.tell me DB2 tuning?

```
DB2 tuning is decided after analysing the optimizer access strategy that
is stored in the Plan_table. For ex. If one of the columnname in the
plan_table that is ACCESSTYPE is 'R', then this shows that the query is
not making use of indexes while accessing data. This may be one of the
reasons for the poor performance of the query. At this stage, Add an
index to the table and do REBIND and check the performance of the query
and at the same time check the plan table, now the ACCESSTYPE column
will be with 'I'.

Host Variables.
```

A COBOL host structure is a named set of host variables that is defined in the program's WORKING-STORAGE SECTION or LINKAGE SECTION. COBOL host structures have a maximum of two levels, even though the host structure might occur within a multilevel structure. One exception is the declaration of a varying-length character string, which must be level 49.

Indicator Variables in COBOL

An indicator variable is a two-byte integer (PIC S9(4) USAGE BINARY). On retrieval, an indicator variable is used to show whether its associated host variable has been assigned a null value. On assignment to a column, a negative indicator variable is used to indicate that a null value should be assigned.
See **References to Host Variables** for more information on the use of indicator variables.
Indicator variables are declared in the same way as host variables, and the declarations of the two can be mixed in any way that seems appropriate to the programmer.

Example

Given the statement:

```
EXEC SQL FETCH CLS_CURSOR INTO
                                :DAY-VAR :DAY-IND,
                                :BGN-VAR :BGN-IND,
                                :END-VAR :END-IND
END-EXEC.
```

Variables can be declared as follows:

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
77 CLS-CD    PIC X(7).
77 DAY-VAR   PIC S9(4) BINARY.
77 BGN-VAR   PIC X(8).
77 END-VAR   PIC X(8).
77 DAY-IND   PIC S9(4) BINARY.
77 BGN-IND   PIC S9(4) BINARY.
77 END-IND   PIC S9(4) BINARY.
EXEC SQL END DECLARE SECTION END-EXEC.
```

Each *host-identifier* must be declared in the source program. The variable designated by the second *host-identifier* is called an *indicator variable* and must be a small integer.

The purposes of the indicator variable are to:

- Specify the null value. A negative value of the indicator variable specifies the null value.
- Indicate that a numeric conversion error (such as a divide by 0 or overflow) has occurred. [29]
- Indicate that a character could not be converted.
- Record the original length of a truncated string, if the string is not a LOB.
- Record the seconds portion of a time if the time is truncated on assignment to a host variable.

For example, if :V1:V2 is used to specify an insert or update value, and if V2 is negative, the value specified is the null value. If V2 is not negative the value specified is the value of V1.
Similarly, if :V1:V2 is specified in a CALL, FETCH, SELECT INTO or VALUES INTO statement, and if the value returned is null, V1 is undefined and V2 is set to a negative value. The negative value is:

- -1 if the value selected was the null value
- -2 if the null value was returned due to a numeric conversion error (such as divide by 0 or overflow) or a character conversion error. [30]

If the value returned is not null, that value is assigned to V1 and V2 is set to zero (unless the assignment to V1 requires string truncation in which case V2 is set to the original length of the string). If an assignment requires truncation of the seconds part of a time, V2 is set to the number of seconds.
If the second *host-identifier* is omitted, the host variable does not have an indicator variable. The value specified by the *host-variable* :V1 is always the value of V1, and null values cannot be assigned to the variable. Thus, this form should not be used unless the corresponding result column cannot contain null values. If this form is used and the column contains nulls, the database manager will return an error at run-time.
The general form of a *host-variable* reference in Java is:

```
>>-:--+-------+--+-Java-identifier-------+--------------------><
      +-IN----+   '-(--Java-expression--)-'
      +-OUT---+
      '-INOUT-'
```

In Java, indicator variables are not used. Instead, instances of a Java class can be set to a null value. Variables defined as Java primitive types can not be set to a null value.
If IN, OUT, or INOUT is not specified, the default depends on the context in which the variable is used. If the Java variable is used in an INTO clause, OUT is the default. Otherwise, IN is the default. For more information on Java variables, see **Using Host Variables and Expressions in Java**.
An SQL statement that references host variables must be within the scope of the declaration of those host variables. For host variables referenced in the SELECT statement of a cursor, that rule applies to the OPEN statement rather than to the DECLARE CURSOR statement.
The CCSID of a string host variable is the default CCSID of the application requester at the time the SQL statement that contains the host variable is executed

unless the CCSID is for a foreign encoding scheme. In this case the host variable value is converted to the default CCSID of the current server.

Example

Using the PROJECT table, set the host variable PNAME (VARCHAR(26)) to the project name (PROJNAME), the host variable STAFF (DECIMAL(5,2)) to the mean staffing level (PRSTAFF), and the host variable MAJPROJ (CHAR(6)) to the major project (MAJPROJ) for project (PROJNO) 'IF1000'. Columns PRSTAFF and MAJPROJ may contain null values, so provide indicator variables STAFF_IND (SMALLINT) and MAJPROJ_IND (SMALLINT).

```
  SELECT PROJNAME, PRSTAFF, MAJPROJ
    INTO :PNAME, :STAFF :STAFF_IND, :MAJPROJ :MAJPROJ_IND
    FROM PROJECT
    WHERE PROJNO = 'IF1000'
```

Host Variables in Dynamic SQL

In dynamic SQL statements, parameter markers are used instead of host variables. A parameter marker is a question mark (?) that represents a position in a dynamic SQL statement where the application will provide a value; that is, where a host variable would be found if the statement string were a static SQL statement. The following examples shows a static SQL statement that uses host variables and a dynamic statement that uses parameter markers:

```
   INSERT INTO DEPT
     VALUES( :HV_DEPTNO, :HV_DEPTNAME, :HV_MGRNO:IND_MGRNO,
:HV_ADMRDEPT)

   INSERT INTO DEPT
     VALUES( ?, ?, ?, ? )
```

VSAM

1.what's file status 39 in VSAM?.
 Fixed(physical) file attributes mismatch with the logical file in the program.

2.WHat happens when an empty VSAM file opens in COBOL?.
In output mode, we can open an empty vsam file.
In Input mode, we will get an error while opening it.

3.What's the primary allocation and secondary allocation in VSAM?.
Primary allocation is for one time allocation and the secondary allocation can be extended to 122 extents as when requested by the vsam dataset.