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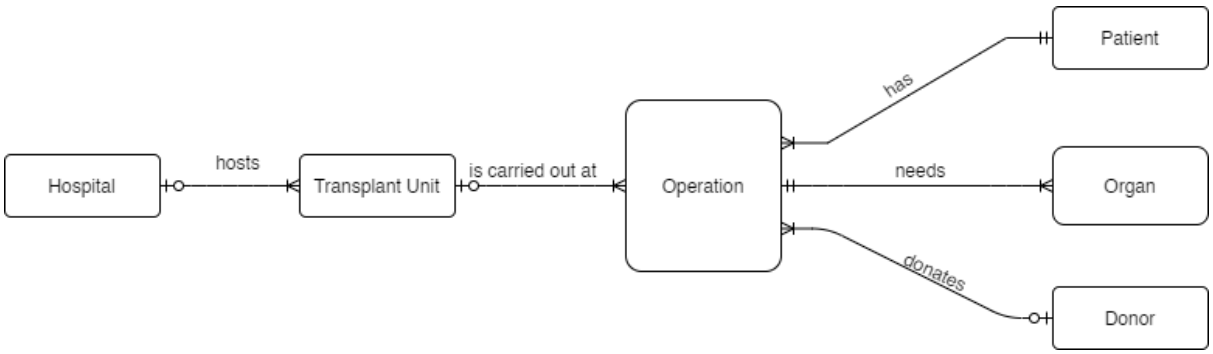
Assessment Title: Database Systems Semester ONE Coursework

Module: Database Systems

CRN: 32741

E-R Diagram drawn using the Crow's foot notation



Entities

Patient (nhs_id, name, age)

Donor (donor_id, name, age)

Operation (operation_id)

Transplant Unit (unit_id, specialisation)

Hospital (hospital_id, name, city, postcode)

Organ (organ_id, type_of_organ)

Relationships

Needs (organ_id, operation_id)

Donates [1:M][o:m]

Has[M:1][m:m]

Is carried out at [1:M][o:m]

Hosts[1:M][o:m]

Constraints/Assumptions

None

Listing of logical (relational) model

The logical model comprises the following 7 relations

Primary keys are underlined and foreign keys are followed by an asterisk

Patient (nhs_id, name, age)

Donor (donor_id, name, age)

Operation (operation_id, donor_id*, nhs_id*, unit_id*)

Transplant Unit (unit_id, hospital_id*, specialisation)

Hospital (hospital_id, name, city, postcode)

Organ (organ_id, type_of_organ)

Needs (organ_id*, operation_id*)

Explanation of why my model is in first, second and third normal form

First Normal Form

Patient: nhs_id → name, age.

Donor: donor_id → name, age

Operation: operation_id → donor_id, nhs_id, unit_id

Transplant Unit: unit_id → hospital_id, specialisation

Hospital: hospital_id → name, city, postcode

Organ: organ_id → type_of_organ

Needs: organ_id ↔ operation_id

The primary key determines the other attributes in every relation. These other attributes are single valued; there are no repeating groups in the relations. Therefore, the relations are in first normal form.

Second Normal From

All relations are in first normal form; there are no partial dependencies, every non-key attribute is fully functional and dependent on the primary key.

Third Normal Form

All relations are in second normal form; there are no transitive dependencies, every non-key attribute is dependent on the primary key and not on another non-key attribute.

SQL statement that creates the relations

```
CREATE TABLE patient
(nhs_id CHAR(3) CONSTRAINT nhs_pk PRIMARY KEY,
name VARCHAR(30) CONSTRAINT name_not_null NOT NULL,
age INTEGER NOT NULL);


CREATE TABLE donor
(donor_id CHAR(3) CONSTRAINT donor_pk PRIMARY KEY,
name VARCHAR(30) CONSTRAINT name_not_null NOT NULL,
age INTEGER NOT NULL);


CREATE TABLE hospital
(hospital_id CHAR(3) CONSTRAINT hospital_id_pk PRIMARY KEY,
name VARCHAR(30) CONSTRAINT name_and_adress_not_null NOT NULL,
city VARCHAR(20) CONSTRAINT city_not_null NOT NULL,
postcode VARCHAR(8) NOT NULL UNIQUE);


CREATE TABLE transplant_unit
(unit_id CHAR(4) CONSTRAINT unit_pk PRIMARY KEY,
specialisation VARCHAR(20) CONSTRAINT specialisation_not_null NOT NULL,
hospital_id CHAR(3) CONSTRAINT hospital_fk REFERENCES hospital(hospital_id));


CREATE TABLE operation
(operation_id CHAR(3) CONSTRAINT operation_pk PRIMARY KEY,
nhs_id CHAR(3) CONSTRAINT nhs_fk REFERENCES patient(nhs_id),
donor_id CHAR(3) CONSTRAINT donor_fk REFERENCES donor(donor_id),
unit_id CHAR(4) CONSTRAINT unit_fk REFERENCES transplant_unit(unit_id));


CREATE TABLE organ
(organ_id CHAR(3) CONSTRAINT organ_pk PRIMARY KEY,
type_of_organ VARCHAR(20) CONSTRAINT type_of_organ_not_null NOT NULL);


CREATE TABLE needs
(organ_id CHAR(3) CONSTRAINT organ_fk REFERENCES organ(organ_id),
operation_id CHAR(3)CONSTRAINT operation_fk REFERENCES
operation(operation_id), PRIMARY KEY(organ_id, operation_id));
```

Populate the database

```
INSERT INTO patient VALUES("p03", "ben", 58);
INSERT INTO patient VALUES("p04", "jane", 27);
INSERT INTO patient VALUES("p05", "joan", 50);


INSERT INTO donor VALUES("d01", "tom", 34);
INSERT INTO donor VALUES("d02", "dick", 45);
INSERT INTO donor VALUES("d03", "harry", 27);
INSERT INTO donor VALUES("d04", "sue", 60);
INSERT INTO donor VALUES("d05", "kate", 49);
INSERT INTO donor VALUES("d06", "rose", 34);


INSERT INTO hospital VALUES("h01", "Royal Infirmary", "Manchester", "M13 1AB");
INSERT INTO hospital VALUES("h02", "St James's University Hospital", "Leeds", "LE6
6JX");
INSERT INTO hospital VALUES("h03", "Eye hospital", "Manchester", "M5 3AC");
INSERT INTO hospital VALUES("h04", "Wythenshawe Hospital", "Manchester", "M22
4XD");



INSERT INTO transplant_unit VALUES("u001", "Kidney(Renal)", "h01");
INSERT INTO transplant_unit VALUES("u002", "Kidney(Renal)", "h02");
INSERT INTO transplant_unit VALUES("u003", "Pancreas", "h01");
INSERT INTO transplant_unit VALUES("u004", "Liver", "h02");
INSERT INTO transplant_unit VALUES("u005", "Cardiothoracic", "h04");


INSERT INTO operation VALUES("op1","p03", "d01", "u002");
INSERT INTO operation VALUES("op2", "p04", "d02", "u005");
INSERT INTO operation VALUES("op3", "p05", "d03", "u003");
INSERT INTO operation VALUES("op4", "p05", "d05", "u004");
INSERT INTO operation VALUES("op5", "p03", "d01", "u002");


INSERT INTO organ VALUES ("or1", "kidney");
INSERT INTO organ VALUES ("or2", "heart");
INSERT INTO organ VALUES ("or3", "lung");
INSERT INTO organ VALUES ("or4", "pancreas");
INSERT INTO organ VALUES ("or5", "liver");
```

```
INSERT INTO needs VALUES("or1",  "op1");
INSERT INTO needs VALUES("or2 ", "op2");
INSERT INTO needs VALUES("or3",  "op2");
INSERT INTO needs VALUES("or4",  "op3");
INSERT INTO needs VALUES("or5", "op4");
INSERT INTO needs VALUES("or5", "op5");
```

SQL statement to query the database

```
SELECT name FROM patient WHERE age >= 50 ORDER BY name;
```

```
SELECT organ.type_of_organ, COUNT(needs.organ_id) AS countOfOrgans
FROM needs, organ
WHERE needs.organ_id = organ.organ_id
GROUP BY type_of_organ;
```

```
SELECT transplant_unit.hospital_id, COUNT(operation.unit_id) AS CountOfhospital_id
FROM transplant_unit, operation
WHERE transplant_unit.unit_id=operation.unit_id
GROUP BY transplant_unit.hospital_id;
```

```
SELECT MAX(donor.age) AS oldestDonor
FROM donor, operation, transplant_unit, hospital
WHERE operation.donor_id=donor.donor_id AND
operation.unit_id=transplant_unit.unit_id AND
transplant_unit.hospital_id=hospital.hospital_id AND
hospital.city="Manchester";
```