UNIVERSITY INSTITUTE OF COMPUTING

MASTER OF COMPUTER APPLICATIONS

DESIGN AND ANALYSIS OF ALGORITHMS

24CAT-611

UNIT-3

DISCOVER . **LEARN** . EMPOWER

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DESIGN AND ANALYSIS OF ALGORITHMS

Course Outcome

CO Number	Title	Level
CO4	Implement the major graph algorithms to model engineering problems	Understand
CO5	Synthesize efficient algorithms in common engineering design situations	Understand

- General method with Examples, Multistage Graphs, Binomial Coefficient

Binomial coefficients are coefficients of the binomial formula:
$$(a + b)^n = C(n,0)a^n b^0 + \ldots + C(n,k)a^{n-k}b^k + \ldots + C(n,n)a^0 b^n$$

Recurrence: $C(n,k) = C(n-1,k) + C(n-1,k-1)$ **for** $n > k > 0$

$C(n,0) = 1, \quad C(n,n) = 1$ **for** $n \geq 0$

Value of $C(n,k)$ can be computed by filling a table:

	0	1	2	. . .	k-1	k
0	1					
1	1	1				
.						
.						
.						
n-1					$C(n$-1,k-1)	$C(n$-1,$k)$
n						$C(n,k)$

ALGORITHM $Binomial(n, k)$

//Computes $C(n, k)$ by the dynamic programming algorithm
//Input: A pair of nonnegative integers $n \geq k \geq 0$
//Output: The value of $C(n, k)$
for $i \leftarrow 0$ **to** n **do**
    for $j \leftarrow 0$ **to** $\min(i, k)$ **do**
        if $j = 0$ **or** $j = i$
            $C[i, j] \leftarrow 1$
        else $C[i, j] \leftarrow C[i - 1, j - 1] + C[i - 1, j]$
return $C[n, k]$

Time efficiency: $\Theta(nk)$

Space efficiency: $\Theta(nk)$

References

1) https://www.tutorialspoint.com/data_structures_algorithms/divide_and_conquer.htm

2) Data Structures and Algorithms made easy By Narasimha Karumanchi.

3) The Algorithm Design Manual, 2nd Edition by Steven S Skiena

4) Fundamentals of Computer Algorithms - Horowitz and Sahani

THANK YOU