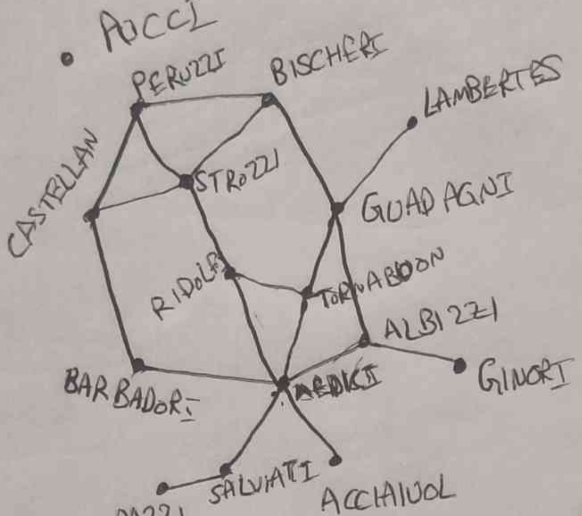
Task 2 - Graph algorithm application and knowledge graph tool familiarization

Padgett's data on marriage alliances among leading Florentine families in the latter Renaissance is given in the figure below. Each node is a family and each edge denotes a connection by marriage.



For the medici family, hand calculate degree centrality, closeness centrality and betweenness centrality.

1. Degree Centrality

Degree Centrality is nothing but the number of direct connections each node has.

formula $\Rightarrow$ DC (nodei) = degree of node i

from the above figure, MEDICI has more number of connections which is 6.

Medici - 6
Guadagni - 4
Strozzi - 3
Ridolfi - 3
Tornabuon - 3
Albizzi - 3
Castellan - 3
Peruzzi - 3
Bischeri - 3
Barbadori - 3
Salviati - 2
Lamberteg - 2
Pazzi - 2
Ginori - 1
Acciajuol - 1
Pucci - 0

2) Closeness Centrality

Closeness Centrality Can be measured by how close a node is to all other nodes in the network.

formula ⟹ $CC(i) = \frac{(n-1)}{\sum_{u \neq v} d(v,u)}$ where $d(v,u)$ is the shortest path distance

Example for Medici node

Distance 1 – Acciaiuol, Albizzi, Barbadori, Ridolfi, Salviati, Tornabuon (6 nodes)

Distance 2 – Castellan, Ginori, Guadagni, Pazzi (4 nodes)

Distance 3 – Bischeri, Lamberteschi, Peruzzi, Strozzi (4 nodes)

$$CC(\text{medici}) = \frac{15}{6(1)+4(2)+4(3)} = 0.57$$

3) Betweenness Centrality

Betweenness Centrality measures how often a node lies on the shortest path between other nodes.

formula ⟹ $BC(i) = \sum (\sigma_{st}(i) / \sigma_{st})$ for all pairs s,t where $s \neq t \neq i$

- σ_{st} = number of shortest paths from s to t
- $\sigma_{st}(i)$ = number of those paths that pass through i

Example for Medici node

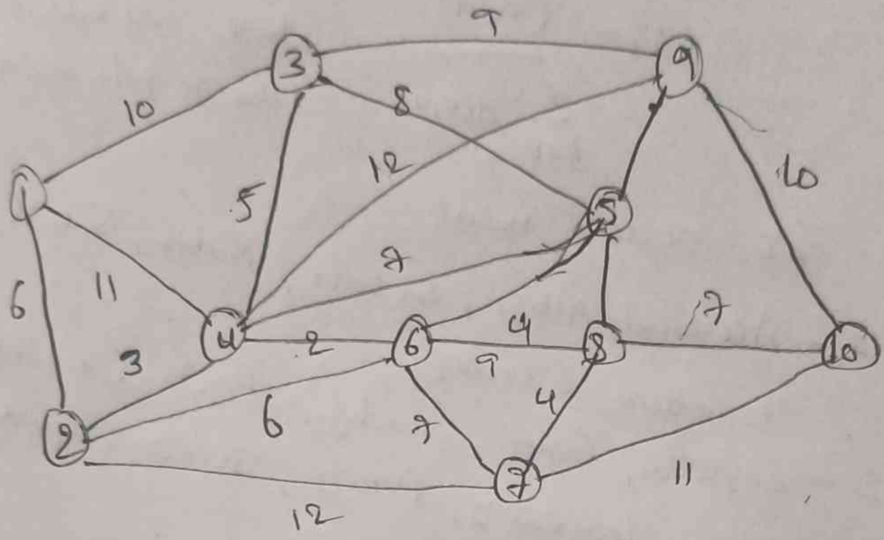
- Ridolfi ⟷ Salviati : through Medici (1 path)
- Ridolfi ⟷ Acciaiuol : through Medici (1 path)

and many pairs (120)

= 95

Task 3 - Shortest Path from 1 to node 10 using

Dijkstra's shortest path algorithm



Step - 1

Node	Shortest Dist	Previous node
1	0	
2	∞	
3	∞	
4	∞	
5	∞	
6	∞	
7	∞	
8	∞	
9	∞	
10		

Step - 2

Node	Shortest Dist	Previous node
1	0	
2	6	1
3	10	1
4	11	1
5	∞	
6	∞	
7	∞	
8	∞	
9	∞	
10		

V. Node = [1]

Step - 3

Node	Shor D	P.N
1	0	
2	6	1
3	10	1
4	9	2
5	∞	
6	12	2
7	18	2
8	∞	
9	∞	
10	∞	

V. Nodes = [1, 2]

Step - 4

Node	S.D	PN
1	0	
2	6	1
3	10	1
4	9	2
5	16	4
6	11	4
7	~~18~~ 18	2
8	21	4
9		

[.., 4]

Step - 5

Node	S.D.	PN
1	0	
2	6	1
3	10	1
4	9	2
5	16	4
6	11	4
7	18 ~~∞~~	2
8	19	3
9	∞	
10		

[.., 4, 3]

Step 6

Node	S.D.	PN
1	0	
2	6	1
3	10	1
4	9	2
5	15	6
6	11	4
7	18	2
8	20	6
9	19	3
10	∞	

Step - 7

Node	S.D.	PN
1	0	
2	6	1
3	10	1
4	9	2
5	15	6
6	11	4
7	18	2
8	17	5
9	18	5
10	∞	

[1,2 4,3,6,5]

Step - 8

Node	S.D.	PN
1	0	
2	6	1
3	10	1
4	9	2
5	15	6
6	11	4
7	18	2
8	17	5
9	18	5
10	24	8

[1,2,4,3,6,5,8]

Step - 9

Node	S.D.	PN
1	0	
2	6	1
3	10	1
4	9	2
5	15	6
6	11	4
7	18	2
8	17	5
9	18	5
10	24	8

[1,2,4,3,6,5,8,7]

Step - 10

Node	S.D.	PN
1	0	
2	6	1
3	10	1
4	9	2
5	15	6
6	11	4
7	18	2
8	17	5
9	18	5
10	24	8

[1,2,4,3,6,5,8,7,9]

Gd.

Calculation =)

$1-10 \Rightarrow 1 \to 2 \to 4 \to 6 \to 5 \to 8 \to 10$

$6+3+2+4+2+7 = \underline{\underline{24}}$

$S.P = 1 \to 2 \to 4 \to 6 \to 5 \to 8 \to 10$