**COMP 3005**  
**Assignment #1**  
**Due: Sept. 27@11:59PM**

**Instruction**

1. Do the assignments independently. Copying is not allowed.
2. First replace Last in the Employee table with your own last name. If your last name is not shown correctly in the result, you will get 0 for the assignment.
3. Do this assignment directly on this document and rename it with your last + first name and submit to **brightspace**. Scanned handwritten documents *won’t* be accepted. Make sure your uploaded file can be opened.
4. You need to use either [Openstack](https://carleton.ca/scs/tech-support/scs-open-stack/openstack-technical-support/openstack-step-by-step-guide/) or install Oracle VM on your personal computing running intel chips. Macbooks with M1 chips cannot use Oracle VM. Detail about how to install and use Oracle VM can be found in the file Oracle-VM2023.docx.

**Part 1 Concepts (20 marks)**

Explain the following concepts based on the definitions given in the lecture notes. Different answers found online will be marked wrong. The explanation should be complete; i.e, it does not contain any concept not explained here. Each concept is 2 marks.

1. Data

Data refers to information that can be recorded that holds meaning. They are facts that that have implied meanings such as someone’s contact information. We assume someone’s name and phone number to be true so it is a fact.

1. Domain

A domain is a space that defines valid values. In the context of databases, the domain is the set of valid values for attributes. It has a name, a type, and a set of values. Values for the attributes need to fall into the specified domain in order to be correct.

1. Attribute

An attribute is a characteristic of something. In the context of a database, an attribute is a characteristic of a relation (a table). A set attributes identifies a row in a table. They are also called keys.

1. Key

In the context of databases, keys are the set of attribute(s) that uniquely identifies a row in a table. They are underlined in the table to indicate that they are the key to that table. They are one way to constrain in a relational model.

1. Primary Key

In a database, a primary key is typically a chosen key that is the smallest of all the keys in terms of size. They are used to identify tuples in a relation. When tuple(s) in relations reference a tuple(s) in other relations, they use this type of key.

1. Key integrity constraints

This type of constraint specifics uniqueness for values of a data item. For example, in a course table, no two courses can have the same course id, or else they would not be different.

1. Entity Integrity Constraint

Entity integrity constraints state that no primary keys can be NULL. Since primary keys are used to identify unique tuples in a relation, they cannot be NULL or we have no way of identifying some tupples.

1. Referential Integrity Constraint

Referential integrity constraint is a constraint that is applied between two relations and is used to maintain consistency between them. It basically says that if a tuple in one relation refers to a tuple in another relation, it must exist. It involves the use of a foreign key, which is an attribute that refers to the primary key in a relation. The value of the foreign key column(s) must have the same domain as the primary key that they are referencing or NULL.

1. Data Definition Language (DDL)

DDL is the language used to specify the schema constructs. This includes the creation, modification and access control of a schema.

1. Query Language (QL)

QL is the language to specify database queries. These provide an alternative to programming, making it faster to write the queries.

**Part 2 (80 marks)**

Given the following employee and project databases with three relations. Use Oracle DBMS to create, populate and query this database. Test your statements on Oracle DBMS and take necessary screenshots to show your statements executed successfully. Copy and paste the corresponding SQL statements into this assignment.

1. Use SQL Data Definition Language to create the database. You should properly define primary keys and foreign keys with other 8uniqueintegrity constraints of different kinds. You can use check more than once. **Boldface** every integrity constraints. (10)
2. Use SQL Data Manipulation Language to populate the database with the data given in the tables. (10)
3. Use Relational Algebra (ALG) to express the following queries based on the above database. Submit your ALG expressions for each query as well as the query result. Each query is 4 marks and the result is 2 marks (60)

|  |  |  |  |
| --- | --- | --- | --- |
| **Employee** | | | |
| **E#** | **Name** | **Age** | **Manager** |
| E1 | Adams | 50 |  |
| E2 | Blake | 40 | E1 |
| E3 | Clark | 35 | E1 |
| E4 | David | 30 | E3 |
| E5 | Emily | 25 | E4 |
| E6 | Last | 20 | E5 |

|  |  |  |
| --- | --- | --- |
| **Workson** | | |
| **E#** | **P#** | **Hours** |
| E1 | P1 | 700 |
| E2 | P1 | 300 |
| E2 | P2 | 200 |
| E3 | P1 | 100 |
| E3 | P2 | 200 |
| E3 | P3 | 300 |
| E4 | P1 | 100 |
| E4 | P2 | 200 |
| E4 | P3 | 300 |
| E6 | P1 | 200 |
| E6 | P2 | 300 |
| E6 | P3 | 400 |
| E6 | P4 | 500 |

|  |  |  |
| --- | --- | --- |
| **Project** | | |
| **P#** | **Name** | **Location** |
| P1 | CPU | B1 |
| P2 | GPU | B2 |
| P3 | GPU | B2 |
| P4 | SSD | B3 |

1. Use Relational Algebra (ALG) to express the following queries based on the above database. Submit your ALG expressions for each query as well as the query result. Each query is 4 marks and the result is 2 marks (60)
2. Get the age of Last.
3. Get the name of Last’s manager
4. Get the name of the employee who works on GPU project.
5. Get the name of the employee who does not work on any project.
6. Get the pair of employee name and project name such that the employee works on the project less than 300 hours.
7. Get the name of the employee who works on every project
8. Get the name of the employee who works on every project except SSD.
9. Get the name of the employee who works on every project that Clark works on.
10. Get the name of the employee who works on the same projects that Clark works on.
11. Get the name of the employee who works on more than two projects.