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* Chinese Postman Problem

Algorithm to find shortest closed path or optimal Chinese Postman Problem in a weighted graph that may not be Eulerian.

Step 1: If a graph is Eulerian, return sum of all Edge weights Else perform the following steps.

$$\text{Edge Weight } W(G) = \sum_{e \in E(G)} w(e)$$

Step 2: We compute all the vertices with odd degrees.

Step 3: List all possible pairings of odd vertices. For n odd vertices Total number of pairings possible are $(n-1)(n-3)(n-5)\ldots 1$

Step 4: For each set of pairings, find the shortest path connecting them.

Step 5: Find the pairing with minimum Shortest path connecting pairs.

Step 6: Modify the graph by adding all the edges found in step 5.

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Step 7: Weight of Chinese Postman Tour is sum of all edges in the modified graph.

Step 8: Print Euler Circuit of the modified graph. The Euler circuit is the Chinese Postman Tour.

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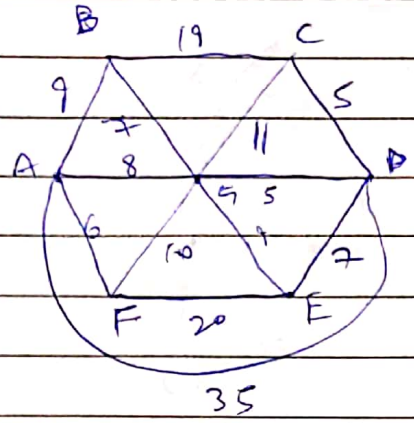
Q) Chinese Postman Problem:-



We identify all odd vertices :-

(B) (C) (E) (F) → degree 3

This graph is Not Eulerian.

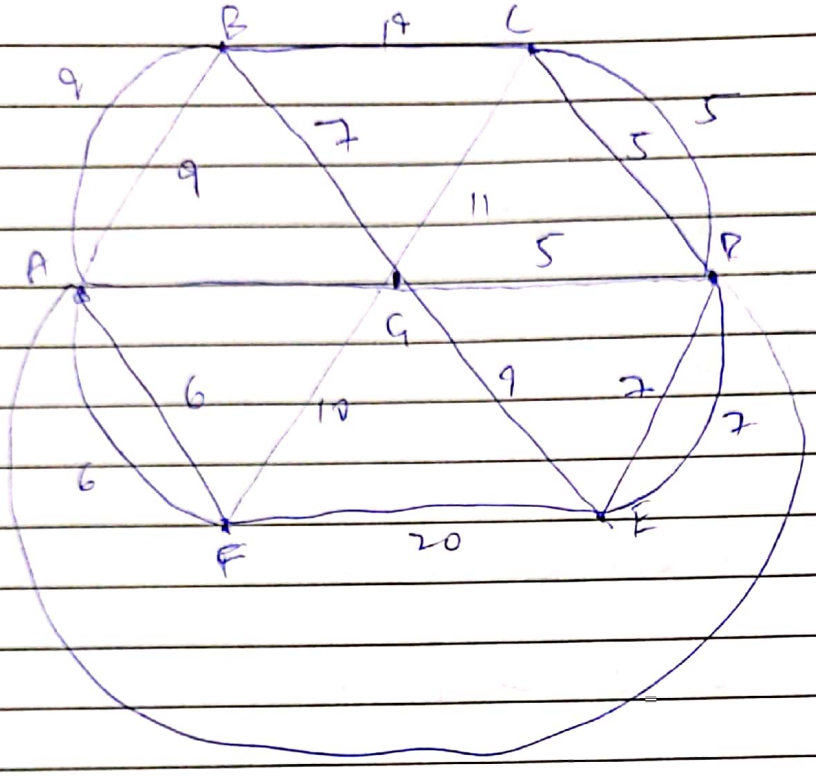
We take pairwise sets from these vertices and take minimum edge set from that.

BC* EF*
BGC-18 EGF-19 ⇒ 18+19 = 37

BE* CF*
BGE-16 CDGF-20 ⇒ 16+20 = 36

BF* CE*
BAF-15 CDE-12 ⇒ 15+12 = 27

We select minimum edge weight sum 27 and these are the edges we will duplicate. We will duplicate edges BA, AF, CD, DE in our graph.



Now, the sum of edge weight which will be traversed in Chinese postman tour will be :-

$$\sum_{e \in E} e + \text{repeated / duplicated edges}$$

$$\left(\begin{array}{l} 9+18+5+7+20+6+35 \\ +\ 8+7+11+5+9+10 \end{array}\right) + (9+6+5+7)$$

$$151 + 27 \quad \boxed{= 178}$$

The tour will be :

ADEFAFGEDCDGCBGABA