W6. Check List — Junyi

- What do we do with the created KG?
  - retrieve information → Query languages
  - conclude new facts from the knowledge graph that are not explicitly present in it → inference algorithm
- two classes of inference algorithms
  - graph algorithms
    - path finding
      - shortest path
      - single source shortest path
      - minimum spanning tree
    - centrality detection
      - function
        - understanding the importance of a node - most important nodes, bridges in a network
      - types
        - degree centrality
        - betweenness centrality
        - closeness centrality
        - page rank
    - community detection
      - algorithms
        - standard graph algorithms
          - connected components
          - strongly connected components
        - bottom up algorithms
          - label propagation

- assign each node to be a different community
- examine all nodes in a fixed order → update the community of a node that is shred by most of its neighbors, break ties in a random order
- terminate when each node is in a community shared by most of its neighbors

▼ unfolding

▼ phase 1

- Assign each node into a separate community
- Examine each node and its neighbors to test if there will be an overall gain in modularity by placing it in the same community as a neighbor

▼ phase 2

- Create a new graph in which each node represents a community from Phase I
- If there are edges between nodes in a community, represent it as a self-loop

▼ repeat

▼ ontology-based algorithms

- Associates classes with nodes
- Defines semantic properties of relationships
- Two major categories of inference

▼ Class-based Inference or Taxonomic Reasoning → primarily relies on the hierarchy of classes and instances and inheritance of values across the hierarchy

▼ Application conditions

▼ applicable when it is useful to organize knowledge into classes

▼ both property graph and RDF data models support classes

▼ class

- hierarchy
- disjoint
- definition
  - necessary properties
    - have instance-of in the body of the rule
  - sufficient properties
    - have instance-of in the head of the rule
- value restriction
  - domian
  - range
  - cardinality
- inheritance

- Rule-based inference → involve general logical rules
  - Why it is needed
    - existential rules are needed whenever we need to create new objects in our knowledge graph. Relationship reification is an obvious such situation.
  - Approaches
    - bottom up / chase
      - we apply all the rules against the knowledge graph, and add new facts to it until we can no longer derive new facts
      - → the reasoning can proceed using traditional query processing methods.
    - top-down
      - a tighter interaction between the query engine of the knowledge graph with the rule evaluation. → we begin from the query to be answered, and apply the rules on as needed basis
      - → use lot less space as compared to the bottom up reasoning strategy.

▼ Comparison

Boundary between taxonomic inference and rule-based inference is not sharp

- It is generally a matter of the implementation approach
- Taxonomic inferences can be usually implemented using rules