Birla Institute of Technology and Science, Pilani
Mid-semester examination

Data management & warehousing
MPBA G506
Total marks: 50 (Closed-book examination)
Time: 4:00 pm - 5:30 pm (90 minutes)
Attempt all questions

1 For the following statements, write True/False as your answer. 5

1.1 Self Joins can be performed when there is unary relationship between entities
True

1.2 Together, a prime and non-prime attribute determine a non-prime attribute is a violation of the third Normal Form (3NF)
True

1.3 **`ON DELETE CASCADE`** is used to delete tuples of only one relation
False

1.4 In the E-R diagram, derived attributes are represented with braces '{}' inside the entity
False

1.5 Crow's-foot notation is not used as a notation for mapping cardinality.
False

2 Fill in the blanks for the following statements 5

2.1 In a situation where an attribute that is part of the candidate key can determine a non-prime attribute is a violation of _Second_ Normal Form (_2_NF).

2.2 Relationships treated as higher-level entities in an ER diagram is known as Aggregation

2.3 The PIN code is a fixed-length six-digit attribute with only specific permitted values, which is also known as _Domain_ of that attribute.

2.4 From the security point of view, two-tier database architecture is _Less_ secure compared to three-tier database architecture.

2.5 The all-or-none requirement in a relation field is known as _atomicity_.

3 For the relation R (A, B, C, D, E) 5

Calculate the normal form

FD: { E → A, A → BC, CD → E, B → D}

C.K. = {A, E, BC, CD }; P = {A, B, C, D, E}; NP = {}

3NF

4 Match the following 5

4.1 Primary key	a. Belongs to the referenced relation
4.2 Super key	b. Represented using a two-headed arrow
4.3 Foreign key	c. Represented using double ellipses in the ER diagram
4.4 Referential integrity constraint	d. Superset of candidate key attributes
4.5 Multi-valued attribute	e. It belongs to referencing relation

4.1 a
4.2 d
4.3 e
4.4 b
4.5 c

5 Match the following 5

5.1 Select operator	a. ×	A. Modifies the name of attributes/relations
5.2 Project operator	b. σ	B. Filters the attributes
5.3 Cartesian operator	c. ρ	C. Requires a predicate
5.4 Rename operator	d. Π	D. Adds spurious tuples in output relation
5.5 Join operator	e. ⋈	E. Filters the tuples

5.1-b-E
5.2-d-B
5.3-a-D
5.4-c-A
5.5-e-C

6 Write only one major difference between (one/two-liners only) 5

6.1 **`varchar(n)`** and **`nvarchar(n)`** data types

Both specify variable length character array with max length n, Nvarchar specifies Unicode encoding

6.2 Primary key and unique key

Unique key can be null

6.3 SQL's **`delete`** and **`drop`** statement

DELETE delete only tuples, DROP deletes entire relation with the schema

6.4 Total and partial participation

All entities of a relation are associated with the other relation is a Total relation

6.5 Overlapping and disjoint specialization
Overlapping: Possibility of an entity to be a part of two entity set in a hierarchical relation

7 Write executable and valid SQL code for the following queries for the preexisting **`student`** table. (As succinct as possible) 5

select student_name from students where student_name like '%esh%';

7.1 Fetch **`student_id`** and only show missing values.
select * from students where marks is null;
7.2 Show the **`student_id`**, **`team_name`**, and **`marks`** of students sorted as per their **`team_name`** of those students who scored more than 70 marks.
select student_id, marks, team_name from students where marks > 70 order by team_name;
7.3 Delete the tuples where **`marks`** are less than 60.
delete from students where marks < 60;
7.4 Increase the student **`marks`** by +1 if marks <100 (Use **`update`** statement)
update students set marks = marks + 1 where marks < 100;
7.5 Display the **`student_name`** of the students where the name contains ‘esh’
select student_name from students where student_name like '%esh%';

8 Briefly explain in only one statement the following Database system concepts. (One/Two-liners only) 5
3.1 Compatible relations
Relation having the same number of dimensions (arity)
3.2 Imperative programming
Programming that changes state variable
3.3 Physical schema
States the data structures which hold and manage data for a DBMS
3.4 Data dictionary
It stores the metadata and keeps physical information of the database and relations
3.5 Composite candidate key
Candidate key having more than one attribute

9 For the relation R (A, B, C, D, E) 5
Calculate the Minimal cover
FD: { $A \rightarrow B$, $AB \rightarrow C$, $D \rightarrow ACE$ }
Minimal cover: $A \rightarrow B$, $A \rightarrow C$, $D \rightarrow A$, $D \rightarrow E$

10 For the following section table 5

year	semester	course_id
2017	Fall	FIN-102
2018	Spring	FIN-112
2018	Fall	CS-121

2017	Spring	MU-123
2018	Fall	CS-315
2017	Fall	CS-319
2018	Fall	MU-192
2017	Spring	PHY-311
2018	Spring	FIN-102
2018	Fall	PHY-311

Show the output relation as per the following relational algebra queries.

1. $\Pi_{course\_id}\ (\sigma_{semester\ =\text{"Fall"}\ \wedge\ year=2017}\ (section)) \cup \Pi_{course\_id}\ (\sigma_{semester\ =\text{"Spring"}\ \wedge\ year=2018}\ (section))$
2. $\Pi_{course\_id}\ (\sigma_{semester\ =\text{"Fall"}\ \wedge\ year=2017}\ (section)) \cap \Pi_{course\_id}\ (\sigma_{semester\ =\text{"Spring"}\ \wedge\ year=2018}\ (section))$
3. $\Pi_{course\_id}\ (\sigma_{semester\ =\text{"Fall"}\ \wedge\ year=2017}\ (section)) - \Pi_{course\_id}\ (\sigma_{semester\ =\text{"Spring"}\ \wedge\ year=2018}\ (section))$
4. $\Pi_{course\_id}\ (\sigma_{semester\ =\text{"Fall"}\ \wedge\ year=2018}\ (section)) \cup \Pi_{course\_id}\ (\sigma_{semester\ =\text{"Spring"}\ \vee\ year=2017}\ (section))$
5. $\Pi_{course\_id}\ (\sigma_{semester\ =\text{"Fall"}\ \vee\ year=2018}\ (section)) \cap \Pi_{course\_id}\ (\sigma_{semester\ =\text{"Spring"}\ \wedge\ year=2017}\ (section))$

A	B	C	D	E	F
Fall ∧ 2017	**Fall ∧ 2018**	**Spring ∧ 2017**	**Spring ∧ 2018**	**Spring ∨ 2017**	**Fall ∨ 2018**
FIN-102	CS-121	MU-123	FIN-102	FIN-102	FIN-102
CS-319	CS-315	PHY-311	FIN-112	FIN-112	FIN-112
	MU-192			MU-123	FIN-102
	PHY-311			CS-319	CS-121
				PHY-311	CS-315
				FIN-102	CS-319
					MU-192

					PHY-311

1. B ∪ D	2. B ∩ D	3. B − D	4. A ∪ E	5. F ∩ C
FIN-102	FIN-102	CS-319	CS-121	PHY-311
FIN-102	FIN-102		CS-315	
CS-319			CS-319	
FIN-112			MU-123	
			MU-192	
			PHY-311	
			PHY-311	
			FIN-102	
			FIN-102	
			FIN-112	