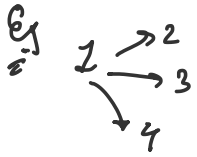
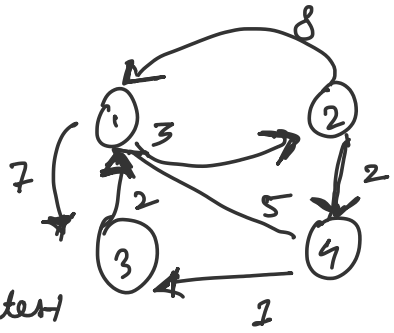
All Pair Shortest Path (Floyd - Warshall)

Sunday, 1 February 2026 9:59 PM

Eg:





We can use Dijkstra Algorithm on each of vertex & find the shortest Path but that will take n^3 time

Matrix to find all the possible paths ←

$A^0 =$

	1	2	3	4
1	0	3	∞	7
2	8	0	2	∞
3	5	∞	0	1
4	2	∞	∞	0

↳ self loop.

↓ absence of edge

$A^1 =$

	1	2	3	4
1	0	3	∞	7
2	8	0	2	15
3	5	8	0	1
4	2	8	∞	0

→ $A^2 =$

	1	2	3	4
1	0	3	5	7
2	8	0	2	15
3	5	8	0	1
4	2	8	7	0

$A^0[2,3] = 2$ ✓

$A^0[2,1] + A^0[1,3] = 8 + \infty$ ✗

↳ second row and column Remain same.

The final one will have shortest path :→

$A^3 =$

	1	2	3	4
1	0	3	5	6
2	7	0	2	3
3	5	8	0	11
4	2	5	7	0

$A^4 =$

	1	2	3	4
1	0	3	5	6
2	5	0	2	3
3	3	6	0	1
4	2	5	7	0

formula :→

$$A^k[i,j] = \min\left\{ A^{k-1}[i,j],\ A^{k-1}[i,k] + A^{k-1}[k,j] \right\}$$

Code for the same :-

for(k=1; k<=n; k++) { → 4 will remain the no. of

```
for(k=1;k<=n;k++)  ← it will generate the matrix
  for(i=1;i<=n;i++)
   {
  for(j=1;j<=n;j++)
   {
  A[i,j] = min(A[i,j], A[i,k]+A[k,j]);
   }
  }
}
```

→ To create the element in matrix

Time = $O(n^3)$.