

**Indian Statistical Institute
Documentation Research and Training Center**

**MS in Library and Information Science
Semester Exam (IV semester) (2023-2025)
Paper –20: SEMANTIC WEB (THEORY)**

Date: 25.04.2025

Max Marks: 100
Time: 3 Hours

Instructions: Answer Question 1 and any four from the remaining questions.
All questions carry equal marks.

1. Answer *all* of the following questions.

[2×10=20]

- (i) Explain how the Semantic Web improves upon traditional web technologies with two concrete examples.
- (ii) Demonstrate how semantic nets overcome limitations of hierarchical taxonomies.
- (iii) Convert the following statement into a valid RDF graph using Turtle syntax: "Professor Sharma teaches Artificial Intelligence course at IIT Delhi."
- (iv) What is the Open World Assumption (OWA)? How does it differ from Closed World Assumption?
- (v) What is "punning" in OWL? Provide an example.
- (vi) Explain the purpose of `rdf:about` and `rdf:ID`.
- (vii) What is a "SPARQL endpoint"? Name one publicly available endpoint.
- (viii) Define taxonomy.
- (ix) Define knowledge graph.
- (x) Define triple store.

2. "An ontology is an explicit specification of a shared conceptualization."

(a) Critically analyze this definition in the context of semantic web applications.

[10]

(b) Compare domain ontology with upper-level ontology using concrete examples.

[10]

3. (a) What is "Inferencing" in the context of Semantic Web technologies? Describe different reasoning tasks with examples.

[10]

(b) Briefly describe the followings:

[10]

- i) The role of RDF in data interoperability.
- ii) How does OWL build upon the capabilities of RDFS?

4. Discuss the evolution from Term List to Ontology. Use examples to highlight differences between Glossary, Thesaurus, Taxonomy, and Ontology.

[20]

5. (a) Critically evaluate the limitations of RDFS as an ontology language. How does OWL address these limitations?

[10]

(b) Define "Linked Data" and discuss its usage.

[10]

6. Answer the following *four* questions.

[5×4=20]

- (a) Write a short note on schema.org.
- (b) Describe the following two with examples:
 - i) owl:TransitiveProperty
 - ii) owl:SymmetricProperty
- (c) Describe SKOS and its use in organizing knowledge.
- (d) Define TBox, RBox, and ABox with examples.

7. (a) Given the following RDF triples (in Turtle format), write a SPARQL query to retrieve all books published before 1860, along with their titles and authors. Present the results in a tabular format. [10]

```
@prefix dc: <http://purl.org/dc/elements/1.1/>.  
@prefix rec: <http://bookstore.com/records#>.  
@prefix inv: <http://bookstore.com/inventory#>.
```

```
Rec:book1 dc:title "David Copperfield";  
           Dc:creator "Charles Dickens";  
           Dc:date 1849.
```

```
Rec:book2 dc:title "The Woman in White";  
           Dc:creator "Wilkie Collins";  
           Dc:date 1859.
```

```
Rec:book3 dc:title "Pilgrim's Progress";  
           Dc:creator "John Bunyan";  
           Dc:date 1678.
```

(b) Draw an RDF diagram for the following RDF/XML data. [10]

```
<?xml version="1.0"?>  
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:cvoc="http://purl.org/cvoc/1.0/">  
  
  <rdf:Description rdf:about="http://example.org/publication/2025/graph-ai">  
    <rdf:type rdf:resource="http://example.org/Publication"/>  
    <cvoc:title>Advancements in Graph Neural Networks for Semantic Web</cvoc:title>  
    <cvoc:publisher rdf:resource="https://www.aclweb.org"/>  
    <cvoc:publishedIn rdf:resource="https://www.aclweb.org/anthology/P25-1012"/>  
    <cvoc:publicationDate>2025-03-15</cvoc:publicationDate>  
    <cvoc:creator rdf:nodeID="authors1"/>  
    <cvoc:reviewedBy rdf:resource="http://linkedin.com/in/DrAnjaliMenon"/>  
  </rdf:Description>  
  
  <rdf:Description rdf:nodeID="authors1">  
    <rdf:type rdf:resource="http://example.org/AuthorGroup"/>  
    <cvoc:firstAuthor rdf:resource="http://linkedin.com/in/SameerKhan"/>  
  </rdf:Description>  
</rdf:RDF>
```

```

    <cvoc:secondAuthor rdf:resource="http://linkedin.com/in/MeeraSharma"/>
    <cvoc:thirdAuthor rdf:resource="http://linkedin.com/in/RaviKulkarni"/>
  </rdf:Description>

  <rdf:Description rdf:about="http://linkedin.com/in/SameerKhan">
    <rdf:type rdf:resource="http://example.org/Researcher"/>
    <cvoc:name>Sameer Khan</cvoc:name>
    <cvoc:affiliation rdf:resource="http://www.iitb.ac.in"/>
  </rdf:Description>

  <rdf:Description rdf:about="http://linkedin.com/in/MeeraSharma">
    <rdf:type rdf:resource="http://example.org/Researcher"/>
    <cvoc:name>Meera Sharma</cvoc:name>
    <cvoc:affiliation rdf:resource="http://www.iisc.ac.in"/>
  </rdf:Description>

  <rdf:Description rdf:about="http://linkedin.com/in/RaviKulkarni">
    <rdf:type rdf:resource="http://example.org/Researcher"/>
    <cvoc:name>Ravi Kulkarni</cvoc:name>
    <cvoc:affiliation rdf:resource="http://www.nitk.ac.in"/>
  </rdf:Description>

  <rdf:Description rdf:about="http://linkedin.com/in/DrAnjaliMenon">
    <rdf:type rdf:resource="http://example.org/Reviewer"/>
    <cvoc:name>Dr. Anjali Menon</cvoc:name>
    <cvoc:affiliation rdf:resource="http://www.jnu.ac.in"/>
  </rdf:Description>
</rdf:RDF>

```

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1. Create an ontological data model using protégé to represent the following scenario. [50]

Arjun Desai, aged 30, is a Software Engineer at Infosys Ltd., Pune. His father, Mr. Vasant Desai, aged 60, is a retired Mechanical Engineer who previously worked at Tata Motors, Pune. Arjun's mother, Mrs. Shobha Desai (58 years old), is a homemaker. Arjun has a younger sister, Anjali Desai (25 years), who is pursuing her MBA from Symbiosis Institute of Business Management (SIBM), established in 1978 and located in Pune. Anjali was inspired by her uncle, Mr. Raghav Desai (Vasant's younger brother) age 50, who is currently a Professor in the Department of Management Studies at the same institute. Arjun and Anjali are fond of trekking and recently trekked to Sinhagad Fort on March 15, 2025, along with their cousin Neha Desai (age 23), daughter of Raghav. They often share their trekking stories with their grandfather, Mr. Dattatreya Kulkarni (Shobha's father), aged 85, a retired school principal.

2. Write SPARQL queries for **any five questions**.

[10*5 = 50]

- a. Count the number of males and females in the model.
- b. How many children does Vasant have?
- c. Retrieve all individuals who are older than 50.
- d. What are the name and year of establishment of the institute attended by the person whose first name is "Anjali"?
- e. What is the profession of the person whose first name is "Raghav"?
- f. On what date did Arjun, Anjali, and Neha go trekking?
- g. Identify all individuals whose first name starts with the letter "A".