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CENG 301 Database Management Systems
Final Exam (Take-Home)

Q1) Decide if below statements are true or false (20 points).

1.1)	DBMS aims to provide data abstraction as much as possible	True ■	False ☐
1.2)	High level conceptual models bind to a specific commercial database	True ☐	False ■
1.3)	Physical storage structure of the database is called as internal schema	True ■	False ☐
1.4)	A table cannot have a relation to itself since it will cause and indefiniteness	True ☐	False ■
1.5)	An attribute can be atomic, composite, or multivalued	True ■	False ☐
1.6)	Constraints should be used to force valid data entry / modification to the database	True ☐	False ■
1.7)	A primary key can contain only single row with null value since duplicate values are not allowed	True ☐	False ■
1.8)	Comparison with null can be meaningfully done with equals and not equals operator	True ☐	False ■
1.9)	Order of execution is critical since some operations are only meaningful after some order (i.e. having)	True ■	False ☐
1.10)	As being a sub language of SQL, DML has select, insert, update, and delete operations	True ■	False ☐
1.11)	SQL does not support creating or deleting database object and granting or revoking access rights	True ■	False ☐
1.12)	Common Table Expression (CTE) is only used to develop recursive SQL queries	True ☐	False ■
1.13)	The implicit goals of the design activity are information preservation and minimum redundancy	True ■	False ☐
1.14)	Update anomalies are known as insertion anomalies, deletion anomalies, and modification anomalies	True ☐	False ■
1.15)	A well-designed database can handle both OLTP and OLAP operations efficiently	True ☐	False ■
1.16)	Database engine uses statistics to generate estimated execution plans then picks the best one	True ■	False ☐
1.17)	If a server has only one CPU core and single hyper-thread, then it does not support concurrent access	True ■	False ☐
1.18)	A DBMS must have ability to prevent lost update, dirty read, and incorrect summary problems	True ■	False ☐
1.19)	ACID means Atomicity, Consistency preservation, Isolation, and Durability	True ■	False ☐
1.20)	2PL uses locking mechanism to prevent multiple transactions from accessing the items concurrently	True ■	False ☐

Q2) Mark the correct choice for below questions (10 points).

2.1) Which statement is false about SQL Language?
a) SQL is the abbreviation of Structured Query Language
b) SQL contains sub languages such as DDL, DML, DCL, and TCL
c) SQL is based on relational data model and set based operations
d) SQL allows also cursor-based data processing which is faster compared to set based operations
e) SQL queries allows quick and efficient retrieval of a large amount of records from a database

2.2) Which one is not one of the four informal guidelines that may be used as measures to determine the quality of database design?
a) Making sure that the semantics of the attributes is clear in the schema
b) Reducing the redundant information in tuples
c) Reducing the NULL values in tuples
d) Using minimal number of entity and relations
e) Disallowing the possibility of generating spurious tuples

2.3) Which one is not one of the definitions of a NULL value?
a) The attribute does not apply to this tuple (i.e. Not Applicable → NA)
b) The data type is not suitable for the entry data
c) The attribute value for this tuple is unknown
d) The attribute value for this tuple will be determined later
e) The value is known but absent

2.4) Which below statement is not true for indexes?
a) Each table may contain at most one clustered index
b) Each table may contain none to many non-clustered index
c) Actual data is kept in the leaf of non-clustered index
d) Indexes are used to store data and allow efficient data retrieval
e) Non-clustered indexes increase data retrieval performance but decreases data modification performance

2.5) Which below is not one of the isolation levels in transaction processing?
a) Consistent read b) Read uncommitted c) Read committed d) Repeatable read e) Serializable

Q3) For below relational tables try to insert given data in PERSON table in given sequence, if you cannot insert data due to violation of a constraint (show 5 errors) just write "error" to the "operation status" (10 points).

CITY

CityId integer	Name varchar(10) not null
1	Adana
6	Ankara
7	Antalya
34	İstanbul

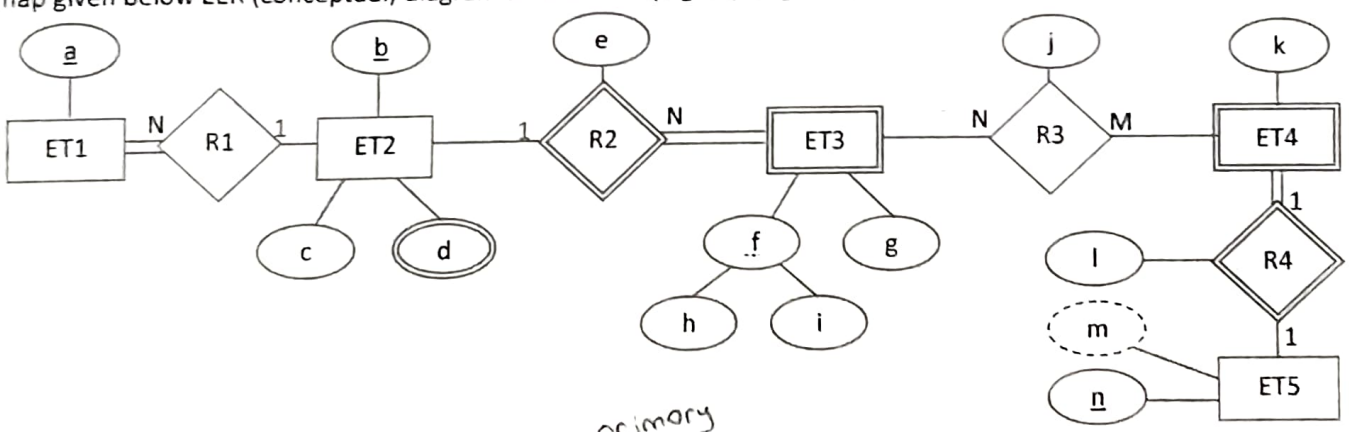
COUNTRY

CountryId integer	Name varchar(10) not null
1	Turkey
2	Azerbeycan
3	German
4	USA

PERSON

CitizenId integer CitizenId > 0	Name varchar(10) not null	Surname varchar(10) not null	Birthdate date (dd.mm.yyyy) nullable YEAR(Birthdate) > 1950	TaxId integer not null	CityId integer not null	CountryId integer	Operation status
null	Elif	UYSAL	Null	4	7	1	error
0	Sedat	YILMAZ	Null	1	1	3	error
1	Mehmet	ARSLAN	Null	1	1	1	
2	Mert	DOĞAN	Null	2	6	1	
3	Mustafa	ÇATALTAŞ	Null	9426521	7	1	
4	Ömer	METİN	17.07.1954	5	null	2	error
5	Sevcan	DOĞRAMACI	Null	4	34	null	error
6	Tuğba	KORKMAZ	22.06.1964	6	34	5	
7	Süleyman	ÇELİK	Null	-6	6	1	
8	Mustafa	DOĞAN	18.12.1946	7	34	4	error
9	Elif	TEK	Null	0	34	1	

Q4) Create necessary tables, fields, foreign keys, primary keys, unique indexes, not null (NN) constraints in order to map given below EER (conceptual) diagram to relational (logical) diagram (15 points).



Relational

ET1	
a	b NN

ET2 (b, c)

R2 (e, b)

ET3 (b, f, g) ← primary key

R3 (j)

ET4 (n)

R4 (l, n)

ET5 (n, m)

ET2, (b, d) → Composite attribute

ET3, (b, h, i, g)

join ET3/ET2 (Relation)

join ET3/ET4 (Relation)

Q5) For below EXPERIMENT and MEASUREMENT tables, write a query (*query5.sql*) that will create the desired output. For the output, experiment values in MEASUREMENT will be multiplied for each experiment and will be shown as ValueMultiplication derived attribute. Note that, use of you are only allowed to use what you learned in the class (set based solutions), i.e. user defined functions, cursors, stored procedure are not allowed (15 points).

EXPERIMENT

ExperimentId	Code
1	A10
2	A20
3	C40
4	B00
5	B99

MEASUREMENT

ExperimentId	Value
1	30.0
1	3.0
1	0.5
2	5.0
2	7.0
3	0.1
4	1.0
4	2.0
4	3.0
4	5.0
5	2.0
5	0.1
5	3.0

Desired output

ExperimentCode	ValueCount	ValueMultiplication
A10	3	45
A20	2	35
B00	4	30
B99	3	0.6
C40	1	0.1

30.0 x 3.0 x 0.5 → 45
5.0 x 7.0 → 35
1.0 x 2.0 x 3.0 x 5.0 → 30
2.0 x 0.1 x 3.0 → 0.6
0.1 → 0.1

Q6) For below DEPARTMENT table write a SQL query (*query6.sql*) so that repeated group names are shown with quotation symbol like in above desired output (15 points).

DEPARTMENT

ID	GroupName
1	Research and Development
2	Research and Development
3	Sales and Marketing
4	Sales and Marketing
5	Inventory Management
6	Research and Development
7	Manufacturing
8	Manufacturing
9	Executive General and Administration
10	Executive General and Administration
11	Executive General and Administration
12	Quality Assurance
13	Quality Assurance
14	Executive General and Administration
15	Inventory Management
16	Executive General and Administration

Desired output

ID	GroupName
1	Research and Development
2	"
3	Sales and Marketing
4	"
5	Inventory Management
6	Research and Development
7	Manufacturing
8	"
9	Executive General and Administration
10	"
11	"
12	Quality Assurance
13	"
14	Executive General and Administration
15	Inventory Management
16	Executive General and Administration

Q7) Develop *query7a.sql* and *query7b.sql* such that there will be a deadlock independent of order of execution of these 2 queries. Note that, once a query is executed other query should be executed immediately after it with minimal delay (in default isolation level: Read Committed). Then, suggest 2 different approaches to avoid deadlock for these queries such that first approach is fast but does not guarantees data integrity and second approach guarantees data integrity while being a bit slower (15 points).