

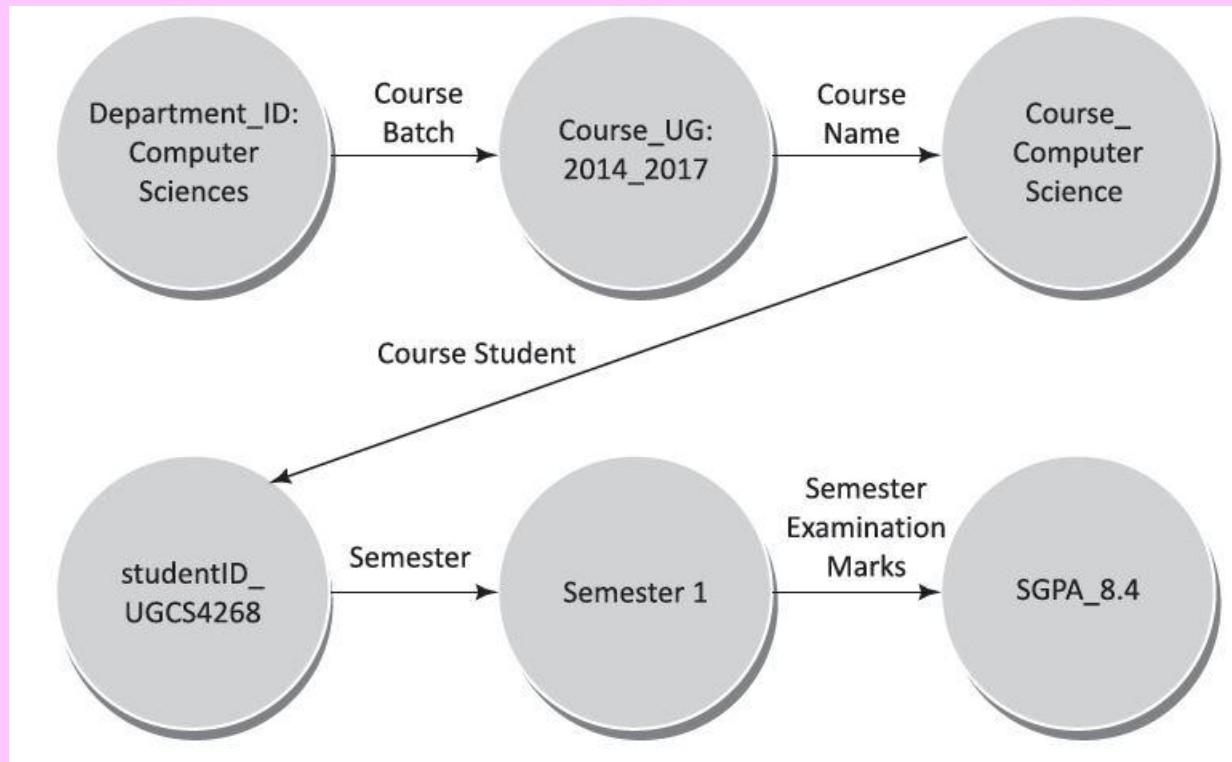
Lesson 1

Graph Characteristics and Properties

Graph

- Refers to a set of vertices and edges. receives at the processing end in a network
- An edge is a line joining two vertices,
- Graph vertices, called nodes
- The edges connect each other through relations, associations and properties.

Example of Graph for a student grade sheet



Graph

1. Defines the entities and properties to each vertex and edge
2. Graph represents a database using graph parameters or properties assigned to each vertex, v and edge, e .



Graph

- Creates a database system which models the data in a completely different way than the key-values, document, columnar and object data store models

Graph Database

- Graph database explicitly stores the relationships at each edge. A hierarchy graph stores hierarchal relationships.

Graph

3. Represents an abstract data type for the relationships

Depicts relationships, such as, a relationship between two or more quantitative dependent variables with respect to an independent variable

Graph

4. Represents knowledge and reasoning in a conceptual graph model
5. Represents a network, such as a social network

Data in a network flows between the source and receiver ends, and which is processed in real time or in batches

Graph

- Shows hierarchy relations between the tables do not store but implicit in the codes for a search or query

Graph

- Can have hyper-edges
- [A hyper-edge is a set of vertices of a hypergraph. A hypergraph is a generalization of a graph in which an edge can join any number of vertices (not only the neighbouring vertices).

Graph Order

- Order of a graph specifies by number of vertices N_v and number of edges N_e , where $N_v = |\mathcal{V}|$, and $N_e = |\mathcal{E}|$.

Graph as Dataflow Graph

- Models the data flows and program flows using directed graphs
- A Dataflow Graph (DFG) represents the flows of data and program

Dataflow Graph Representation

- The DFG consists of sets of circles
- A circle represents a node (vertex). Each node represents a set of computations or a set of operations which change the initial state to a new state (of entities or properties).

Directed Multigraph

- Provisions for the multiple parallel edges and that enables multiple relationships between the entities.
- Multiple parallel edges share the common source and destination vertices.

Graph Inward and Outward Edges

- Inward edge(s) represents an input for computation or state change input at the node
- Outward edge(s) represent the node output(s) which is input to the next node in the graph or represents state change after computation at that vertex

Directed Acyclic Graph (DAG)

- Directed Acyclic Graph is a special kind of directed graph that contains no cycles.
- [Cycle means returning to a vertex with incoming and outgoing edges.]

Graph Computations

- Computes using path traversal, which means going through a finite or infinite sequence of edges in a graph that connect a sequence of vertices between initial vertex v_0 and end vertex v_e .
Traversing is along a path from v_0 to v_e along the connected edges

Graph for Data Analysis

- Analyzes data using graphic parameters, relationships, associations and distribution of properties along the vertices in the path, and property variations on path traversal from a node to other nodes along the edges

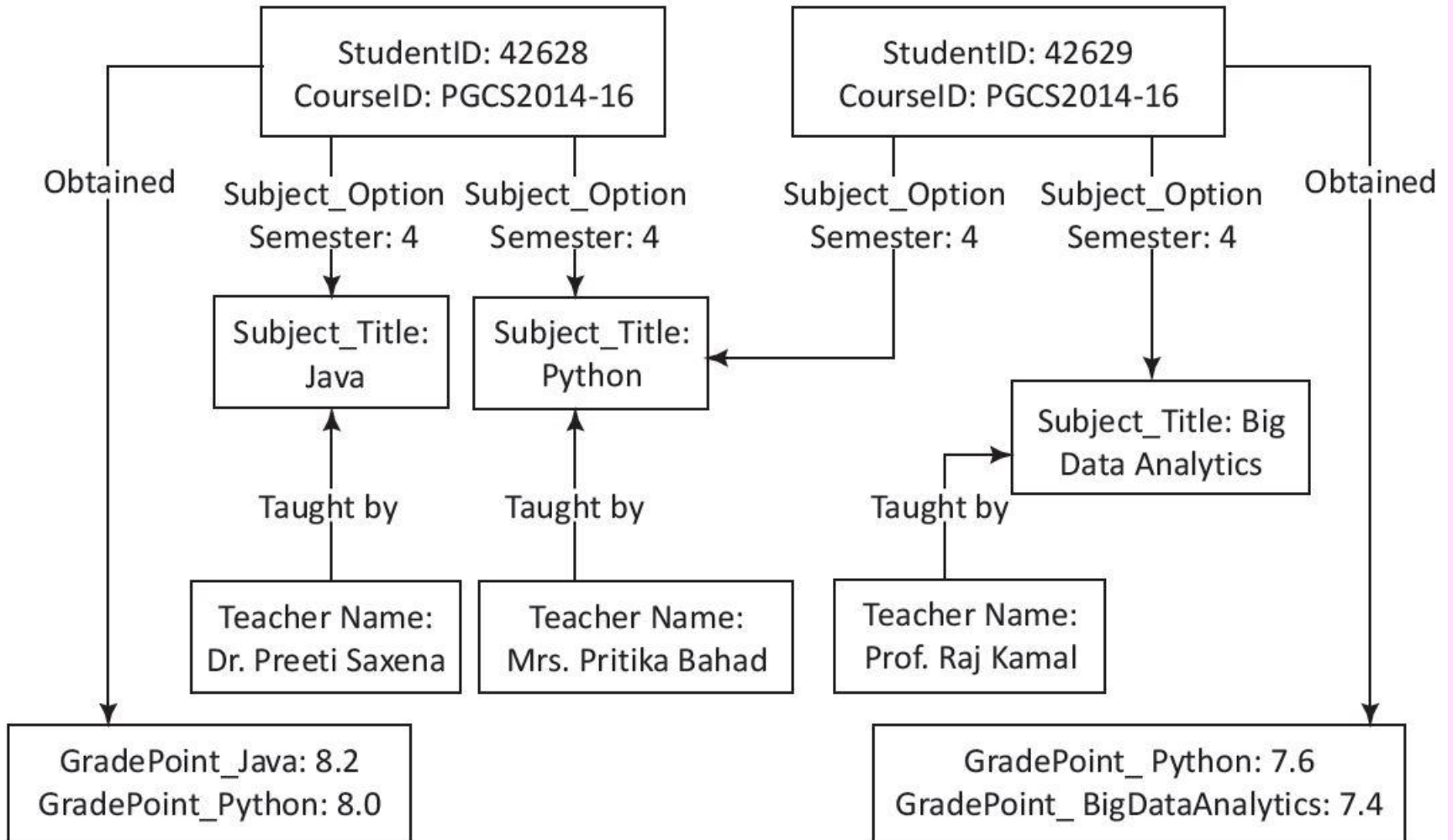
Graph for Querying in Data Analysis

- Analyzes data through the queries on graph database using path traversal, which means from v_0 following the sequence of steps to v_e .

Property Graph

- Assigns property to the nodes and edges
- Example 8.5 for detailed understanding

Figure 8.4 Property graph of students, semester, subject options, grades, and teachers



Graph Node In-degree and Out-degree

- A node parameter called *in-degree*, the number of inward edges in a directed graph
- A node parameter called out-degree, the number of outgoing edges from the node.

Summary

We learnt:

- Graph Vertices (nodes) and Edges
- Graph as an Abstract Data type
- Graph represents the relations, associations and properties.
- Graph Node In-degree and Out-degree
- Order Parameters N_v and N_e

Summary

We learnt that a Graph:

- Represents Dataflow and Program flow
- Represents a Database
- Represents a Network
- Hyper-graph and hyper-edges
- Computes and Queries through Path Traversal

End of Lesson 1 on
**Graph Characteristics and
Properties**