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Individual project (100 points)

BSAN 326: Database Management Systems Fall 2020

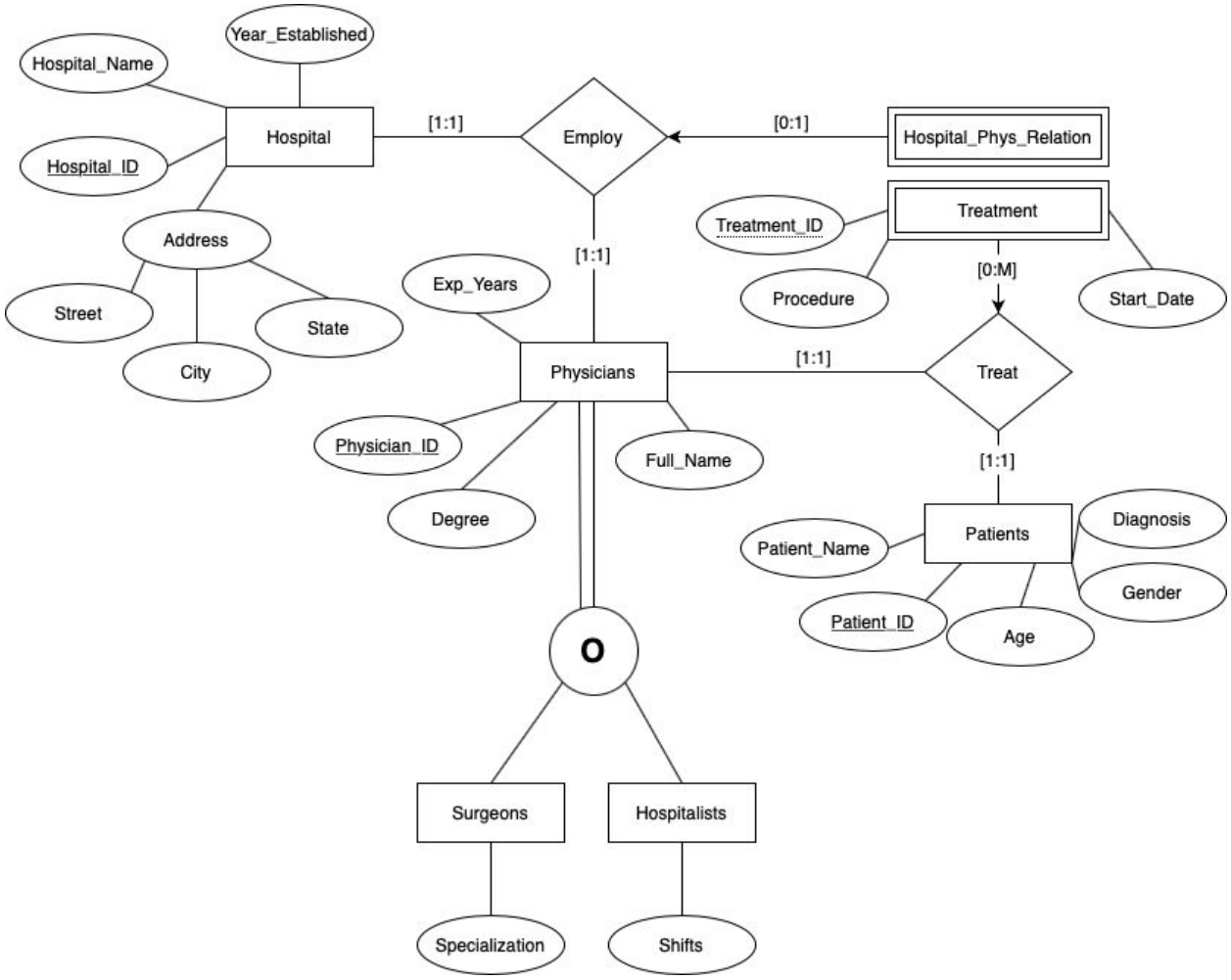
School of Business - KU

Due date: Dec 8th, 2020 *Deliverable:* pdf document *Document submission guidelines:*

- Export your .pages file (in Mac) or .docx file (in Windows) to .pdf format after you have saved and finalized all your work.
- The document must include your name, your email address, and your group number in the very first page.
- The document must be uploaded in blackboard using the respective upload link. File name for your submitted document should be of the form ***Individual_project_lastname_firstname***.pdf.
  This project requires you to design a database (i.e., ER diagram, relational model, discuss normalization), as well as implement it (create tables, insert data), and write a few sample queries.
  Following is the mini-world for the database:
  WinnerHealth, a major healthcare provider owns hospitals across US in different cities. Information about each hospital such as Hospital Name, Address (Address can further be broken down into street, city, state), and Year Established is available.
  Each hospital employs multiple physicians. The hospital maintains information about physicians such as Physician ID, full name, degree and experience in years. Physicians can be further classified as surgeons and hospitalists. The shift information is recorded for hospitalists whereas specialization type of surgeons is recorded.
  WinnerHealth has multiple patients at a given point of time. The Patient Name, Admitting Diagnosis, Age and Gender is recorded at point of admission. At a given time, one physicians may treat multiple patients. Treatment information such as treatment start date, list of procedures (there may be more than one procedure) is recorded for each pair of physician and patient.

1. Create an implementation entity-relationship diagram showing the conceptual data model for the mini-world.

NOTE: All elements of the ER should be correctly specified. The entity classes should have primary keys and corresponding set of attributes describing the entities. The entity classes should be linked to each other in a meaningful way using relationships. All the business and cardinality constraints should be specified.



2. Convert your ER diagram to relations/tables.

   HOSPITAL(Hospital_ID, Hospital_Name, Year_Established, Hospital_Address, Hospital_Street, Hospital_City, Hospital_State)

   PHYSICIANS(Physician_ID, Full_Name, Degree, Exp_Years)

   SURGEONS(Physician_ID, Specialization) FK(Physician_ID) ref PHYSICIANS

   HOSPITALISTS(Physician_ID, Shifts) FK(Physician_ID) ref PHYSICIANS

   HOSP_PHYS_RELATION(Hospital_ID, Physician_ID) FK(Hospital_ID) ref HOSPITAL FK(Physician_ID) ref PHYSICIANS

   PATIENT(Patient_ID, Patient_Name, Age, Gender, Diagnosis)

   PATIENT_PHYS_RELATION(Patient_ID, Physician_ID) FK(Patient_ID) ref PATIENT FK(Physician_ID) ref PHYSICIAN

   TREATMENT(Treatment_ID, Physician_ID, Patient_ID, Procedure, Start_Date) FK(Physician_ID) ref PHYSICIAN FK(Patient_ID) ref PATIENT

3. Justify that all relations in your logical design are in 3NF.

To ensure that my relations were in 3NF, I had to progress through the previous stages of normalization.

First, to verify that my relations were in 1NF I needed to check for multi-valued attributes and ensure that each relation was valid with an existing primary key. After reviewing my relations, I then confirmed that each relation had a primary key and was a valid relation with no multi-valued attributes. This meant that my relations were in form 1NF.

Next, to make certain that my relations were in form 2NF I had to review them for any partial functional dependencies. This meant that I needed to verify that each non-key attribute in my relations was fully dependent on its respective primary key. To ensure that each relation was in 2NF I reviewed my relations checking that all attributes could be fully derived from the primary key of the relation. After verifying that all non-key attributes could be determined from the primary key, freeing my relations of partial dependencies, I knew my relations were in 2NF.

Finally, to ensure that my relations were in form 3NF, I had to check for transitive dependencies. A transitive dependency is when any non-key attribute is determined by a different non-key attribute. To avoid transitive dependencies in my relations, I split relations involving patient and physician relationships and hospital and physician relationships. Doing this, I created additional tables that would serve to model the connections between different entities using foreign keys from both entities. This ensured that my data was free of transitive dependencies and therefore in form 3NF.

4. Create a data dictionary for your relations.

Data Dictionary

HOSPITAL	Entity Class, models hospital information	
Hospital_ID	ID number assigned to hospital for identification	Identifying attribute, cannot be NULL
Hospital_Name	Name of hospital	Cannot be NULL
Year_Established	Year of establishment for hospitals	Should be year in the past, cannot be NULL
Hospital_Address	Full address of hospital	Cannot be NULL
Hospital_Street	Hospital street location	Cannot be NULL
Hospital_City	Hospital city location	Cannot be NULL
Hospital_State	Hospital state location	Cannot be NULL
PHYSICIAN	Entity Class, models physician information	

Physician_ID	ID number assigned to physician for identification	Identifying attribute, cannot be NULL
Degree	Degree held by physician	Cannot be NULL
Exp_Years	Years of experience held by physician	Cannot be NULL
Full_Name	Full name of physician	Cannot be NULL
SURGEONS	Subclass of of physician, models surgeon information	
Specialization	Area of specialization for surgeons	Cannot be NULL
HOSPITALISTS	Subclass of of physician, models hospitalists information	
Shifts	Hours of work for hospitalists	Should be a valid date, cannot be NULL
Employ	Relationship linking hospitals and their employment of physicians	One to many relationship
HOSP_PHYS_RELATION	Associative class, models hospital and physician relationship	

PATIENTS	Entity class, models patient information	
Patient_ID	ID number assigned to patients for identification	Identifying attribute, cannot be NULL
Patient_Name	Full name of patient	Cannot be NULL
Diagnosis	Initial Diagnosis of patient	Cannot be NULL
Gender	Listed gender of patient	Cannot be NULL, standard form “Male” “Female”
Age	Listed age of patient	Cannot be NULL
Treat	Relationship linking physicians and their treatment of patients	One to many relationship
TREATMENT	Associative class, models treatment information	
Treatment_ID	ID number assigned to treatments for identification	Identifying attribute, cannot be NULL
Procedures	Procedures performed	Cannot be NULL

Start_Date	Start date of treatment	Should be valid date, cannot be NULL
PATIENT_PHYS_RELATION	Associative class, models patient and physician relationship	

5. Create the tables needed to implement your database
   NOTE: Define the fields in your table. Indicate the primary keys and foreign keys for each table. The referential integrity should be consistent with the business problem as well as the ER model and relational model.
   In your report, provide the SQL code you wrote to create tables.

Tables:

HOSPITAL: *Primary Key - Hospital_ID*
- Hospital_Name
- Year_Established
- Hospital_Address
- Hospital_Street
- Hospital_City
- Hospital_State

PHYSICIANS: *Primary Key - Physician_ID*
- Full_Name
- Degree
- Exp_Years

PATIENTS: *Primary Key - Patient_ID*
- Patient_Name
- Age
- Gender
- Diagnosis

SURGEONS: *Foriegn Key - Physician_ID ref PHYSICIANS*
- Specialization

HOSPITALISTS: *Foriegn Key - Physician_ID ref PHYSICIANS*
- Shifts

HOSP_PHYS_RELATION: *Foriegn Key - Physician_ID ref PHYSICIANS*
Foriegn Key- Hospital_ID ref HOSPITAL

PATIENT_PHYS_RELATION: *Foriegn Key - Physician_ID ref PHYSICIANS*
Foriegn Key- Patient_ID ref PATIENTS

TREATMENT: *Primary_Key - Treatment_ID*
Foriegn Key - Physician_ID ref PHYSICIANS
Foriegn Key- Patient_ID ref PATIENTS
- Procedure
- Start_Date

CREATION SQL:

```
Create table HOSPITAL
(
        Hospital_ID integer constraint Hospital_PK Primary Key,
   Hospital_Name varchar2(50),
   Year_Established number(4),
   Hospital_Address varchar2(50),
   Hospital_Street varchar2(50),
   Hospital_City varchar2(50),
   Hospital_State varchar2(50)
   );

Create table PHYSICIANS
(
        Physician_ID integer constraint Physician_PK Primary Key,
   Full_Name varchar2(50),
   Degree varchar2(50),
   Exp_Years integer
   );

Create table PATIENTS
(
        Patient_ID integer constraint Patient_PK Primary Key,
   Patient_Name varchar2(50),
   Age integer,
   Gender varchar2(50),
   Diagnosis varchar2(50)
   );

Create table SURGEONS
(
   Physician_ID integer constraint PhysicianS_FK references PHYSICIANS,
   Specialization varchar2(50)
   );




Create table HOSPITALISTS
(
   Physician_ID integer constraint PhysicianH_FK references PHYSICIANS,
   Shifts date
   );
```

```
Create table HOSP_PHYS_RELATION
(
   Hospital_ID integer constraint HospitalPR_FK references HOSPITAL,
   Physician_ID integer constraint PhysicianHR_FK references PHYSICIANS
   );

Create table PATIENT_PHYS_RELATION
(
   Patient_ID integer constraint PatientPR_FK references PATIENTS,
   Physician_ID integer constraint PhysicianPR_FK references PHYSICIANS
   );

Create table TREATMENT
(
  Treatment_ID integer constraint Treatment_PK Primary Key,
   Patient_ID integer constraint PatientT_FK references PATIENTS,
   Physician_ID integer constraint PhysicianT_FK references PHYSICIANS,
   Procedures varchar2(50),
   Start_Date date
   );
```

6. Add sample data to the database tables (each table should have at least 3 rows). Paste your tables in your report in the appendix section for my reference.
   NOTE: You may import data from a spreadsheet or using insert command to input data.

   INSERTIONS SQL:

HOSPITAL:

```
Insert into HOSPITAL
(Hospital_ID, Hospital_Name,Year_Established, Hospital_Address, Hospital_Street,
Hospital_City, Hospital_State) values
(121345, 'Oak Hills', 1990, '711','Oak Street', 'Chicago', 'Illinois');

Insert into HOSPITAL
(Hospital_ID, Hospital_Name,Year_Established, Hospital_Address, Hospital_Street,
Hospital_City, Hospital_State) values
(134628, 'Maple Valley', 2000, '1620','Maple Street', 'Iowa City', 'Iowa');

Insert into HOSPITAL
(Hospital_ID, Hospital_Name,Year_Established, Hospital_Address, Hospital_Street,
Hospital_City, Hospital_State) values
(465829, 'Apple Grove', 2005, '1111','Apple Street', 'Overland Park', 'Kansas');
```

PHYSICIANS:

```
Insert into PHYSICIANS
(Physician_ID, Full_Name, Degree, Exp_Years) values
(138924, 'Mike Healy', 'Pharmaceutical',10);

Insert into PHYSICIANS
(Physician_ID, Full_Name, Degree, Exp_Years) values
(652873, 'Belini Hudspeth', 'Pharmaceutical',1);

Insert into PHYSICIANS
(Physician_ID, Full_Name, Degree, Exp_Years) values
(852631, 'Grant Healy', 'Medical',5);

Insert into PHYSICIANS
(Physician_ID, Full_Name, Degree, Exp_Years) values
(387146, 'Dennis Vandyke', 'Pharmaceutical',7);

Insert into PHYSICIANS
```

(Physician_ID, Full_Name, Degree, Exp_Years) values
(931682, 'Michael Womack', 'Medical',3);

Insert into PHYSICIANS
(Physician_ID, Full_Name, Degree, Exp_Years) values
(171832, 'John Deveny', 'Medical',11);

PATIENTS:
Insert into PATIENTS
(Patient_ID, Patient_Name, Age, Gender, Diagnosis) values
(323612, 'Drew Staples', 20, 'Male', 'Clamydia');

Insert into PATIENTS
(Patient_ID, Patient_Name, Age, Gender, Diagnosis) values
(823461, 'Luke Bernard', 21, 'Male', 'Stomach Ache');

Insert into PATIENTS
(Patient_ID, Patient_Name, Age, Gender, Diagnosis) values
(562134, 'Kyle Angelucci', 22, 'Male', 'Artritis');

HOSPITALISTS:
Insert into HOSPITALISTS
(Physician_ID, Shifts) values
(138924, to_date('20-DEC-20','DD-MON-YY'));

Insert into HOSPITALISTS
(Physician_ID, Shifts) values
(652873, to_date('22-DEC-20','DD-MON-YY'));

Insert into HOSPITALISTS
(Physician_ID, Shifts) values
(852631, to_date('15-DEC-20','DD-MON-YY'));

SURGEONS:
Insert into SURGEONS
(Physician_ID, Specialization) values
(387146, 'Brain Surgery');

Insert into SURGEONS

(Physician_ID, Specialization) values
(931682, 'Heart Surgery');

Insert into SURGEONS
(Physician_ID, Specialization) values
(171832, 'Knee Surgery');

HOSP_PHYS_RELATION:

Insert into HOSP_PHYS_RELATION
(Hospital_ID, Physician_ID) values
(121345, 138924);

Insert into HOSP_PHYS_RELATION
(Hospital_ID, Physician_ID) values
(121345, 387146);

Insert into HOSP_PHYS_RELATION
(Hospital_ID, Physician_ID) values
(134628, 652873);

Insert into HOSP_PHYS_RELATION
(Hospital_ID, Physician_ID) values
(134628, 931682);

Insert into HOSP_PHYS_RELATION
(Hospital_ID, Physician_ID) values
(465829, 852631);

Insert into HOSP_PHYS_RELATION
(Hospital_ID, Physician_ID) values
(465829, 171832);

PATIENT_PHYS_RELATION:

Insert into PATIENT_PHYS_RELATION
(Patient_ID, Physician_ID) values
(323612, 652873);

Insert into PATIENT_PHYS_RELATION
(Patient_ID, Physician_ID) values
(823461, 171832);

Insert into PATIENT_PHYS_RELATION
(Patient_ID, Physician_ID) values
(562134, 387146);

TREATMENT:

Insert into TREATMENT
(Treatment_ID, Patient_ID, Physician_ID, Procedures, Start_Date) values
(100123, 323612, 652873, 'Eye Swab', to_date('01-DEC-20','DD-MON-YY'));

Insert into TREATMENT
(Treatment_ID, Patient_ID, Physician_ID, Procedures, Start_Date) values
(100245, 823461, 171832, 'Ear Swab', to_date('06-DEC-20','DD-MON-YY'));

Insert into TREATMENT
(Treatment_ID, Patient_ID, Physician_ID, Procedures, Start_Date) values
(100389, 562134, 387146, 'Mouth Swab', to_date('10-DEC-20','DD-MON-YY'));

7. Come up with at least 5 meaningful database queries that include the following:

a) At Least One Query With Where Clause
b) At Least One Query With Having Clause

c) At least one query with *a join condition*

QUERIES:

Query 1: ***Where Clause***
Which Hospital is located in Kansas?
SQL:

```
Select Hospital_Name as Kansas_Hospitals
From HOSPITAL
Where Hospital_State = 'Kansas';
```

Query 2: ***Having Clause***
How many collective years of experience do physicians with a “medical” degree have?
SQL:

```
Select SUM(Exp_Years) as Total_Physician_Experience, Degree
From PHYSICIANS
Group by Degree
Having Degree ='Medical';
```

Query 3: ***Join Condition***
What is the full name of the physician treating the patient with ID# 323612 (Drew Staples)?
SQL:

```
Select p.Full_Name as Treating_Physician
From PHYSICIANS p Join PATIENT_PHYS_RELATION r on (p.Physician_ID = r.Physician_ID)
Where r.Patient_ID = 323612;
```

Query 4: ***MISC***
How old is the oldest patient in the database?
SQL:

```
Select MAX(Age) as "Age_of_Oldest_Patient"
From PATIENTS;
```

Query 5: ***MISC***
Which hospitals were established after the year 1995?
SQL:

```
Select Hospital_Name as Newer_Hospitals
From HOSPITAL
Where Year_Established >'1995';
```

APPENDIX

TABLE IMAGES:

HOSPITAL

	hospital_id	hospital_name	year_established	hospital_address	hospital_street	hospital_city	hospital_state
1	121345	Oak Hills	1990	711	Oak Street	Chicago	Illinois
2	134628	Maple Valley	2000	1620	Maple Street	Iowa City	Iowa
3	465829	Apple Grove	2005	1111	Apple Street	Overland Park	Kansas

PHYSICIANS

	physician_id	full_name	degree	exp_years
1	138924	Mike Healy	Pharmaceutical	10
2	852631	Grant Healy	Medical	5
3	652873	Belini Hudspeth	Pharmaceutical	1
4	387146	Dennis Vandyke	Pharmaceutical	7
5	171832	John Deveny	Medical	11
6	931682	Michael Womack	Medical	3

PATIENTS

	patient_id	patient_name	age	gender	diagnosis
1	562134	Kyle Angelucci	22	Male	Artritis
2	323612	Drew Staples	20	Male	Clamydia
3	823461	Luke Bernard	21	Male	Stomach Ache

HOSPITALISTS

	physician_id	shifts
1	138924	12/20/20 12:00:00 ...
2	652873	12/22/20 12:00:00 ...
3	852631	12/15/20 12:00:00 ...

SURGEONS

	physician_id	specialization
1	931682	Heart Surgery
2	171832	Knee Surgery
3	387146	Brain Surgery

HOSP_PHYS_RELATION

	hospital_id	physician_id
1	121345	138924
2	134628	931682
3	465829	852631
4	465829	171832
5	121345	387146
6	134628	652873

PATIENT_PHYS_RELATION

	patient_id	physician_id
1	323612	652873
2	823461	171832
3	562134	387146

TREATMENT

	treatment_id	patient_id	physician_id	procedures	start_date
1	100123	323612	652873	Eye Swab	12/01/20 12:00:00 ...
2	100245	823461	171832	Ear Swab	12/06/20 12:00:00 ...
3	100389	562134	387146	Mouth Swab	12/10/20 12:00:00 ...

QUERY RESULTS IMAGES:

Query 1:

	kansas_hospitals
1	Apple Grove

Query 2:

	total_physician_exper	degree
1	19	Medical

Query 3:

	treating_physician
1	Belini Hudspeth

Query 4:

	age_of_oldest_patient
1	22

Query 5:

	newer_hospitals
1	Maple Valley
2	Apple Grove