

AIN SHAMS UNIVERSITY FACULTY OF ENGINEERING
CREDIT HOURS ENGINEERING PROGRAMS
Computer Engineering and Software Systems Program



"Ontologies & the Semantic Web"

"Term Project"

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Hospital Project

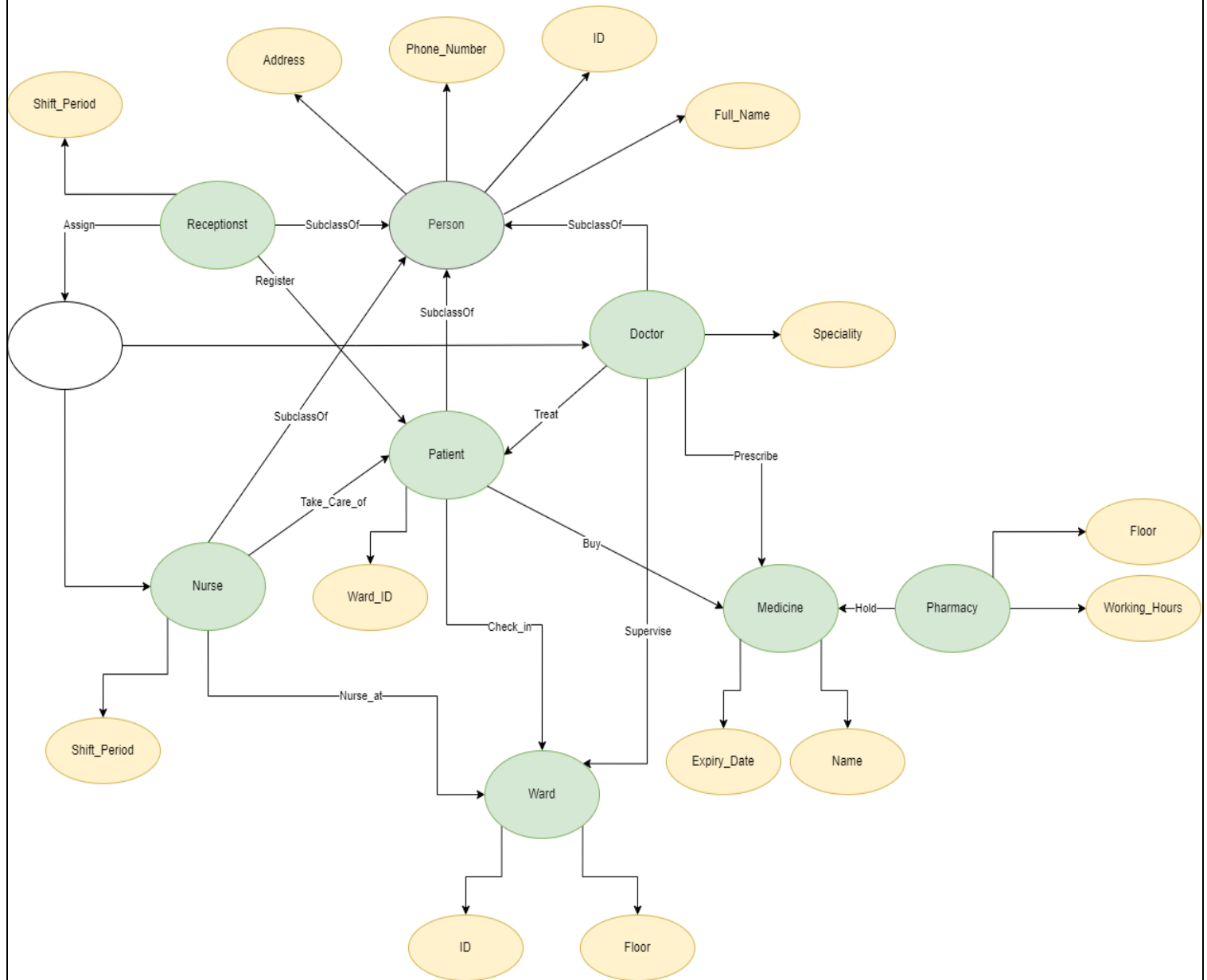
1. Problem Statement:

We are representing a case study of a “Hospital System” by means of Ontologies and Semantic Web.

The hospital system includes Doctors, Nurses, Patients, a Pharmacy, Receptionists, Medicines, and Wards.

The project will be implemented in “Owl” through Protégé and it will be illustrated in details through an RDF diagram, a detailed RDF description, entities cardinality constraints, and finally, we will show several examples for info that are extracted using SPARQL queries.

2.RDF Graph:



3.Detailed RDF Description:

Classes:

Person

Doctor

Ward

Nurse

Pharmacy

Receptionist

Patient

Medicine

Data Properties:

Person: Full_Name, Phone_Number, Address, ID

Doctor: Speciality

Patient: Ward_Id

Nurse: Shift_Period

Receptionist: Shift_Period

Ward: ID, Floor

Medecine: Expiry_Date, Name

Pharmacy: Floor, Working_Hours

Object Properties:

Take_Care_of

Register

Treat

Assign

Nurse_at

Supervise

Buy

Prescribe

Hold

Check_in

4.Entities Cardinality Constraints:

- Doctor
 - prescribe min 1 Medicine
 - supervise min 1 Ward
 - treat max 3 Patient
- Nurse
 - nurse_at max 2 Ward
 - take_care_of max 4 Patient

- Patient
 - check_in exactly 1 Ward
 - buy min 1 Medicine

- Pharmacy
 - hold min 1 Medicine

- Receptionist
 - assign min 1 Doctor
 - assign min 1 Nurse
 - register min 1 Patient

- Ward
 - check_in max 6 Patient
 - nurse_at min 2 Nurse
 - supervise exactly 1 Doctor

5. SPARQL Queries:

- Query to extract Patients and their Doctor's names:

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Active Ontology Entities Classes Object Properties Data Properties Annotation Properties Individuals OWLViz DL Query OntoGraf Ontology Differences SPARQL Query

SPARQL query:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?patientName ?doctorName
WHERE {
  ?person a uri:Patient .
  ?person uri:name ?patientName .
  ?Doctor uri:treat ?person .
  ?Doctor uri:name ?doctorName .
}
```

patientName	doctorName
"Chris greg"^^<http://www.w3.org/2001/XMLSchema#string>	"Ahmed Mohamed"^^<http://www.w3.org/2001/XMLSchema#string>
"Berry White"^^<http://www.w3.org/2001/XMLSchema#string>	"Sam John"^^<http://www.w3.org/2001/XMLSchema#string>

- Query to extract Patients, their Doctors and their Specialty:

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PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?patientName ?doctorName ?doctorSpecialty
WHERE {
  ?person a uri:Patient .
  ?person uri:name ?patientName .
  ?Doctor uri:treat ?person .
  ?Doctor uri:name ?doctorName .
  ?Doctor uri:specialty ?doctorSpecialty .
}
```

patientName	doctorName	doctorSpecialty
"Chris greg"^^<http://www.w3.org/2001/XMLSchema#string>	"Ahmed Mohamed"^^<http://www.w3.org/2001/XMLSchema#string>	"Radiologist"^^<http://www.w3.org/2001/XMLSchema#string>
"Berry White"^^<http://www.w3.org/2001/XMLSchema#string>	"Sam John"^^<http://www.w3.org/2001/XMLSchema#string>	"Dermatology"^^<http://www.w3.org/2001/XMLSchema#string>

- Query to extract Patients, their Address and Phone Number:

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PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?patientName ?patientAddress ?patientPhoneNumber
WHERE {
  ?person a uri:Patient .
  ?person uri:name ?patientName .
  ?person uri:address ?patientAddress .
  ?person uri:phone_number ?patientPhoneNumber .
}
```

patientName	patientAddress	patientPhoneNumber
"Berry White"^^<http://www.w3.org/2001/XMLSchema#string>	"New Cairo street 3"^^<http://www.w3.org/2001/XMLSchema#string>	"03948767892"^^<http://www.w3.org/2001/XMLSchema#integer>
"Chris greg"^^<http://www.w3.org/2001/XMLSchema#string>	"New Cairo street 20"^^<http://www.w3.org/2001/XMLSchema#string>	"09428768765"^^<http://www.w3.org/2001/XMLSchema#integer>

- Query to extract Patients, their Nurses and their Shifts:

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SPARQL query:

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PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?patientName ?nurseName ?nurseShift
WHERE {
  ?person a uri:Patient .
  ?person uri:name ?patientName .
  ?Nurse uri:take_care_of ?person .
  ?Nurse uri:name ?nurseName .
  ?Nurse uri:nurse_shift_period ?nurseShift .
}
```

patientName	nurseName	nurseShift
"Berry White"^^<http://www.w3.org/2001/XMLSchema#string>	"John Elton"^^<http://www.w3.org/2001/XMLSchema#string>	"8"^^<http://www.w3.org/2001/XMLSchema#integer>
"Chris greg"^^<http://www.w3.org/2001/XMLSchema#string>	"Sandra eric"^^<http://www.w3.org/2001/XMLSchema#string>	"12"^^<http://www.w3.org/2001/XMLSchema#integer>

- Query to extract Receptionists, their registered Patients and their Wards:

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SPARQL query:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?patientName ?receptionistName ?patientWard
WHERE {
  ?person a uri:Patient .
  ?person uri:name ?patientName .
  ?receptionist uri:register ?person .
  ?receptionist uri:name ?receptionistName .
  ?person uri:ward_number ?patientWard .
}
```

patientName	receptionistName	patientWard
"Berry White"^^<http://www.w3.org/2001/XMLSchema#string>	"Maria Andres"^^<http://www.w3.org/2001/XMLSchema#string>	"305"^^<http://www.w3.org/2001/XMLSchema#integer>
"Chris greg"^^<http://www.w3.org/2001/XMLSchema#string>	"Jack adam"^^<http://www.w3.org/2001/XMLSchema#string>	"203"^^<http://www.w3.org/2001/XMLSchema#integer>

- Query to extract Receptionists, their Shifts and Phone Number:

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SPARQL query:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?receptionistName ?receptionistShiftPeriod ?receptionistPhoneNumber
WHERE {
  ?person a uri:Receptionist .
  ?person uri:name ?receptionistName .
  ?person uri:receptionist_shift_period ?receptionistShiftPeriod .
  ?person uri:phone_number ?receptionistPhoneNumber .
}
```

receptionistName	receptionistShiftPeriod	receptionistPhoneNumber
"Jack adam"^^<http://www.w3.org/2001/XMLSchema#string>	"8"^^<http://www.w3.org/2001/XMLSchema#integer>	"09217898765"^^<http://www.w3.org/2001/XMLSchema#integer>
"Maria Andres"^^<http://www.w3.org/2001/XMLSchema#string>	"12"^^<http://www.w3.org/2001/XMLSchema#integer>	"09128767898"^^<http://www.w3.org/2001/XMLSchema#integer>

- Query to extract Patients' Names:

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SPARQL query:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?person ?name
WHERE { ?person a uri:Patient .
        ?person uri:name ?name . }
```

person	name
Patient2	"Berry White"^^<http://www.w3.org/2001/XMLSchema#string>
Patient1	"Chris greg"^^<http://www.w3.org/2001/XMLSchema#string>

- Query to extract Doctors' Names:

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SPARQL query:

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PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?person ?name
WHERE { ?person a uri:Doctor .
        ?person uri:name ?name . }
```

person	name
DR1	"Ahmed Mohamed"^^<http://www.w3.org/2001/XMLSchema#string>
DR2	"Sam John"^^<http://www.w3.org/2001/XMLSchema#string>

- Query to extract Receptionist' Names:

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PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?person ?name
WHERE { ?person a uri:Receptionist .
        ?person uri:name ?name . }
```

person	name
Receptionist2	"Maria Andres"^^<http://www.w3.org/2001/XMLSchema#string>
Receptionist1	"Jack adam"^^<http://www.w3.org/2001/XMLSchema#string>

- Query to extract Nurses' Names:

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SPARQL query:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX uri: <http://www.semanticweb.org/moham/ontologies/2022/4/untitled-ontology-5#>
SELECT ?person ?name
WHERE { ?person a uri:Nurse .
        ?person uri:name ?name . }
```

person	name
Nurse1	"Sandra eric"^^<http://www.w3.org/2001/XMLSchema#string>
Nurse2	"John Elton"^^<http://www.w3.org/2001/XMLSchema#string>