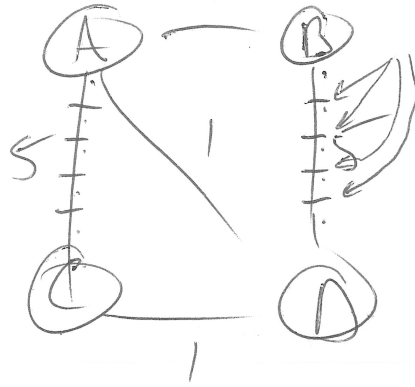
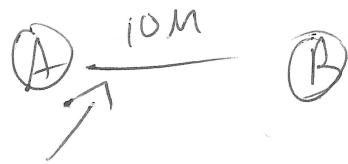


Turn General Graph into Unit graph, and Run BFS



Shortest path (B-C) uses 3 edges  
BFS won't work normally



10m nodes/edges

Memory

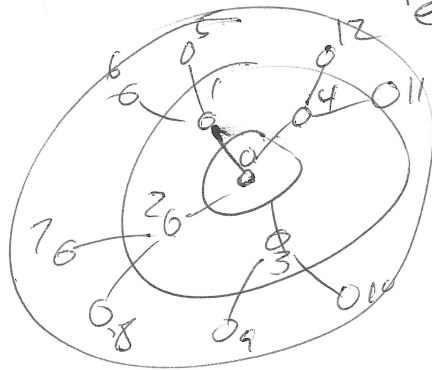
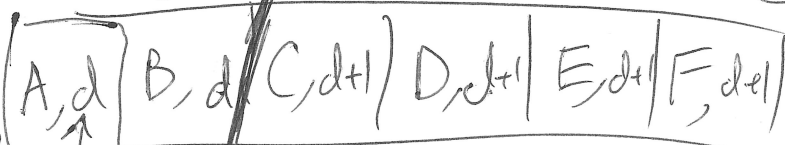
$$O(\sum e)$$



Very bad

Normal BFS (Unweighted)

Queue



Store elements in queue by shortest Distance

~~Handle "Closer" Nodes~~

First

abcdefghijkl

Dijkstra's

Inorder

pharantics

pharantics

Input: Graph, Source Node

Create empty Priority Queue

Add source with distance 0 to Queue

Loop until queue is empty

~~Get~~ Get Node to Process

~~Verify~~ Verify Node has Not been Processed

Update Node distances using

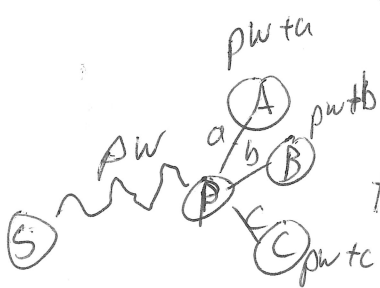
this Node to process

Add to Priority Queue Updated

Paths

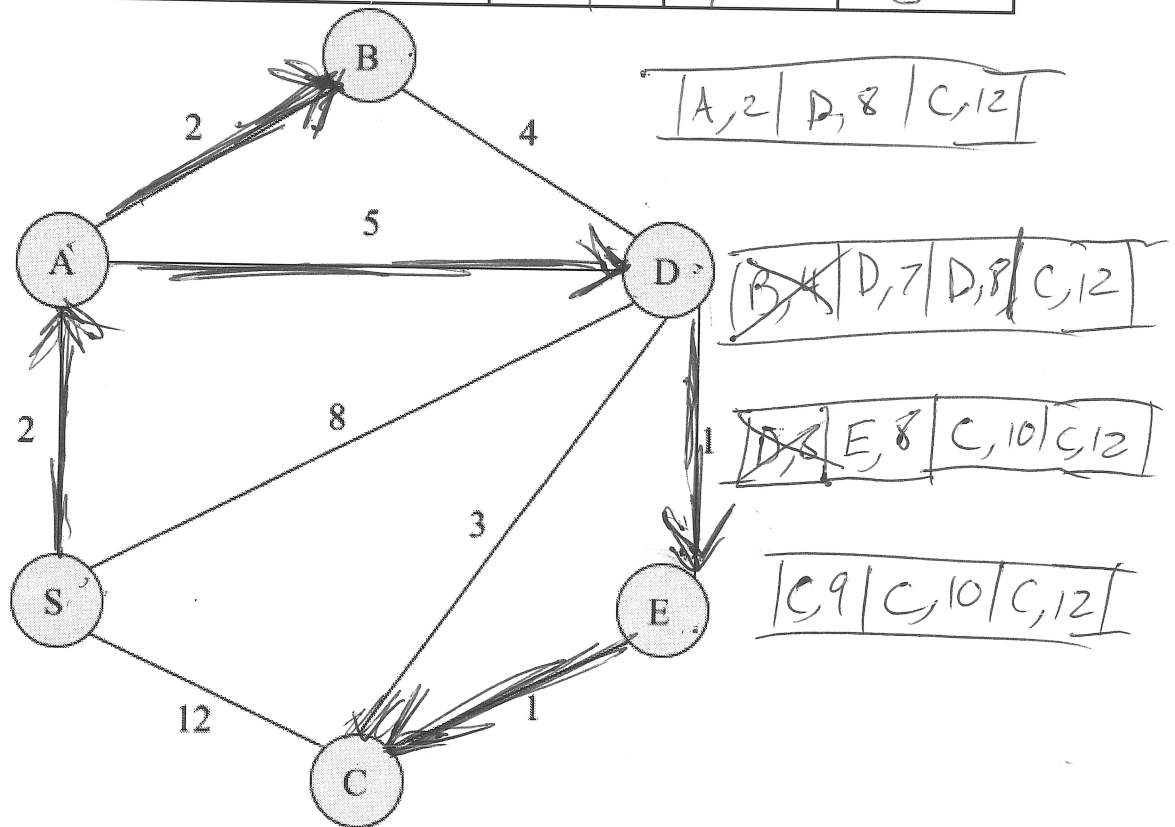
End Loop

Return Distances



00 = 9 8 7 6 5 4 3 2 1

|                | Distances |          |          |          |          |          |
|----------------|-----------|----------|----------|----------|----------|----------|
| Processed Node | S         | A        | B        | C        | D        | E        |
| <del>X</del>   | 0         | $\infty$ | $\infty$ | $\infty$ | $\infty$ | $\infty$ |
| S(0)           | 0         | 2        | $\infty$ | 12       | 8        | $\infty$ |
| A(2)           | 0         | 2        | 4        | 12       | 7        | $\infty$ |
| B(4)           | 0         | 2        | 4        | 12       | 7        | $\infty$ |
| D(7)           | 0         | 2        | 4        | 10       | 7        | 8        |
| E(8)           | 0         | 2        | 4        | 9        | 7        | 8        |
| C(9)           | 0         | 2        | 4        | 9        | 7        | 8        |



# Analysis

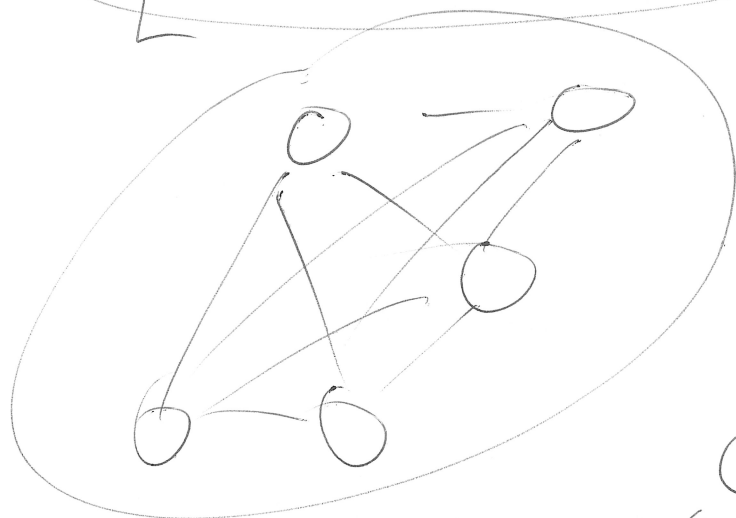
# Nodes processed

$\hookrightarrow N \leftarrow$

for each Node

loop over each neighbor

$O(N^2)$   
?



clique

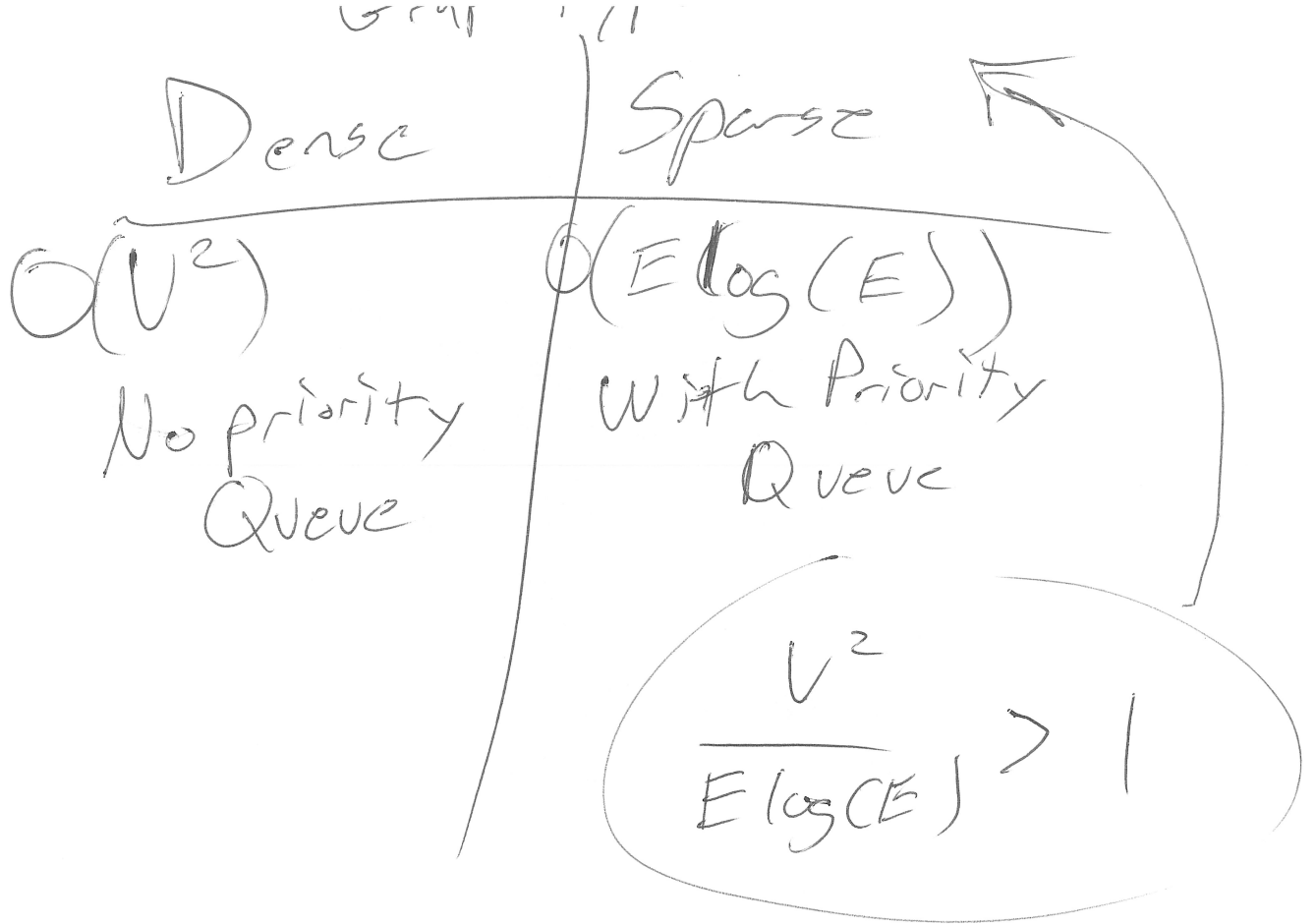
heap

Worst

$O(E \log(E))$

with priority queue

If  $E = V^2$  ← Dense Graph  $O(V^2 \log(V))$   
Modification  $O(V^2)$



Break Case



C, B, A