Duration: 50 min.   **Max.Marks:15**
Note: - There is internal choice in Question 3

Q1. Solve the following: **(3)**

Id	Name	Age	Gender	OccupationId	CityId
1	John	25	Male	1	3
2	Sara	20	Female	3	4
3	Victor	31	Male	2	5
4	Jane	27	Female	1	3

Occupation

OccupationId	OccupationName
1	Software Engineer
2	Accountant
3	Pharmacist
4	Library Assistant

City

CityId	CityName
1	Halifax
2	Calgary
3	Boston
4	New York
5	Toronto

1. Solve the following relational expressions for above relations.

   a. $P_{Name}(R_{Age>25}(\text{User}))$

   b. $R_{Id>2 \vee Age!=31}(\text{User})$

   c. $R_{User.OccupationId=Occupation.OccupationId}(\text{User X Occupation})$

   d. User ⋈ Occupation ⋈ City

   e. $P_{Name,Gender}(R_{CityName="Boston"}(\text{User} ⋈ \text{City}))$

2. Write SQL statements for relational expressions in question 1.

**Q2.** Explain the following: **(2*4=8)**

   i.   How does DBMS provide data abstraction? Explain the concept of data independence.
   ii.   What is DBA? Mention the functionalities of DBA.
   iii.   Explain the importance of Null value in Relational Model.
   iv.   Which of the following is not outer join and why?
           (a) Left outer join
           (b) Right outer join
           (c) Full outer join
           (d) All of the mentioned

Q3. (a) Consider the following ER diagram: **(1*4=4)**
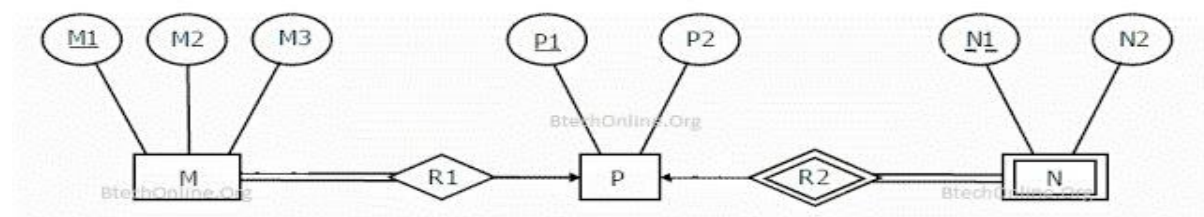
The minimum number of tables needed to represent M, N, P, R1, R2 is:
(a) 2 (b) 3 (c) 4 (d) 5   also make these tables.

Q3. (b) Let R and S be two relations with the following schema R (P,Q,R1,R2,R3) S (P,Q,S1,S2) Where {P, Q} is the key for both schemas. Which of the following queries are equivalent?

$$\text{I.} \quad \Pi_P (R \bowtie S)$$

$$\text{II.} \quad \Pi_P (R) \bowtie \Pi_P (S)$$

$$\text{III.} \quad \Pi_P \left(\Pi_{P,Q} (R) \cap \Pi_{P,Q} (S) \right)$$

$$\text{IV.} \quad \Pi_P \left(\Pi_{P,Q} (R) - \left(\Pi_{P,Q} (R) - \Pi_{P,Q} (S) \right) \right)$$

(i)   Only I and II
(ii)   Only I and III
(iii)   Only I, II and III
(iv)   Only I, III and IV

Q3. (c) Suppose (A,B) and (C,D) are two relation schemas. Let r1 and r2 be the corresponding relation instances. B is a foreign key that refers to C in r2. If data in r1 and r2 satisfy referential integrity constraints, which of the following is ALWAYS TRUE?

$$\text{(A)} \quad \Pi_B (r_1) - \Pi_C (r_2) = \varnothing$$

$$\text{(B)} \quad \Pi_C (r_2) - \Pi_B (r_1) = \varnothing$$

$$\text{(C)} \quad \Pi_B (r_1) = \Pi_C (r_2)$$

$$\text{(D)} \quad \Pi_B (r_1) - \Pi_C (r_2) \neq \varnothing$$

(i)   A   (ii)   B   (iii)   C   (iv)   D

Q3. (d) Consider a relational table with a single record for each registered student with the following attributes.
1. Registration _Number: Unique registration number of each registered student
2. UID: Unique Identity number, unique at the national level for each citizen
3. Bank Account _Number: Unique account number at the bank. A student can have multiple accounts or joint accounts. This attributes stores the primary account number
4. Name: Name of the Student
5. Hostel_ Room: Room number of the hostel
which of the following options is INCORRECT?
(a) Bank Account _Number is a candidate key
(b) Registration _Number can be a primary key
(c) UID is a candidate key if all students are from the same country
(d) If S is a superkey such that S ∩ UID is NULL then S U UID is also a superkey

OR

Q3. (a) Consider a relation scheme R = (A, B, C, D, E, H) on which the following functional dependencies hold: {A–>B, BC–>D, E–>C, D–>A}. What are the candidate keys of R?
(A) AE, BE
(B) AE,BE ,DE
(C) AEH,BEH, BCH
(D) AEH,BEH,DEH

Q3. (b) The following functional dependencies are given:

AB->CD, AF->D, DE->F, C->G , F->E, G->A

Which one of the following options is false?

(a)$CF^+ = \{ACDEFG\}$ (b)$BG^+ = \{ABCDG\}$

(c)$AF^+ = \{ACDEFG\}$ (d)$AB^+ = \{ABCDFG\}$

Q3. (c) Consider the relation X(P, Q, R, S, T, U) with the following set of functional dependencies

F = {

$\{P, R\} \rightarrow \{S, T\}$

$\{P, S, U\} \rightarrow \{Q, R\}$

}

Which of the following is the trivial functional dependency in F+ is closure of F?

(a) $\{P, R\} \rightarrow \{S, T\}$

(b) $\{P, R\} \rightarrow \{R, T\}$

(c) $\{P, S\} \rightarrow \{S\}$

(d) $\{P, S, U\} \rightarrow \{Q\}$

Q3. (d) Consider the following functional dependencies in a database.

Date_of_Birth->Age   Age->Eligibility

Name->Roll_number   Roll_number->Name

Course_number->Course_name   Course_number->Instructor

(Roll_number, Course_number)->Grade

The relation (Roll_number, Name, Date_of_birth, Age) is

(a) in second normal form but not in third normal form

(b) in third normal form but not in BCNF

(c) in BCNF

(d) in none of the above   **(1*4=4)**