University of British Columbia, Department of Computer Science

CPSC 304

Cover Page for Project Part <u>2</u>

Date: <u>Friday Oct 23rd, 2020</u>

Project Group Number on Canvas: <u>96</u>

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By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

Here is our updated ER diagram to reflect the changes we made in this iteration of our project
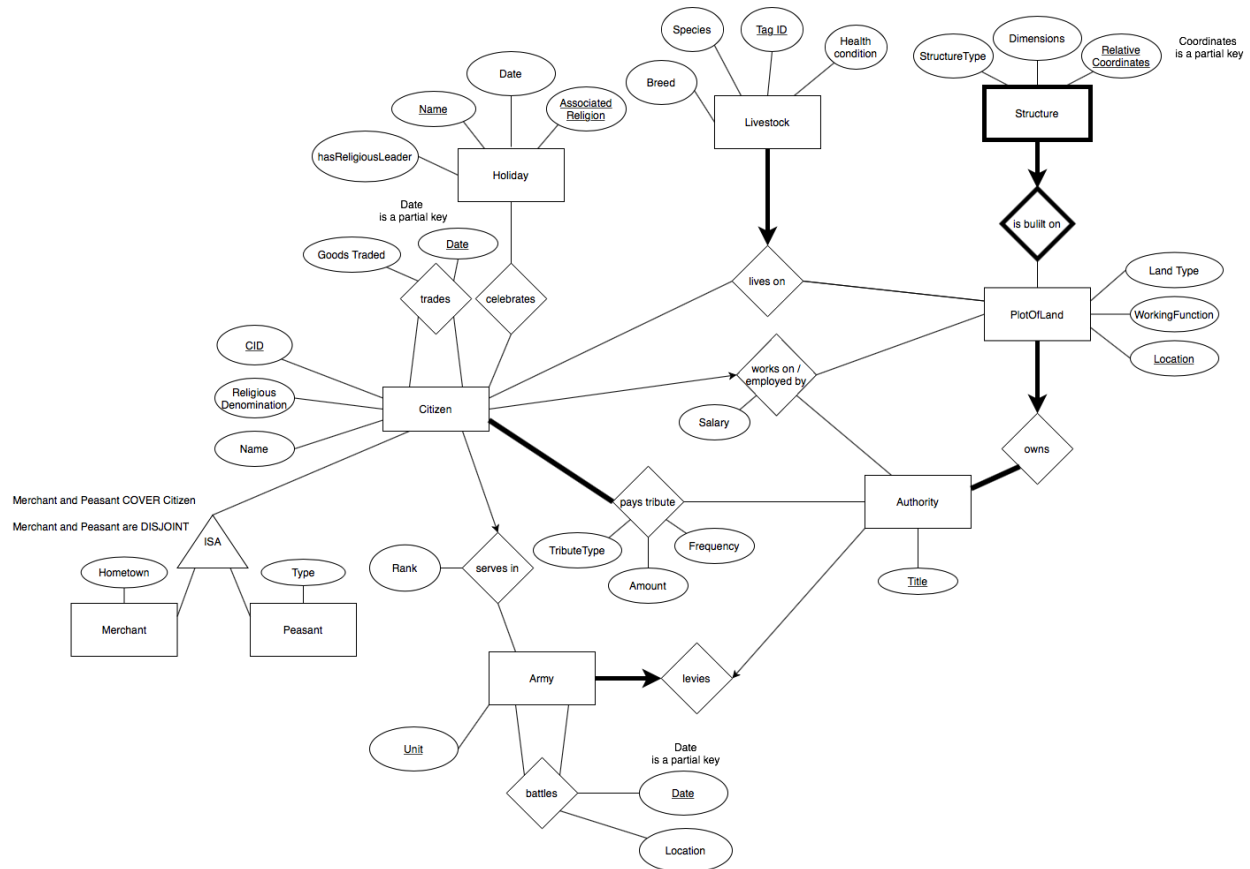
1. Translation to Relational Model

Citizen(<u>CID</u>:Integer, ReligiousDenomination:String, Name:String, **Unit**:String, Rank:Integer, **Location**:String)

PlotOfLand(<u>Location</u>:String, LandType:String, LandUsage:String, **Title**:String)

Authority(<u>Title</u>:String)

Structure(<u>RelativeCoordinates</u>:String, **Location**:String, Dimensions:String, StructureType:String)

Merchant(**<u>CID</u>**:Integer, Hometown:String)

Peasant(**<u>CID</u>**:Integer, Type:String)

paysTribute(**<u>CID</u>**:Integer, **<u>Title</u>**:String, TributeType:String, Amount:Integer, Frequency:String)

LiveStock(<u>TagID</u>:Integer, Species:String, Breed:String, Health/Condition:String, **CID**:Integer, **Location**:String)

Celebrates(**<u>CID</u>**:Integer, **<u>Name</u>**:String, <u>AssociatedReligion</u>:String)

Trades(**<u>Citizen$_1$-CID</u>**:Integer, **<u>Citizen$_2$-CID</u>**:Integer, GoodsTraded:String, <u>Date</u>:Date)

Holiday(<u>Name</u>:String, <u>AssociatedReligion</u>:String, Date:Date)

worksOn(**<u>CID</u>**:Integer, **<u>Location</u>**:String, **<u>Title</u>**:String, Salary:Integer)

Army(Army1-<u>Unit</u>:String, **Title**:String) Title is UNIQUE

Battles(**<u>Army1-Unit</u>**:String, **<u>Army2-Unit</u>**:String, <u>Date</u>:Date)

2. Functional Dependencies

The Holiday entity in our ERD has functional dependencies. With both the Name and AssociatedReligion of our Holiday we can deduce the Date on which said holiday takes place. Also, AssociatedReligion determines whether or not the holiday requires a religious leader to lead it.

We have another non-trivial dependency for our Livestock entity. We see that knowing the Breed of a Livestock entity tells us the Species as well.

3. Normalization

The current table of this Holiday is given by

Holiday(Name, AssociatedReligion, hasAssociatedReligion, Date)
Name, Associated Religion -> Date
AssociatedReligion -> hasAssociatedReligion

We can normalize this to BCNF as follows

Holiday(Name, AssociatedReligion, Date)
Name, AssociatedReligion -> Date

HolidayLeader(AssociatedReligion, hasAssociatedReligion)
AssociatedReligion -> hasAssociatedReligion

Each relation now has only trivial functional dependencies

The current table of Livestock is given by

LiveStock(Tag ID, **CID**, **Location,** Breed, Species, Health/Condition)
Tag ID, CID, Location -> Breed, Species, Health/Condition
Breed -> Species

We can normalize this to BCNF as follows

LiveStock(Tag ID, **CID**, **Location,** Breed, Health/Condition)
Tag ID, CID, Location -> Breed, Health/Condition
LiveStockSpecies(Breed, Species)
Breed -> Species

Each relation now has only trivial functional dependencies

4. SQL DDL

```
 CREATE TABLE Citizen
        (CID INTEGER,
         Name CHAR(20),
         Rank INTEGER,
         ReligiousDenomination CHAR(20),
         Unit CHAR(20),
         PRIMARY KEY (CID),
         FOREIGN KEY (Unit) REFERENCES Army);

CREATE TABLE PlotOfLand
          (Location CHAR(20),
        WorkingFunction CHAR(20),
        LandType CHAR(20),
        Title CHAR(20) NOT NULL,
        PRIMARY KEY (Location),
        FORIEGN KEY (Title) REFERENCES Authority);

CREATE TABLE Authority
          (Title CHAR(20)
        PRIMARY KEY (Title));

CREATE TABLE Structure
          (RelativeCoordinates CHAR(20),
        Dimensions CHAR(20),
        StructureType CHAR(20),
        Location CHAR(20),
        PRIMARY KEY (RelativeCoordinates, Location),
        FORIEGN KEY (Location) REFERENCES PlotOfLand
              ON DELETE CASCADE);

CREATE TABLE CitizenMerchant
          (CID INTEGER,
        Hometown CHAR(20),
        PRIMARY KEY (CID),
        FOREIGN KEY (CID) REFERENCES Citizen
              ON DELETE CASCADE);

CREATE TABLE CitizenPeasant
          (CID INTEGER,
        Peasant CHAR(20),
        PRIMARY KEY (CID),
        FOREIGN KEY (CID) REFERENCES Citizen
              ON DELETE CASCADE);

CREATE TABLE TributePayments
          (CID INTEGER,
```

```
        Title CHAR(20),
        TributeType CHAR(20),
        Amount INTEGER,
        Frequency CHAR(20),
        PRIMARY KEY (CID, Title),
        FOREIGN KEY (CID) REFERENCES Citizen
                ON DELETE CASCADE,
        FOREIGN KEY (Title) REFERENCES Authority
                ON DELETE CASCADE);

CREATE TABLE Livestock
        (TagID INTEGER,
        HealthCondition CHAR(50),
        Breed CHAR(20),
        Location CHAR(20) NOT NULL,
        CID INTEGER NOT NULL,
        PRIMARY KEY (TagID)
        FOREIGN KEY (CID) REFERENCES Citizen
        FOREIGN KEY (Location) REFERENCES PlotOfLand);

CREATE TABLE LivestockBreed
        (Breed CHAR(20),
        Species CHAR(20),
        PRIMARY KEY (Breed),
        FOREIGN KEY (Breed) REFERENCES Livestock);

CREATE TABLE Trades
        (Citizen1CID INTEGER,
        Citizen2CID INTEGER,
        GoodsTraded CHAR(80),
        Date DATE,
        PRIMARY KEY (Citizen1CID, Citizen2CID, Date),
        FOREIGN KEY (Citizen1CID) REFERENCES Citizen
                ON DELETE CASCADE,
        FOREIGN KEY (Citizen2CID) REFERENCES Citizen)
                ON DELETE CASCADE;

CREATE TABLE Holiday
        (Name CHAR (20),
        AssociatedReligion CHAR(20),
        Date DATE,
        PRIMARY KEY (Name, AssociatedReligion);

CREATE TABLE HolidayLeader
        (AssociatedReligion CHAR(20),
        HasAssociatedReligion BOOLEAN,
        PRIMARY KEY (AssociatedReligion);
```

```
CREATE TABLE Celebrates
        (CID INTEGER,
     AssociatedReligion CHAR(20),
     Name CHAR(20),
     PRIMARY KEY (CID, Name, AssociatedReligion)
     FOREIGN KEY (CID) REFERENCES Citizen
            ON DELETE CASCADE,
     FOREIGN KEY (Name) REFERENCES Holiday
            ON UPDATE CASCADE,
     FOREIGN KEY (AssociatedReligion) REFERENCES Holiday;

CREATE TABLE WorksOn
        (CID INTEGER,
     Title CHAR(20),
     Location CHAR(20),
     Salary INTEGER,
     PRIMARY KEY (CID, Title, Location),
     FOREIGN KEY (CID) REFERENCES Citizen
            ON DELETE CASCADE,
     FOREIGN KEY (Location) REFERENCES PlotOfLand
            ON DELETE CASCADE,
     FOREIGN KEY (Title) REFERENCES Authority
            ON DELETE CASCADE,
     UNIQUE (CID));

CREATE TABLE Army
        (Unit CHAR(20),
     Title CHAR(20),
     PRIMARY KEY (Unit),
     FOREIGN KEY (Title) REFERENCES Authority);

CREATE TABLE Battles
        (Army1-Unit CHAR(20),
     Army2-Unit CHAR(20),
     Date DATE,
     PRIMARY KEY (Army1-Unit, Army2-Unit, Date),
     FOREIGN KEY (Army1-Unit) REFERENCES Army,
     FOREIGN KEY (Army2-Unit) REFERENCES Army)
```

5. Population

Citizen

CID	Name	Religious Denomination	Rank	**Unit**	**Location**
1	Bobby Tables	NULL	1	The Sandy Regiment	The area next to the river we dump our sewage in
2	John Appleseed	Pastafarian	1	Holy Pasta Guard	The Duke's Rat Pit
3	Foo Bar	Pastafarian	2	Holy Pasta Guard	Lynnfield field
4	Bar Foo	NULL	1	The Wet Sand Battalion	Seagull Fertilized Fields
5	Stuart Little	Pastafarian	2	Holy Pasta Guard	Lynnfield field
6	Charlie Brown	Pastafarian	NULL	NULL	The Maroon Acres
7	James Trotter	Pastafarian	NULL	NULL	The Maroon Acres
8	Randall Munroe	NULL	1	421st Summit Ridge Corp	Seagull Fertilized Fields
9	Beret Guy	NULL	1	0th Matisse Division	The Duke's Rat Pit
10	Bobby Tables	NULL	NULL	NULL	The Maroon Acres

PlotOfLand

Location	WorkingFunction	LandType	**Title**		
The area next to the river we dump our sewage in	Living	Residential	King of Sandy Bridge		
The Duke's Rat Pit	Commerce	Commercial	Duke of Matisse		
Seagull Fertilized Fields	Living	Agricultural	Prince of Summit Ridge		
Lynnfield field	Farming	Agricultural	Prince of Lynnfield		
The Maroon Acres	Farming	Agricultural	Knight of Renoir		

Authority

Title					
King of Sandy Bridge					
Duke of Matisse					
Prince of Summit Ridge					
Prince of Lynnfield					
Prince of Sandy Bridge					
Pastafarian Church					

Structure

Relative Coordinates	Dimensions	StructureType	Location		
Behind Beret Guy's Outhouse	15 horses by 27 chickens	Tavern	The Duke's Rat Pit		
West of the town well	11 sheep by 19 roosters	Barn	Seagull Fertilized Fields		
East of the town well	12 sheep by 10 roosters	House	Seagull Fertilized Fields		
Middle of the town	15 criminals by 13 vagrants	Town jail	Lynnfield field		
North of the jail	56 long swords by 13 war elephants	Barracks	Lynnfield field		

Citizen Merchant

CID	HomeTown				
6	Camelot				
7	London				
8	Camelot				
9	Camelot				
10	London				

Citizen Peasant

CID	Type				
1	Farmer				
2	Farmer				
3	Butler				
4	Farmer				
5	Farmer				

Tribute Payments

CID	Title	TributeType	Amount	Frequency	
1	King of Sandy Bridge	Taxation	15	Monthly	
1	Prince of Summit Ridge	Taxation	5	Monthly	
2	King of Sandy Bridge	Taxation	10	Monthly	
2	Prince of Lynnfield	Taxation	10	Monthly	
3	King of Sandy Bridge	Taxation	10	Monthly	
4	King of Sandy Bridge	Taxation	10	Monthly	
4	Pastafarian Church	Offering	5	Weekly	
5	King of Sandy Bridge	Taxation	15	Weekly	
6	King of Sandy Bridge	Taxation	20	Monthly	
7	King of Sandy Bridge	Taxation	10	Monthly	
8	King of Sandy Bridge	Taxation	5	Monthly	
8	Duke of Matisse	Taxation	5	Weekly	
9	King of Sandy Bridge	Taxation	10	Monthly	
10	King of Sandy Bridge	Taxation	40	Monthly	

Livestock

TagID	HealthCondition	Breed	Location	CID	
1	Terminal case of KFC	Canadienne	The Duke's Rat Pit	1	
2	Marco pollo	Chantecler	Lynnfield field	1	
3	Came before the egg	Red Shaver	Lynnfield field	2	
4	Probably okay	Buckeye	The Duke's Rat Pit	3	
5	Medium rare	Jeju Black	The Maroon Acres	5	

Livestock Breed

Breed	Species				
Canadienne	Cattle				
Chantecler	Chicken				
Red Shaver	Chicken				
Buckeye	Chicken				
Jeju Black	Pig				

Holiday

Name	Associated Religion	Date			
Pasta Day	Pastafarian	600-04-20			
Penne Day	Pastafarian	777-07-07			
Alfredo Day	Pastafarian	609-06-09			
Jump Over Fire Day	Athestic	666-06-06			
Yolo Day	Polygontheist	696-10-10			
Give us all your money day	Totally Not A Cult	777-01-01			
At least it's not octal	An Alternative Number System	1010-01-11			

Trades

Citizen1-**CID**	Citizen2-**CID**	GoodsTraded	Date		
1	2	1 updog	1511-11-11		
2	6	97 oranges	1511-4-21		
6	3	97 stale oranges	1611-4-21		
8	1	6 medium rare rat tenderloins	1514-8-26		
9	10	2 paper weights	1500-01-01		

Holiday Leader

Associated Religion	HasAssociated Religion				
Athestic	0 (False)				
Pastafarian	1				
Polygontheist	1				
Totally Not A Cult	1				
An Alternative Number System	1				

Celebrates

CID	Associated Religion	Name			
5	Athestic	Jump Over Fire Day			
5	Pastafarian	Alfedo Day			
3	Polygontheist	Yolo Day			
9	Athestic	Jump Over Fire Day			
5	An Alternative Number System	At least it's not octal			

WorksOn

CID	Title	Location	Salary		
1	King of Sandy Bridge	The Maroon Acres	100		
2	King of Sandy Bridge	The Maroon Acres	20		

		The area next to the river we dump our sewage in			
3	Prince of Summit Ridge		30		
6	Duke of Matisse	The area next to the river we dump our sewage in	100		
8	Duke of Matisse	Lynnfield field	50		

Army

Unit	Title				
The Sandy Regiment	King of Sandy Bridge				
Holy Pasta Guard	Pastafarian Church				
The Wet Sand Battalion	Prince of Sandy Bridge				
421st Summit Ridge Corp	Prince of Summit Ridge				
0th Matisse Division	Duke of Matisse				

Battles

Army1-Unit	Army2-Unit	Date			
0th Matisse Division	421st Summit Ridge Corp	1500-01-01			
The Wet Sand Battalion	The Sandy Regiment	1514-6-26			
Holy Pasta Guard	The Wet Sand Battalion	1565-02-21			
Holy Pasta Guard	The Sandy Regiment	1565-02-22			
0th Matisse Division	Holy Pasta Guard	1565-02-23			

6. Queries

1. Insert - Adding a new citizen to the table (E.g. citizen is born or turns old enough to work and become relevant to the economy)
2. Delete - Removing a plot of land from existence (E.g. lost in war to another sovereign)
3. Update - Update TributePayments to reflect changes in tax rates

4. Select - Select all Citizens who are making > $0 (or whatever currency). (E.g. for taxation purposes)
5. Project - Project the Amount entity of the TributePayments relation so that a greedy authority may determine his income
6. Join - Join the list of citizens and holidays by their Associated religion / Religous denomination (if they have one) to determine which citizens will not work on which days
7. Division - Find citizens who pay tribute to every known Authority to find travelling merchants