JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 3 EXAMINATION - 2024

B.Tech-VI Semester (CSE/IT)

COURSE CODE (CREDITS): 20B1WCI732 (2) MAX. MARKS: 35

COURSE NAME: From Graph to Knowledge Graph

COURSE INSTRUCTOR: Ravindara Bhatt MAX. TIME: 2 Hours

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

1. **[2.5 + 2.5 = 5 Marks] [CO3]**

a. Explain what inverse properties are in ontology with the help of an example. For a particular property that exists in the ontology, add the correct inverse property axioms. You are not supposed to add new properties, only state that a property is the inverse of an other property if they already exist in the ontology.

b. Can the graph shown in Figure A be decomposed into edge-disjoint spanning trees?

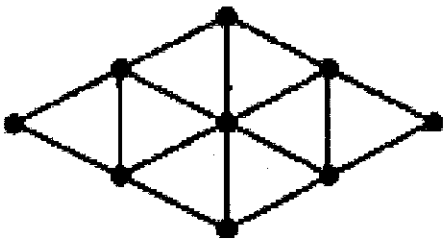

Figure A

2. **[2.5 + 2.5 = 5 Marks] [CO4]**

a. Ordinarily, focused crawlers take as input traditional inputs such as some starting (or seed) URLs and, possibly, a topic description (e.g. a list of keywords). Think of at least two other novel input types. What domains would they particularly useful for?

b. Draw the graph representation of the cipher snippet shown in Figure B.

```
CREATE (bob:Person {name: "Bob"})
CREATE (james:Person {name: "James"})
CREATE (stephen:Person {name: "Stephen"})
CREATE (sarah:Person {name: "Sarah"})
CREATE (google:Company {name: "Google"})
CREATE (tech:Sector {name: "Technology"})
CREATE (bob)-[:WORKSIN]->(tech)-[:COMPANY]->(google)
CREATE (stephen)-[:EMPLOYEDBY]->(google)
CREATE (james)-[:FRIEND]->(stephen)-[:SIBLING]->(sarah)
```

Figure B

3. **[2.5 + 2.5 = 5 Marks] [CO3]**

a. Discuss the major steps involved in modeling an ontology.

b. Discuss the major steps of an overall process model to build a knowledge graph.

4. **[2.5 + 2.5 = 5 Marks] [CO2]**

Prove or disprove:

a. Every subgraph of a planar graph is planar.

b. Every subgraph of a nonplanar graph is nonplanar.

5. **[2.5 + 2.5 = 3 Marks] [CO2]**

a. For the graph G shown in Figure C, compute $\chi'(G)$ (edge chromatic number) and draw L(G) (Line Graph).

b. Prove that the chromatic number of a graph equals the maximum of the chromatic numbers of its components.

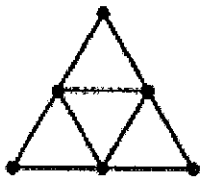

Figure C

6. **[5 Marks] [CO2]**

Figure D shows a flow network. The first value of each edge represents the flow, which is initially 0, and the second value represents the capacity. The value of the flow of a network is the sum of all the flows that get produced in the source s or equivalently to the sum of all the flows that are consumed by the sink t.
A maximal flow is a flow with the maximal possible value. Find the maximal flow of a flow network.

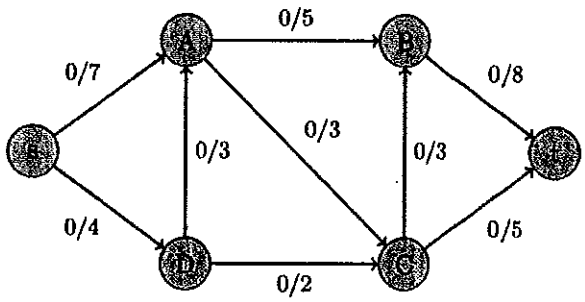

Figure D

7. **[2.5 + 2.5 = 5 Marks] [CO1]**

a. Consider the CLIQUE problem restricted to graphs in which every vertex has degree at most 3. Call this problem CLIQUE-3. Prove that CLIQUE-3 is in NP.

b. *Proving* **NP***-completeness by generalization.* For the LONGEST PATH problem given below, prove that it is **NP**complete by showing that it is a *generalization* of some **NP**-complete problem. LONGEST PATH: Given a graph G and an integer g, and in G a simple path of length g.