APPLICATION OF FLOYD-WARSHAL'S ALGORITHM IN AIR FREIGHT SERVICES USING PYTHON.

PRESENTED

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RELEVANCE OF THE STUDY

- Freights can simply be referred to as goods transported usually in bulk whether by ship, trains, trucks or aircraft. Air-freight: a system of transporting goods which can be commercial or non-commercial by aircraft.

RELEVANCE OF THE STUDY

- Air freight services: Essential mode of transport for low density and relatively high-value commodities such as newspapers, parcels, perishable/short-lived products, precious metals and gemstones and low volume parcels. (BITRE, May 2014).
- Advantages include: Fastest means of transportation, Quick deliver of time-sensitive and perishable goods to end buyers, Urgency in transporting some goods especially those for commercial purpose which are highly demanded by consumers will have no other better means of transport order than Air-Freight.

CHALLENGES:

- Aircraft can travel for a certain number of kilometres to deliver freight form one location to another.
- Higher Cost incurred due to frequent stop overs for refuelling when traveling long distance

- The problem however, is an optimization problem to cut down the distances travelled, minimized number of stops-over so as to optimize the time for delivery of time-sensitive goods and minimize the total cost.

TERGETS:

The main goal of this research work is to apply Floyd Warshall's algorithm to air freight services and the objectives are to:

1. Implement the Algorithm using PYTHON.

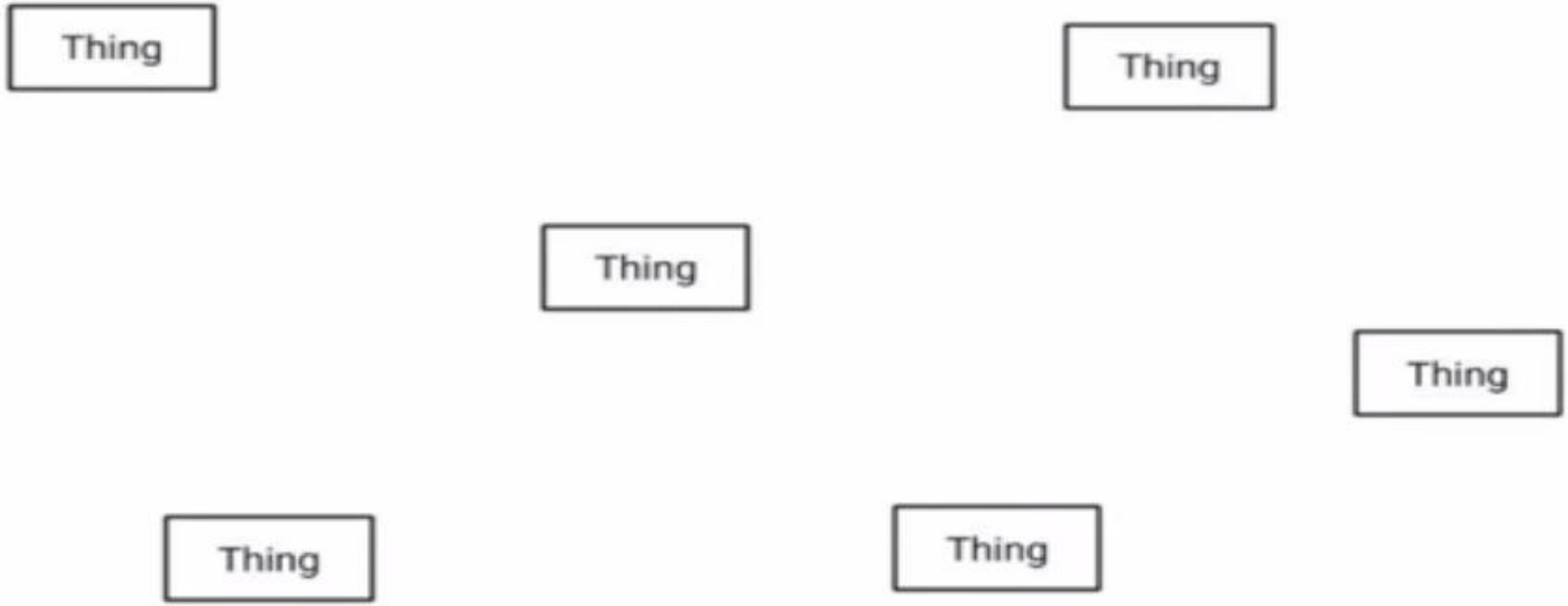
2. Suggest optimal routes to minimize costs and save time.

ADDITIONAL INFO

- Intelligent navigation systems know the current location using GPS and guide cars along the shortest route to minimize travel time, distance, or fuel and energy consumption. Some of these systems also react to changing traffic conditions and, in the future, cars may communicate with each other and negotiate routes to regulate the overall traffic flow and manage congestion. The end users are often interested in trip planning, which means that they want to know the distance and the shortest, cheapest, or most reliable path between two specific points. (C Sommer, 2010)

Shortest Path Problem:

Shortest Path Problems are Graph problem



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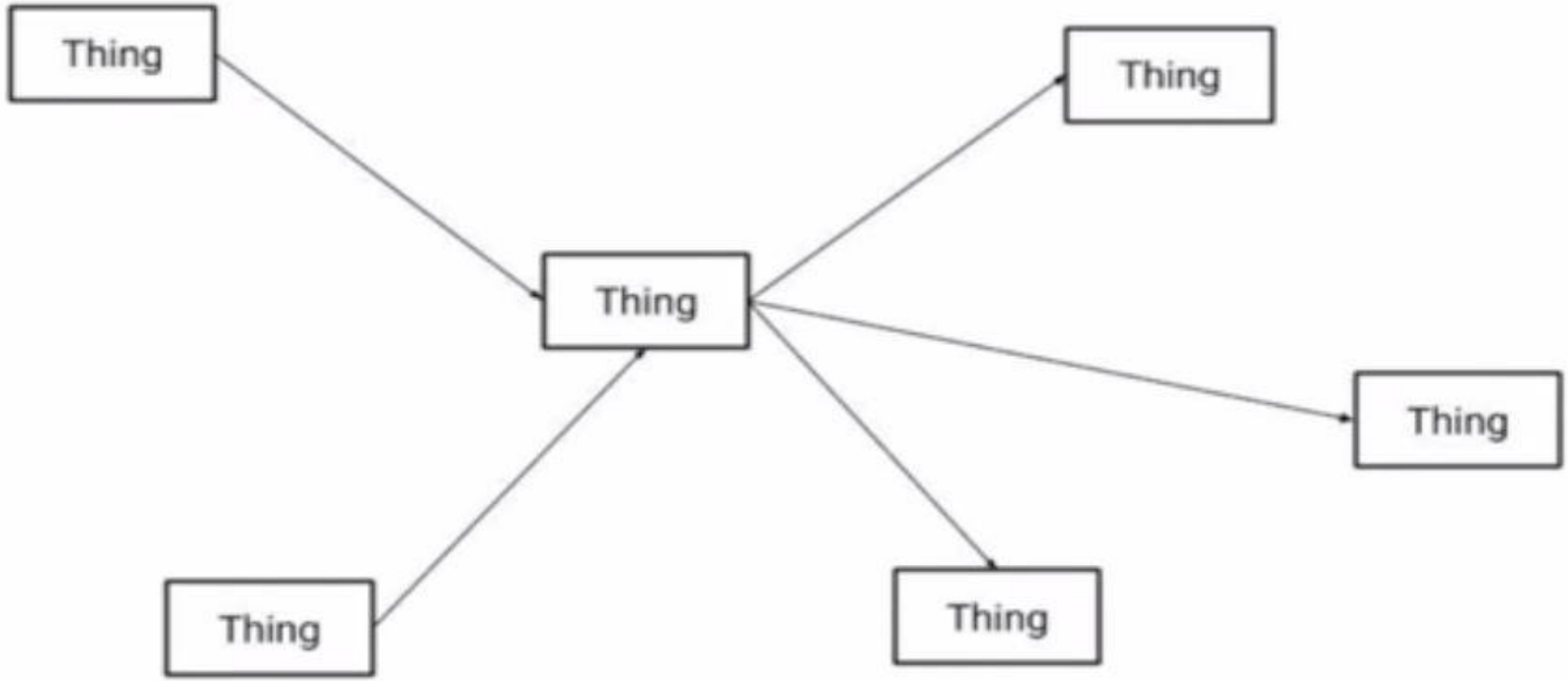

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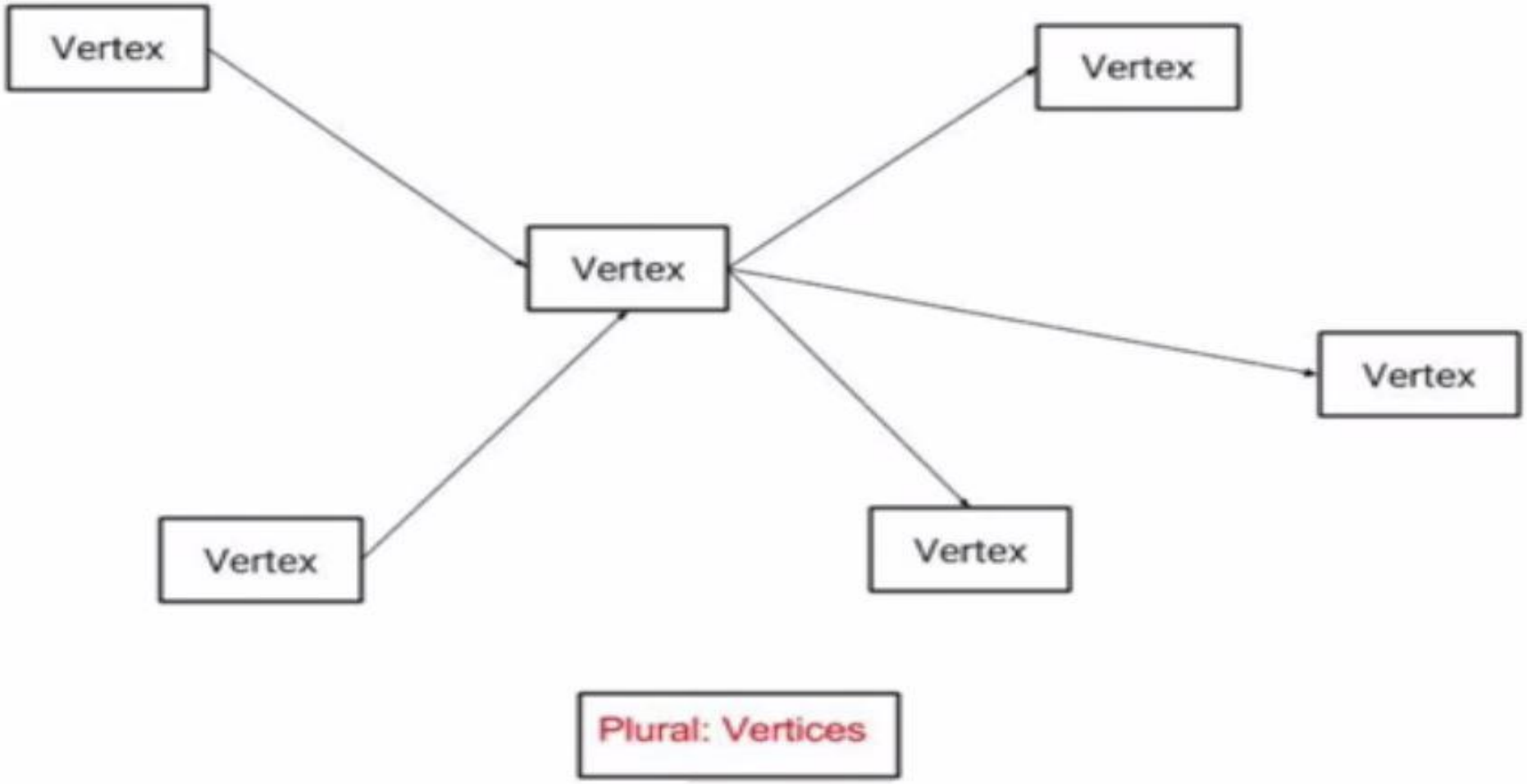

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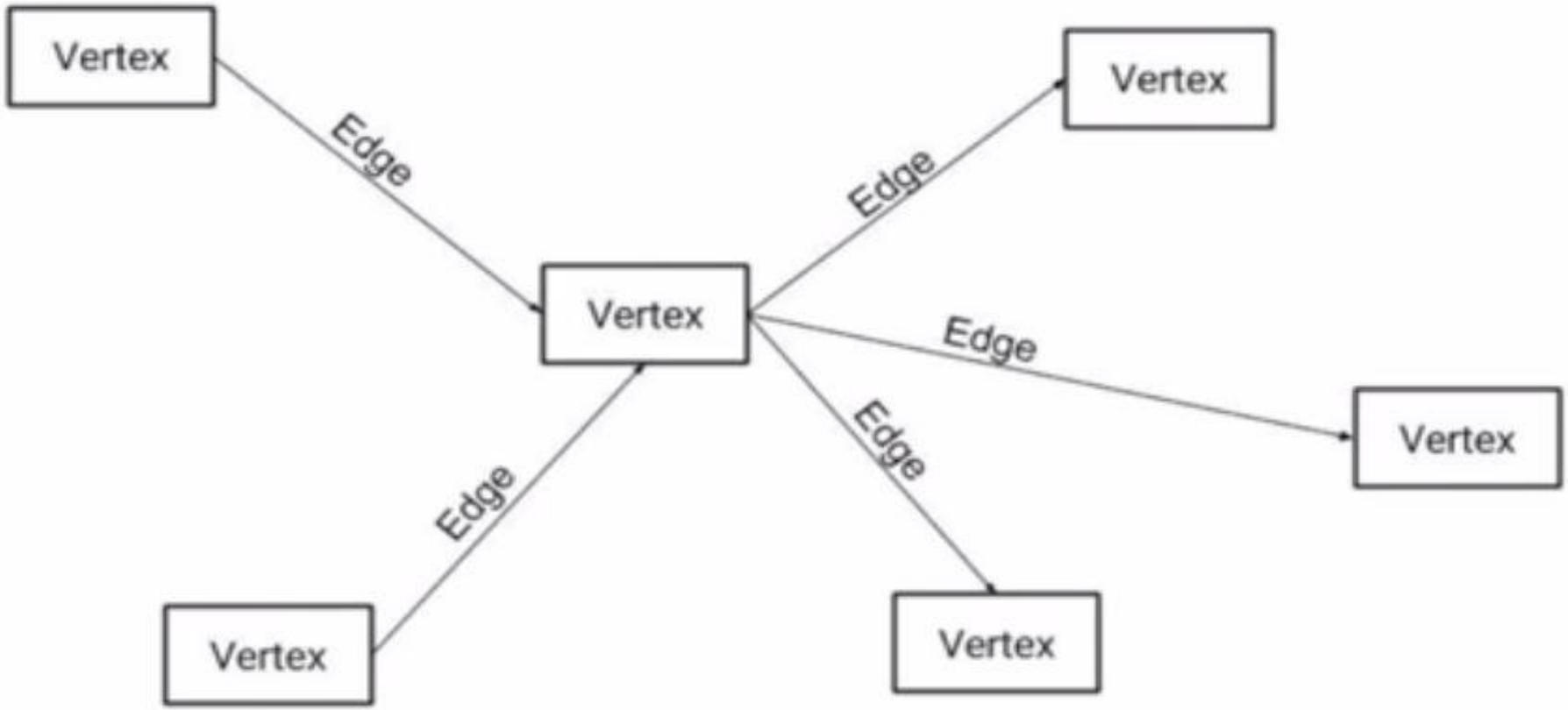


Shortest Path Problem:

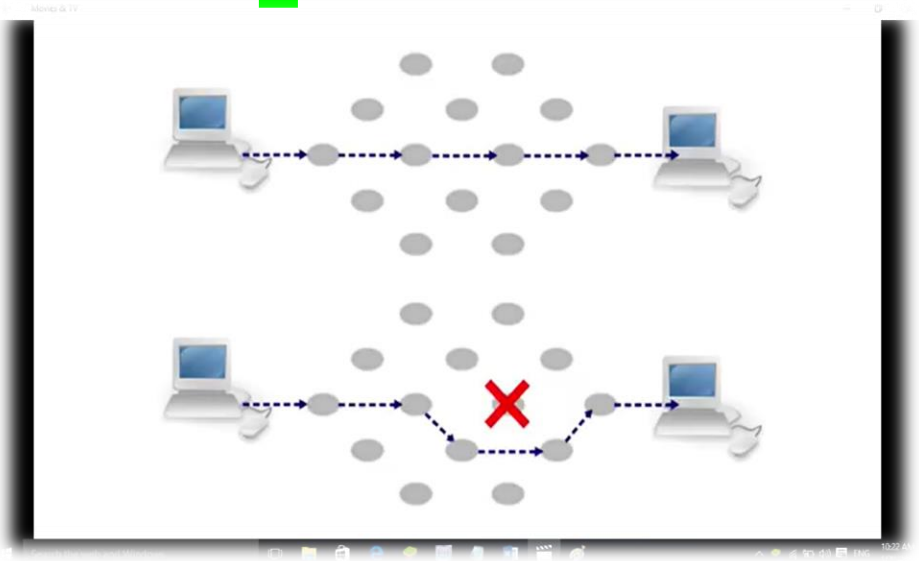
Shortest Path Problems are Graph problem

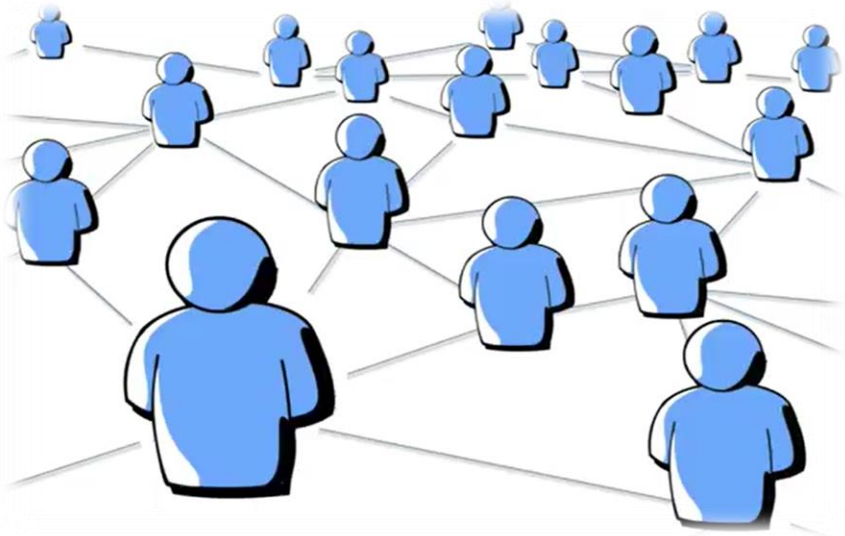
- The Suppose we are given a directed graph G=(V,E) and a weight function w: E->R. We assume that G does not contain cycles of weight 0 or less.

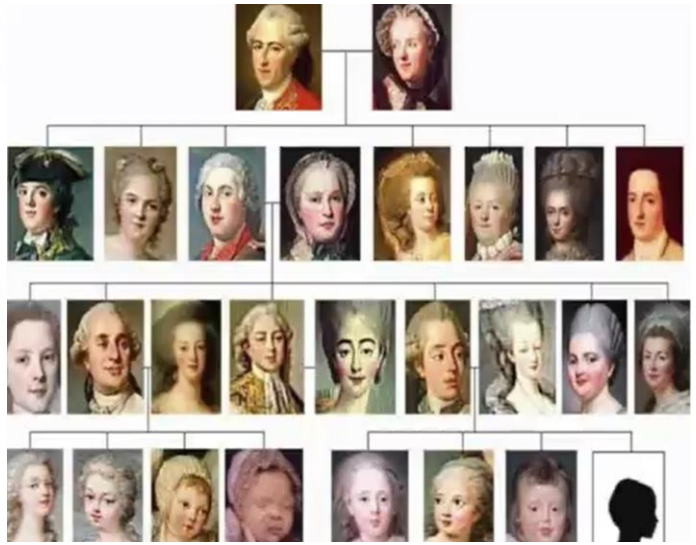
- The All-Pairs Shortest Path Problem asks to find the length of the shortest path between any pair of vertices in G.

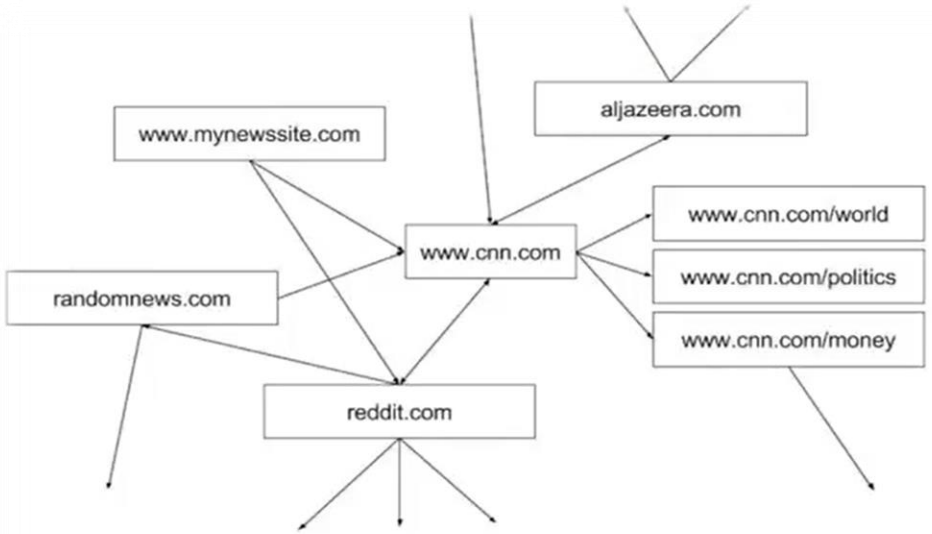
- This yields an O(n3) algorithm on graphs with N vertices

Graph:





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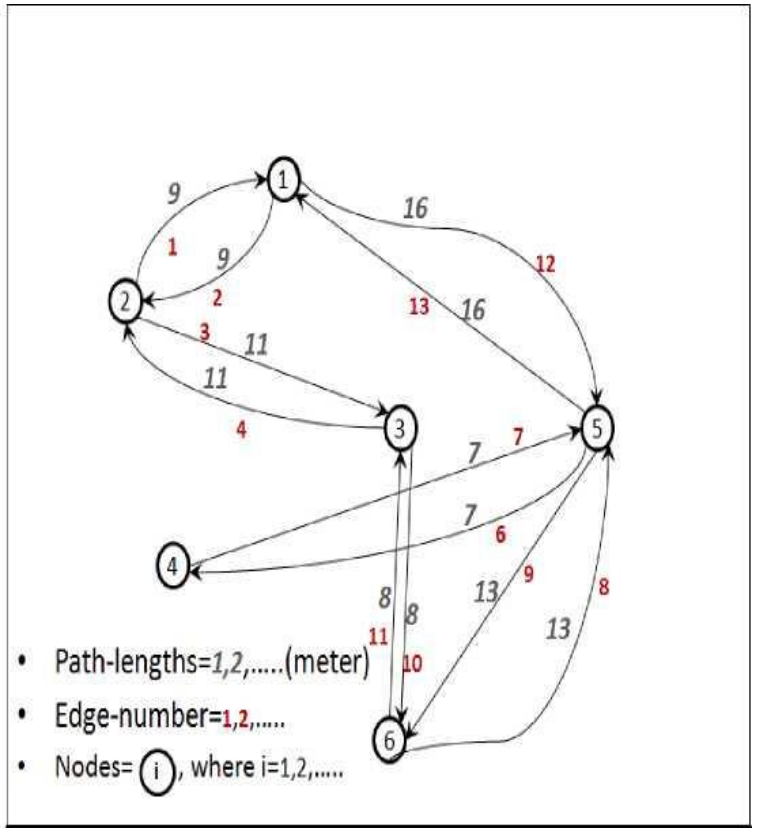
Port Harcourt
Margaret Ekpo
CAMEROON

Representation of Graph



	abuja	lokoja	kano	calaba	ekiti	lagos
abuja	0	219	300	245	210	192
lokoja	119	0	11	22	98	217
kano	219	111	0	132	209	201
calaba	200	187	999	0	7	292
ekiti	116	90	319	265	0	113
lagos	301	300	201	292	113	0

1. Graph

2. Adjacency Matric

Floyd-Warshall Algorithm

- Floyd-Warshall(W)
- n = numbers of rows of W;
- D(0) = W;
- for k = 1 to n do {
- for i = 1 to n do {
- for j = 1 to n do{
- $\mathbf{d_{ij}(k) = \min\{d_{ij}(k-1) , d_{ik}(k-1) + d_{kj}(k-1)\}}$;
- }
- }
- }
- return D(n);

HOW IT WORKS

Consider a shortest path P from i to j such that the intermediate vertices are from the set {1,…,k} then;

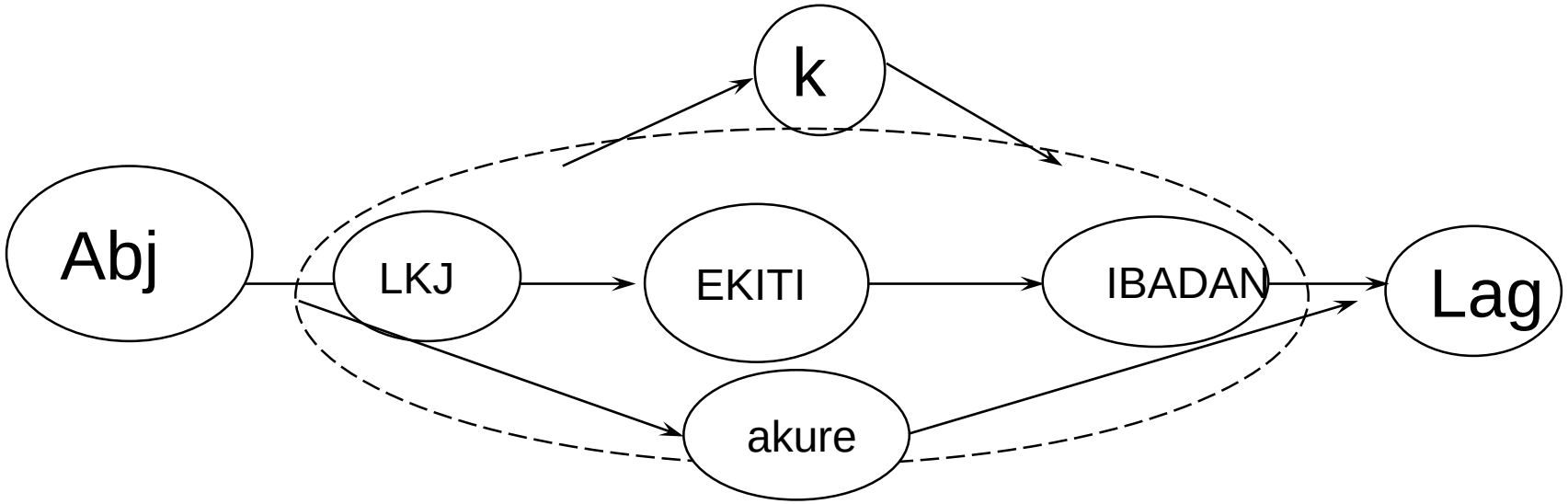
- If the vertex k is not an intermediate vertex on the path P, then $\mathbf{d_{ij}(k) = d_{ij}(k-1)}$
- If the vertex k is an intermediate vertex on the path P, then $\mathbf{d_{ij}(k) = d_{ik}(k-1) + d_{kj}(k-1)}$

Interestingly, in either case, the subpaths contain merely nodes from {1,…,k-1}.

DEDUCTION:>

- Therefore, we can conclude that

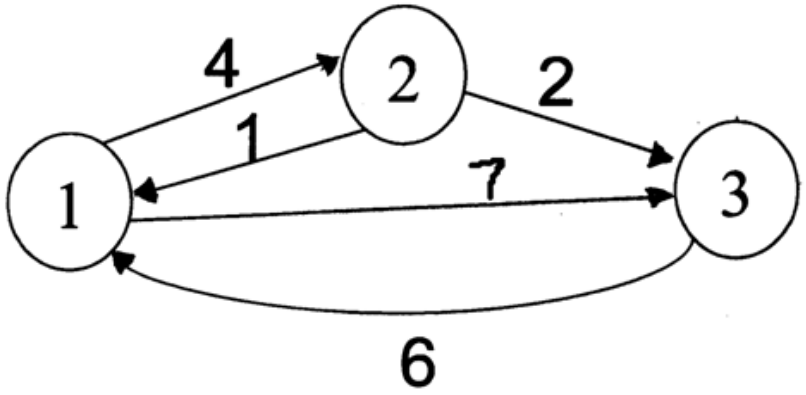
- $d_{ij}(k) = \min\{d_{ij}(k-1) , d_{ik}(k-1) + d_{kj}(k-1)\}$



FLOYD WARSHALL ALGORITHM - EXAMPLE

$$D^{(0)} = \begin{bmatrix} 0 & 4 & 7 \\ 1 & 0 & 2 \\ 6 & \infty & 0 \end{bmatrix}$$

Original weights.



$$D^{(1)} = \begin{bmatrix} 0 & 4 & 7 \\ 1 & 0 & 2 \\ 6 & 10 & 0 \end{bmatrix}$$

Consider Vertex 1:

D(3,2) = D(3,1) + D(1,2)

$$D^{(2)} = \begin{bmatrix} 0 & 4 & 6 \\ 1 & 0 & 2 \\ 6 & 10 & 0 \end{bmatrix}$$

Consider Vertex 2:

D(1,3) = D(1,2) + D(2,3)

$$D^{(3)} = \begin{bmatrix} 0 & 4 & 6 \\ 1 & 0 & 2 \\ 6 & 10 & 0 \end{bmatrix}$$

Consider Vertex 3:

Nothing changes.

ALL YOU NEED

Python programming language Version 3.2

Framework: Flacks

GUI: Tkinters

IDE : PyCharm

Lib: NetworkX is a Python-based package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and explanatory text. Uses include:numerical simulation, statistical modeling, machine learning and much more.

Conclusion:

- This study will contribute greatly to the ease of air freight service development planning.
- To save time and significantly reduce cost of refuelling. Moreover, the resultant program from this study can be integrated with organizations' information systems and facilitate internal reporting and customer service processes.
- Demonstrating the application of Floyd Warshall's algorithm which will grant PYTHONISTAS a better understanding of the algorithm.

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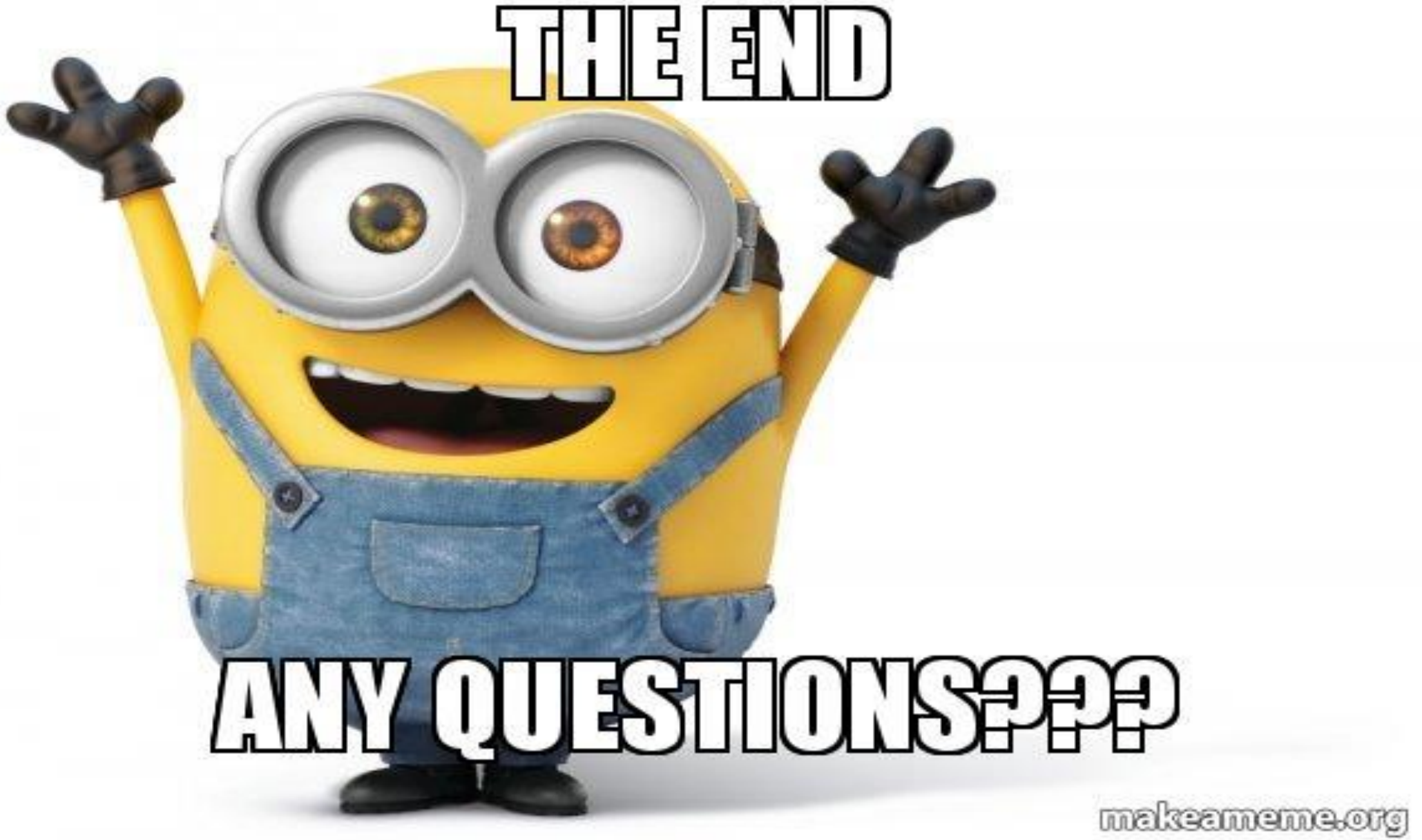
THE END
ANY QUESTIONS???
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