**Exercise 1 (Knowledge Questions) [25 points]**

1. **What is a DBMS? What are the processes that a DBMS facilitates?** **[5 points]**  
   DBMS ( Database Management System ) is a system software which allows us to manage and create databases. Such databases are collection of related data in a symmetrical way which allows either the user or the programmer to create, manage and update such data.  
   DBMS facilitates the process of queries and the process of accessing the stored data such as:

* Definition
* Construction
* Manipulation
* Sharing of databases among users

1. **Consider a database of employees in which we need to record information about employees’ addresses. Name at least two conditions that would cause you to make “address” an entity set of its own rather than an attribute of the employee entity set.**

The two conditions that would cause you to make “addres” an entity set rather than an attribute are:

1. An employee in a company make have numerous addresses and all of them have to be stored in the database. The easiest way will be to make it an individual entity set
2. Address attribute will have many values like state, city, street, zip etc. To make it a different entity we will ease the effort of accessing the data.
3. **What is the difference of generalization and aggregation? [5 points]**

Generalization: It is a type of specialization to generalisation class which uses the “IS-A”. It is a bottom-up approach in which on combination of two lower level entities, one big broad level entity is made. For Example: Saving and Checking IS-A Account or Car and Bicycle IS-A Vehicle etc.

Aggregation: It is a process in which relation between two entities are treated as a single entity. For Example: University offers Courses ( this can be grouped into one entity ) and any visitor visiting can enquire from that single entity i.e University and Courses.

1. **List the basic operations of the Relational Algebra with their name and their correct symbolic notation. [5 points]**  
   The basic operations are:

* ∪ symbol represents Union operator
* - symbol represents Difference operator
* ×symbol represents Cartesian Product operator
* π symbol represents Projection operator
* σ symbol represents Selection operator
* ρ symbol represents Rename operator

1. **What is a key? Should a key contain only a single value? If yes, explain why. If not, give an example. [5 points]**

They play a really important role in dbms. They are used to establish a relationships between the tables and ensure that every element in the table can be uniquely identified by one or more fields in a table. One of the keys can be made into a Primary Key. It can be denoted as Let us assume R(A1, A2, ..., An), and let X ⊆ {A1, A2, ..., An}. X is called key. It has two important conditions that we should keep in mind

1.Uniqueness: for all t1,t2 ∈ R: t1[X] = t2[X] => t1 = t2

2.Minimality: there is no Y ⊆X, such that condition 1 is met.

According to these conditions the key can only have single value. As we see here the key should have a value that can distinguish it from all the other values and can be pointed but if we allow keys to have multiple values then it defeats the whole purpose of minimality as Y exists now which can satisfy that condition and the key is composite which isn’t necessary.

Example: SSN and Contact Number both of these can be used to uniquely identify a person, but if we have a composite key which exist that can unnecessarily defeat the person and not meet the seond condition i.e Minimality.