**BTD310- Assignment 1**

**Due date – September 28, 2018**

Please work in **groups** to complete this lab. This assignment is worth **5% of the total course grade** and will be evaluated through your written submission. Each day being late will result in 10% mark penalty.

Please submit the following files through Blackboard:

* Asg1.docx

1. Add this declaration on the top of your Asg1.docx file.

We, Lukas, Muskan, Priya declare that the attached assignment is our own work in accordance with the Seneca Academic Policy. No part of this assignment has been copied manually or electronically from any other source (including web sites) **or distributed to other students.**

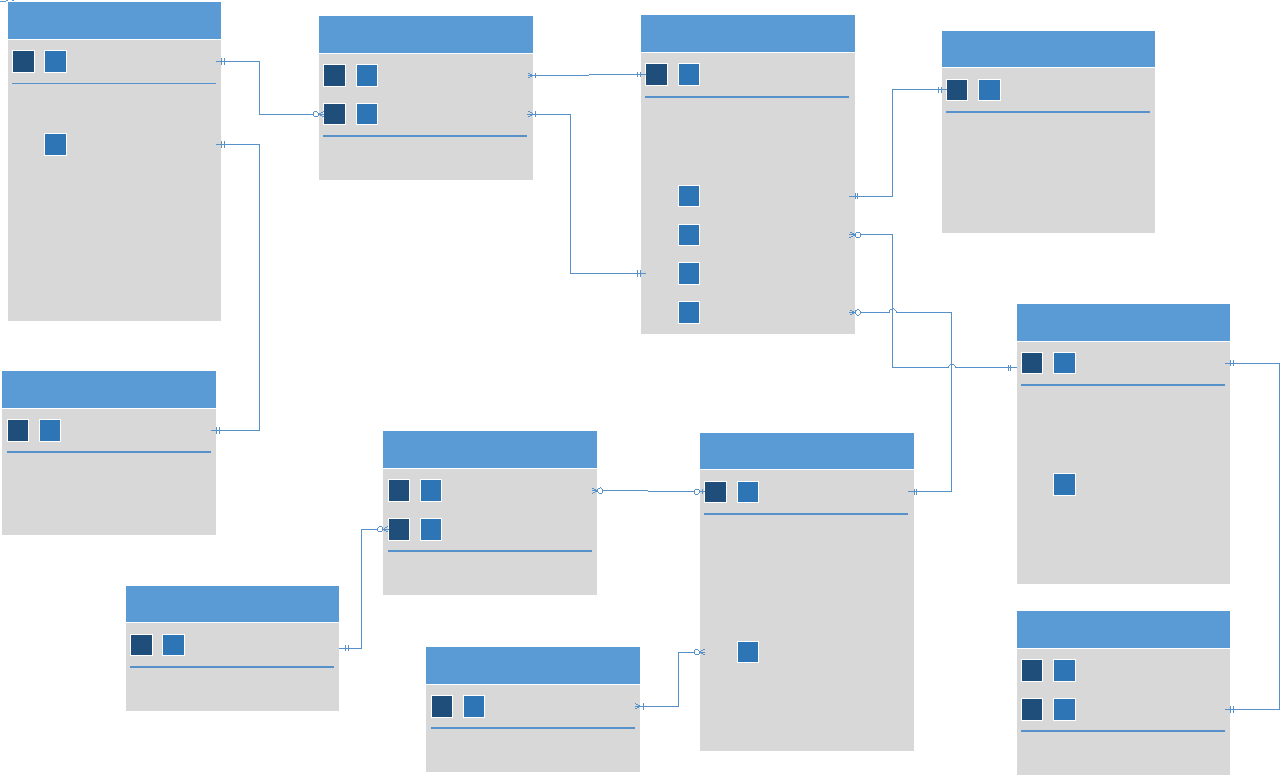
1. Specify what each member has done towards the completion of this work:

|  |  |  |
| --- | --- | --- |
|  | Name | Task(s) |
| 1 | Lukas |  |
| 2 | Muskan |  |
| 3 | Priya |  |

1. Normalization (20 marks):
   1. For **each user view**, submit a 3NF solution. Show all steps: UNF, 1NF, 2NF, 3NF. Clearly show all dependencies, using the arrow notation.
2. Conceptual design (20 marks): Merge the normalized solutions above:
   1. Merging is accomplished by grouping all attributes of 3NF entities that have the identical Primary Key into a single consolidated entity.
   2. After merging, make the attribute names consistent.
   3. You may also need to eliminate some new transitive entities as some entities may have gone back to 2NF.
   4. At this stage, you should closely inspect any resulting entities that have a concatenated Primary Key to ensure that they truly represent a “Many-to- Many” relation. When the relation is actually a “One-to-Many” relation, you must correct the Primary Key by removing one or more columns from the PK and including them as non-key attribute(s).
   5. Check that all necessary Bridge Entities exist and create them if needed.
   6. For each resulting entity, clearly mark the primary and foreign keys as shown in the sample below:

**Relation1 [ column1 (PK), column2, column3, column4 (FK) ]**

1. ERD (10 marks):
   1. Use Microsoft Visio to draw a Crow’s Foot ERD model for the (merged) conceptual design of the database. This ERD MUST match your conceptual design. Show all entities, attributes, and relationships. Clearly show the strength of relationships, show proper notation for participation (mandatory/ optional / connectivities).



**Description**

An engineering firm named **SENECA*-PLUS*** provides design and build services to Government and private organizations. There are five user views from which you can determine an optimal 3NF logical solution. Note that each employee has exactly one skill.

At the end of each project, an invoice is delivered to the customer including the engineering and equipment charges. Below is a screen shot of one of their invoices.

**USER VIEW #1**

**SENECA-PLUS INVOICE**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Invoice Num: EAP-44720 Invoice Date: Oct 17, 2017** | | | | | | | | | |
| **Customer** : 103 – Sears Canada  **Address**  : 417 Allstate Road  Toronto, ON  M2N 6H4 | | | | | | | | | |
| **Project** : Build North Bay Shopping Centre  **Project Type** : 5 – Build Shopping Centre  **Location** : North Bay, ON | | | | | | | | | |
| **Engineering Charges** | | | | | | | | | |
| **Employee** | **Skill** | **Skill**  **Hourly Rate** | | **Date** | | | **Hrs.** | **Charge** | |
| Hall, Roy | Produce Blueprints | 100.00 | | 2017-10-10 | | | 7.0 | 700.00 | |
|  |  |  | | 2017-10-11 | | | 6.5 | 650.00 | |
| Relton, Joan | Produce Blueprints | 100.00 | | 2017-10-10 | | | 6.0 | 600.00 | |
|  |  |  | | 2017-10-11 | | | 7.5 | 750.00 | |
| Rogers, Ann | Supervise Foundation | 150.00 | | 2017-10-12 | | | 7.0 | 1050.00 | |
|  |  |  | | 2017-10-13 | | | 6.0 | 900.00 | |
|  |  |  | | 2017-10-14 | | | 7.0 | 1050.00 | |
| Wang, Alex | Electrical Supervisor | 150.00 | | 2017-10-13 | | | 7.0 | 1050.00 | |
|  |  |  | | 2017-10-14 | | | 6.0 | 900.00 | |
| **Sub-total Engineering Charges:** $7,600.00 | | | | | | | | | |
| **Equipment Charges** | | | | | | | | | |
| **Equipment Number** | | | **Date** | | **Total Hours** | **Hourly**  **Rate** | | | **Charge** |
| P100 - Kodac Photocopier | | | 2017-10-14 | | 7.0 | 60.00 | | | 420.00 |
| CMT22 - Concrete Mixer Truck | | | 2017-10-14 | | 8.0 | 250.00 | | | 2000.00 |
| CMT22 - Concrete Mixer Truck | | | 2017-10-15 | | 8.0 | 250.00 | | | 2000.00 |
| **Sub-total Equipment Charges:** $4,420.00 | | | | | | | | | |
| **Total Charges:** $12,020.00  **PST(8%):**  $961.60  **GST(7%):** $841.40  **\_\_\_\_\_\_\_\_\_**  **Grand Total This Invoice: $13,823.00** | | | | | | | | | |

Answer 3:

**1NF:**

**PK** is (INV\_NUM, EQUIP\_NUM, (EMP\_FIRSTNAME, EMP\_LASTNAME))

(INV\_NUM, EQUIP\_NUM, (EMP\_FIRSTNAME, EMP\_LASTNAME) – INV\_DATE, CUST\_NO, CUST\_NAME, CUST\_ADDRESS, PROJ\_NAME, PROJ\_TYPE, PROJ\_LOCATION, EMP\_SKILL, EMP\_CHG\_PER\_HR, EMP\_DATE, EMP\_HRS, EQUIP\_NAME, EQUIP\_DATE, EQUIP\_HRS, EQUIP\_CHG\_PER\_HR)

**PARTIAL DEPENDENCIES:**

(INV\_NUM – INV\_DATE, CUST\_NO, CUST\_NAME, CUST\_ADDRESS, PROJ\_NAME, PROJ\_TYPE, PROJ\_LOCATION)

(EQUIP\_NUM – EQUIP\_NAME, EQUIP\_DATE, EQUIP\_HRS, EQUIP\_CHG\_PER\_HR)

(EMP\_FIRSTNAME, EMP\_LASTNAME – EMP\_SKILL, EMP\_CHG\_PER\_HR, EMP\_DATE, EMP\_HRS)

**TRANSITIVE DEPENDENCIES:**

(CUST\_NO – CUST\_NAME, CUST\_ADDRESS)

(PROJ\_NAME – PROJ\_TYPE, PROJ\_LOCATION)

(EMP\_SKILL – EMP\_CHG\_PER\_HR)

**2NF:**

Introducing EMP\_NUM as Surrogate PK of entity EMPLOYEES

INVOICES (INV\_NUM – INV\_DATE, CUST\_NO, CUST\_NAME, CUST\_ADDRESS, PROJ\_NAME, PROJ\_TYPE, PROJ\_LOCATION)

EQUIPMENTS (EQUIP\_NUM – EQUIP\_NAME, EQUIP\_DATE, EQUIP\_HRS, EQUIP\_CHG\_PER\_HR)

EMPLOYEES (EMP\_NUM – EMP\_FIRSTNAME, EMP\_LASTNAME, EMP\_SKILL, EMP\_CHG\_PER\_HR, EMP\_DATE, EMP\_HRS)

**3NF:**

Introducing PROJ\_NUM as Surrogate PK of entity PROJECTS

INVOICES (INV\_NUM – INV\_DATE, CUST\_NO, PROJ\_NUM, EQUIP\_NUM, EMP\_NUM)

CUSTOMERS (CUST\_NO – CUST\_NAME, CUST\_ADDRESS)

PROJECTS (PROJ\_NUM – PROJ\_NAME, PROJ\_TYPE, PROJ\_LOCATION)

EQUIPMENTS (EQUIP\_NUM – EQUIP\_NAME, EQUIP\_CHG\_PER\_HR, EQUIP\_HRS, EQUIP\_DATE)

EMPLOYEES (EMP\_NUM – EMP\_FIRSTNAME, EMP\_LASTNAME, EMP\_SKILL, EMP\_CHG\_PER\_HR, EMP\_HRS)

SKILLS (EMP\_SKILL – EMP\_CHG\_PER\_HR)

**USER VIEW #2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SENECA-PLUS**  **Employees By Project Report** | | | | |
| **ProjNum** | **Project Name** | **Emp Num** | **Name** | **Years In**  **Company** |
| 06-2337 | Build North Bay Shopping Centre | 311 | Roy Hall | 7 |
| 06-2337 | Build North Bay Shopping Centre | 201 | Joan Relton | 11 |
| 06-2337 | Build North Bay Shopping Centre | 299 | Ann Rogers | 9 |
| 06-2337 | Build North Bay Shopping Centre | 331 | Alex Wang | 5 |
| 06-2338 | Addition to South Lake Hospital | 205 | Pui-Ling Chan | 11 |
| 06-2338 | Addition to South Lake Hospital | 298 | Robert Guilmore | 9 |
| 06-2338 | Addition to South Lake Hospital | 311 | Roy Hall | 7 |
| 06-2338 | Addition to South Lake Hospital | 201 | Joan Relton | 11 |
| 06-2338 | Addition to South Lake Hospital | 331 | Alex Wang | 5 |

Answer 3:

**1NF:**

**PK** is: (PROJ\_NUM, EMP\_NUM)

(PROJ\_NUM, EMP\_NUM – PROJ\_NAME, EMP\_FIRSTNAME, EMP\_LASTNAME, YRS\_IN\_CMP)

**PARTIAL DEPENDENCIES:**

**(**PROJ\_NUM – PROJ\_NAME)

(EMP\_NUM – EMP\_FIRSTNAME, EMP\_LASTNAME, YRS\_IN\_CMP)

**2NF:**

(PROJ\_NUM, EMP\_NUM)

PROJECTS (PROJ\_NUM – PROJ\_NAME)

EMPLOYEES (EMP\_NUM – EMP\_NAME, YRS\_IN\_CMP)

**3NF:**

Since there are no transitive dependencies, the above is already in 3NF.

**USER VIEW #3**

**SENECA-PLUS**

**EMPLOYEE BENEFITS REPORT**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Emp**  **Num** | **Emp**  **Name** | **Phone** | **Benefit**  **Num.** | **Benefit** | **Start**  **Date** |
| 205 | Stan Chan | (905) 662-3887 | SU-141 | Sun Life Medical(Group 144) | 1995-01-05 |
| 205 | Stan Chan | (905) 662-3887 | EPP-78 | Engineer Pension Plan(Grp 78) | 2004-09-15 |
| 205 | Stan Chan | (905) 662-3887 | MU-100 | Mutual Life – Life Insurance-I | 2004-09-15 |
| 311 | Roy Hall | (416) 487-2480 | EPP-78 | Engineer Pension Plan(Grp 78) | 2009-11-15 |
| 311 | Roy Hall | (416) 487-2480 | MU-100 | Mutual Life – Life Insurance-I | 2009-09-07 |
| 331 | Alex Wang | (905) 457-7728 | SU-141 | Sun Life Medical(Group 144) | 2002-06-22 |

Answer 3:

**1NF:**

**PK** is (EMP\_NUM, BENEFIT\_NUM)

(EMP\_NUM, BENEFIT\_NUM – EMP\_FIRSTNAME, EMP\_LASTNAME, EMP\_PHONE, BENEFIT\_NAME, BENEFIT\_START\_DATE)

**PARTIAL DEPENDENCIES:**

(EMP\_NUM – EMP\_FIRSTNAME, EMP\_LASTNAME, EMP\_PHONE)

(BENEFIT\_NUM – BENEFIT\_NAME, BENEFIT\_START\_DATE)

**TRANSITIVE DEPENDENCES:**

No transitive dependencies

**2NF:**

(EMP\_NUM, BENEFIT\_NUM)

EMPLOYEES (EMP\_NUM – EMP\_FIRSTNAME, EMP\_LASTNAME, EMP\_PHONE)

BENEFITS (BENEFIT\_NUM – BENEFIT\_NAME, BENEFIT\_START\_DATE)

START DATE (EMP\_NUM, BENEFIT\_NUM, BENEFIT\_STATE\_DATE)

**3NF:**

Since there are no transitive dependencies, the tables are already in 3NF.

**USER VIEW #4**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SENECA-PLUS**  **CUSTOMERS BY GROUP** | | | | |
| **Customer**  **Type** | **Customer**  **Sub-Group** | **Customer**  **Name** | **Phone** | **FAX** |
| Gouvernment | Federal | Department of Defense | (877)223-4172 | (207)223-4179 |
| Gouvernment | Federal | Department of Agriculture | (877)223-4111 | (207)223-4113 |
| Gouvernment | Federal | National Archives | (877)223-4201 | (207)223-4202 |
| Gouvernment | Provincial | Ministry of Transportation | (595)326-5173 | (595)326-5181 |
| Gouvernment | Provincial | Ministry of Health | (583)566-4744 | (583)566-4743 |
| Corporation | Financial Services | DUCA Credit Union | (859)692-4292 | (589)692-4299 |
| Corporation | Financial Services | Bank of Nova Scotia | (978)288-4319 | (817)288-5319 |
| Corporation | Oil | Esso Imperial | (856)945-5168 | (856)945-5163 |
| Corporation | Retail | Sears Canada | (678)848-9987 | (678)-948-9989 |

Answer 3:

**1NF:**

Introducinga surrogate PK – CUST\_NO

(CUST\_NO – CUST\_NAME, CUST\_TYPE, CUST\_SUB\_TYPE, CUST\_PHONE, CUST\_FAX)

**PARTIAL DEPENDENCIES:**

Since there is only one PK, there is no partial dependency.

**TRANSITIVE DEPENDENCIES:**

(CUST\_TYPE – CUST\_SUB\_TYPE)

**2NF:**

Since there is no partial dependency, the table is already in 2NF.

**3NF:**

CUSTOMERS (CUST\_NO – CUST\_NAME, CUST\_TYPE, CUST\_PHONE, CUST\_FAX)

CUST\_TYPES (CUST\_TYPE, CUST\_NO – CUST\_SUB\_TYPE)

**USER VIEW #5**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SENECA-PLUS**  **Weekly Sales Report** | | | | | | | | | |
| **Equip**  **Class** | **Class**  **Description** | **Equip**  **Num** | **Equipment**  **Description** | **Charge** | **Qty** | **Inv.**  **Num.** | **Inv.**  **Date** | **SalesRep**  **Person** | **Cust**  **No** |
| OFF | Office Copier | P100 | Kodac Photocopier | $420.00 | 2 | EAP-44720 | 05-10-17 | 23-Oliv Gardenor | 103 |
| MIX | Concrete Mix | CMT22 | Concrete Mixer | $4000.00 | 20 | EAP-44720 | 05-10-17 | 23-Oliv Gardenor | 103 |
| TRU | Wood Trusses | A100 | 50’ x 16’ Roofing | $1200.00 | 48 | EAP-44721 | 05-10-18 | 13-Walter Chan | 83 |
| FRM | Framing | A137 | 2 x 4 x 8 Poplar | $7500.00 | 1000 | EAP-44721 | 05-10-18 | 13-Walter Chan | 83 |
| OFF | Office Copier | P100 | Kodac Photocopier | $840.00 | 4 | EAP-44721 | 05-10-18 | 13-Walter Chan | 83 |
| STF | Steel Framing | STL100 | Front Steel Loader | $1500.00 | 3 | EAP-44721 | 05-10-18 | 13-Walter Chan | 83 |
| **CST** | Crushd Stone | ST22 | Stone Crusher | $950.00 | 1 | EAP-44722 | 05-10-18 | 23-Oliv Gardenor | 46 |
| FLD | Front Loader | FL660 | Front Loading Device | $450 | 1 | EAP-44722 | 05-10-18 | 23-Oliv Gardenor | 46 |
| CRA | Overhead  Lift | CRA-11 | 120’ Overhead Crane | $9000 | 3 | EAP-44723 | 05-10-18 | 20-Joe Shoelly | 52 |

Answer 3:

**1NF:**

**PK** is (**EQUIP\_NUM, INV\_NUM)**

(EQUIP\_NUM, INV\_NUM – EQUIP\_CLASS, CLASS\_DESC, EQUIP\_DESC, EQUIP\_CHG, EQUIP\_QTY, INV\_DATE, SALES\_REP, CUST\_NUM)

**PARTIAL DEPENDENCIES:**

(EQUIP\_NUM – EQUIP\_CLASS, CLASS\_DESC, EQUIP\_DESC, EQUIP\_CHG, EQUIP\_QTY)

(INV\_NUM – INV\_DATE, SALES\_REP, CUST\_NO)

**TRANSITIVE DEPENDENCIES:**

(EQUIP\_CLASS – CLASS\_DESC, EQUIP\_DESC)

**2NF:**

(EQUIP\_NUM, INV\_NUM)

(EQUIP\_NUM – EQUIP\_CLASS, CLASS\_DESC, EQUIP\_DESC, EQUIP\_CHG, EQUIP\_QTY)

(INV\_NUM – INV\_DATE, SALES\_REP, CUST\_NO)

(EQUIP\_NUM, INV\_NUM – EQUIP\_QTY)

**3NF:**

(EQUIP\_NUM, INV\_NUM)

EQUIPMENTS (EQUIP\_NUM – EQUIP\_CLASS, EQUIP\_CHG, EQUIP\_QTY)

DESCRIPTION (EQUIP\_CLASS – CLASS\_DESC, EQUIP\_DESC)

INVOICES (INV\_NUM – INV\_DATE, SALES\_REP, CUST\_NO)

QUANTITY (EQUIP\_NUM, INV\_NUM – EQUIP\_QTY)

Answer 4:

INVOICE (INV\_NUM (PK, FK) – INV\_DATE, SALES\_REP, CUST\_NO (FK), PROJ\_NUM (FK), EQUIP\_NUM (FK), EMP\_NUM (FK))

CUSTOMERS (CUST\_NO (PK, FK) – CUST\_NAME, CUST\_ADDRESS, CUST\_TYPE (FK), CUST\_PHONE, CUST\_FAX)

PROJECTS (PROJ\_NUM (PK, FK) – PROJ\_NAME, PROJ\_TYPE, PROJ\_LOCATION)

EQUIPMENTS (EQUIP\_NUM (PK, FK), – EQUIP\_NAME, EQUIP\_CLASS, EQUIP\_CHG, EQUIP\_CHG\_PER\_HR, EQUIP\_HRS, EQUIP\_DATE)

EMPLOYEES (EMP\_NUM (PK) – EMP\_FIRSTNAME, EMP\_LASTNAME, EMP\_PHONE, EMP\_SKILL (FK), EMP\_HRS, YRS\_IN\_CMP)

SKILLS (EMP\_SKILL (PK, FK) – EMP\_CHG\_PER\_HR)

BENEFITS (BENEFIT\_NUM (PK, FK) – BENEFIT\_NAME)

START DATE (EMP\_NUM (PK), BENEFIT\_NUM (PK, FK), BENEFIT\_STATE\_DATE)

CUST\_TYPES (CUST\_TYPE (PK, FK), CUST\_NO (PK, FK) – CUST\_SUB\_TYPE)

DESCRIPTION (EQUIP\_CLASS (PK, FK) – CLASS\_DESC, EQUIP\_DESC)

QUANTITY (EQUIP\_NUM (PK, FK), INV\_NUM (PK, FK) – EQUIP\_QTY)