

## Semantic Web System

### Assignment 2 Part 2– Sample Answers

#### Question 1:

1. Which course(s) does a student take?
2. Which lecturer(s) teach a specific student?
3. What are the courses offered in first semester?

#### Question 2: Concepts and concept hierarchy

1. Thing
  - a. Person
    - i. Student
      1. LocalStudent
      2. InternationalStudent
      3. ExchangeStudent
    - ii. Staff
      1. Lecturer
      2. TeachingAssistant
      3. Tutor
      4. Demonstrator
  - b. AcademicLevel
    - i. Undergraduate
      1. FirstYearUndergraduate
      2. SecondYearUndergraduate
      3. ThirdYearUndergraduate
      4. FourthYearUndergraduate
      5. FifthYearUndergraduate
    - ii. PostGraduate
      1. Masters
      2. PhD
  - c. Semester
    - i. FirstSemester
    - ii. SecondSemester
  - d. Lecture
  - e. Course
    - i. FirstSemesterCourse
      1. IAML
      2. LP
    - ii. SecondSemesterCourse
      1. SWS
      2. Inf2D
  - f. Tutorial
  - g. Employee
  - h. Room
    - i. LectureRoom
    - ii. Lab
    - iii. Office
  - i. Grade

- j. Marks
- k. TutorialGroup

**Hierarchy examples:**

Student  $\sqsubseteq$  Person  
 InternationalStudent  $\sqsubseteq$  Student

**Disjoint classes**

Person  $\sqcap$  AcedemicLevel  $\equiv \perp$   
 Student  $\sqcap$  Lecturer  $\equiv \perp$   
 LocalStudent  $\sqcap$  InternationalStudent  $\equiv \perp$   
 Undergraduate  $\sqcap$  PostGraduate  $\equiv \perp$   
 FirstSemesterCourse  $\sqcap$  SecondSemesterCourse  $\equiv \perp$

**Equivalence classes**

InternationalStudent  $\equiv$  ForeignStuddent  
 Staff  $\equiv$  Employee  
 Classroom  $\equiv$  LectureRoom  
 Grade  $\equiv$  Marks

**Question 3: Relations and Hierarchies**

Relations (and inverses)

takesCourse (takesCourse, isTakenBy, isStudiedBy), hasLevel, teacherOf (isTaughtBy), tutorOf, hasGrade, isMemberOf( hasMember), inTutorialGroup, hasTutorial, taughtIn (egL lecture hasLectureRoom room1), inLectureRoom, hasAge, hasGender, hasMaxClassSize, hasGrade, hasCourseSemester.

DisjointL (studiesCourse, teachesCourse)

hasAssignmentGrade  $\subset$  hasGrade

hasExamGrade  $\subset$  hasGrade

hasMaxClassSize  $\subset$  hasClassSize

**Question 4: Axioms**

Definition of Teacher:

$$\forall x [Teacher(x) \Leftrightarrow Staff(x) \wedge \exists y [ Course(y) \wedge teacher(x,y)]]$$

Definition of Student:

$$\forall x [Student(x) \Leftrightarrow Person(x) \wedge \exists y [Course(y) \wedge memberOf(x,y)]]$$

Definition of First Semester Corse:

$$FirstSemesterCourse \equiv Course \wedge \exists hasCourseSemester.FirstSemester$$

Definition of Good Student:

$$\forall x,y (GoodStudent(x) \wedge Course(y) \wedge memberOf(x,y) \wedge hasGrade(y) > 70$$

Restrict domain of teacherOf to Teachers

$$\exists teacherOf. T \sqsubseteq Teachers$$

Restrict range of teacherOf to courses

$T \sqsubseteq \text{ALL teacherOf.Course}$

Every teacher teaches at least one course:

$\text{Teacher} \sqsubseteq \geq 1 \text{ teacherOf.Course}$

A tutor is a staff who is tutorOf at least one course

$\text{Tutor} \sqsubseteq \text{Staff} \sqcap \exists \text{tutorOf.Course}$

Every course has at least one assignment

$\text{Course} \sqsubseteq \exists \text{has Assignment.Assistant}$

## Marking Scheme:

### Question 1 (Total marks: 10 x 0.5 = 5 marks)

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Student is able to describe the domain(s) of their vocabulary = **3 marks.**

Student describes how concepts are related in the domain = **3 marks**

Student provides 5 queries that the ontology should be able to answer = **3 marks.**

For very clear and cohesive description of domain, concepts and relations = **1 mark.**

### Question 2 (Total marks: 20 x 0.5 = 10 marks)

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- Each correct concept identified with clear description = **1 mark**  
(Note: Select 8 best scoring concepts and explanations)
- Each correct disjoint class with clear description = **1 mark**  
(Note: Select 8 best scoring subclasses and explanations)
- Each correct subclass or concept hierarchy with clear description = **1 mark.**  
(Note: Select best scoring 5 subclasses)
- Each correct equivalence class with clear description = **1 mark.**  
(Note: Select 3 best scoring equivalences)
- If an explanation is missing, or is invalid, student should be given only 0.5pt.

### Question 3 (Total marks: 20 x 0.5 = 10 marks)

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- Each correct object, data and inverse property with clear descriptions = **9 mark**  
(Note: Select best scoring 5 object properties, 2 data properties, 2 inverse properties and their explanations)
- Correctly specified domain and range of each object, data and inverse property = **9 marks.**
- Each correct relation hierarchy with clear description = **2 mark**  
(Note: Select 2 best scoring relation hierarchies and explanations)

### Question 4 (Total marks : 20 x 0.5= 10 marks)

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- Each correct axiom which gives meaning to a different concept = **2 marks for each axiom**
- Clear explanation of intuition and meaning of each axiom = **1 mark for each axiom**
- Proper use of logical connectives and quantifiers in each axiom = **1 mark for each axiom**

### Question 5 (Total marks: 8marks)

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- OWL/RDF file contains all classes, class hierarchies, relations, relation hierarchies and axioms defined in questions 2,3 and 4 = **2 marks.**

- Generated JPEG file of vocabulary graph from Protege showing all classes and subclasses = 2 marks.

Instance of classes included = **2 marks**.

Import OWL/RDF file in Protege and check consistency (No errors) = **2 marks**.

**Question 6 (Total marks: 7 marks)**

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- Query requires use of at least one axiom and result is correct = **1 mark for each of 5 queries**, otherwise 0.5mark if result incorrect or does not use at least one axiom
- Valid explanation of outputs, identification of limitations of vocabulary **2 mark**.