PAGE No. | DATE / /

Mod 3

→ 3.1 : Greedy
- → Dijkstras (single source shortest path)
- → Knapsack
- → Job sequencing
- → Ford fulkerson method (Max flow)

* Dijkstras (for single source shortest path) $[O(V^2)]$ / $[O(V\log V)]$
1. Given a graph
2. Create source | destination table
3. First all destination empty
4. Then keep choosing shortest dist node to source
5. Check & calculate from new perspective
6. Get a final graph of all nodes min dist.

* Knapsack $[O(n\log n)]$
1. Given Profit, Weight & KS capacity
2. Calculate P/W ratio & arrange in decreasing order
3. Keep adding weight to knapsack
   if full can't be accomodated
   $\frac{\text{remaining capacity}}{\text{weight}} \times \text{profit}$
4. Get final profit

* Jobsequencing $[O(n\log n)]$
1. Given Profit, deadline
2. Max deadline → total Jobs to be sequenced
3. 0 __ 1 __ 2 __ 3
4. Jobs to be arranged for max profit.

Note : deadline doesn't mean, job will take 2 months
It means, we can schedule either in first month or 2nd month.

PAGE No.	
DATE	/ /

* Ford fulkerson method (for max flow)

① Given a graph with edgeweights, source & sink

② Trace every path from source to sink one by one

In each iteration choose min weight

Make a table of

Augmenting Path	Bottleneck capacity

Use that min weight to block one edge every iteration

Repeat until all paths covered & no path left

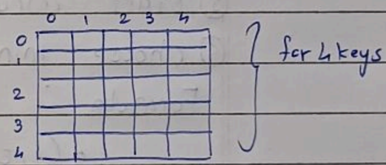
③ Max flow = Σ Bottleneck Capacity

→ 3.2 : Dynamic Programming

* OBST [$O(N^3)$]

① Given keys, frequency & numbers

② We create a matrix starting from 0 always



③ $l = j - i = 0$

directly frequency le skte (min)

fill inthe matrix

④ $l = j - i = 1$

again directly

⑤ $l = j - i = 2$

for each (–,–) there will be two trees get min freq

after totaling level × freq

fill in the matrix but freq

0 ← parent node number

:

$l = j - i = 4$ (serial no. max)

formula

$$c[i,j] = \min\{c[i, k-1] + c[k,j]\} + w(i,j)$$

all combos

⑥ finally draw the OBST

* <u>All pair shortest path [$O(N^3)$]</u>

(Floyd Warshall Algorithm)

① Given a graph,

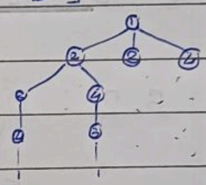
② Find A^0 ← adjacency matrix

③ Find $A^1, A^2 \dots A^n$ n : no. of nodes

Formula :

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

* <u>Travelling Salesman Problem (Using DP) [$N^2 \times 2^n$]</u>



① Given a graph

② Create Adjancency Matrix

③ Create BFS Tree

④ Such that ending goes to start again

⑤ start calculating weight at each node

⑥ Choose min & finally get one weight

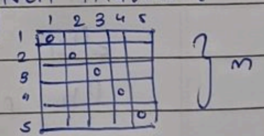
Formula :

$$g(i,s) = \min_{k \in \{2,3,4\}} \{ C_{ik} + g(k, \{2,3,4\} \dots \{k\}) \}$$

$$g(i,s) = \min_{k \in s} \{ C_{ik} + g(k, s - \{k\}) \}$$

* <u>Matrix chain Multiplication [$O(N^3)$]</u>

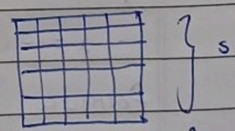
① We need to find Parenthesization of given Matrices



② Two tables starting | m & s

Find m[1,2] , m[3,4] , m[2,3] . . . -

$A_1 \cdot A_2$
$5\times4 \quad 4\times6$



Find m[1,3] , m[2,4]

Find min at each step & fill full (half) table

Formula : $m[i,j] = \min \{ m[i,k] + m[k+1,j] + d_{i-1} * d_k * d_j \}$

③ Using s table get parenthesization.