22nd Oct (K)

$$^{n}C_{K} = \frac{n!}{K!\,(n-K)!} \Rightarrow n!,\ K!,\ (n-K)!$$

very big no.s

$\Downarrow$

Arithmetic overflow

$$^{9}C_{2} = \frac{9!}{2!\,7!} = \frac{9\times 8\times \cancel{7!}}{2\times \cancel{7!}} = 36.$$

Pascal's Δ

0 1 0

0 1 1 0

1 2 1 0

1 3 3 1

1 4 6 4 1

edge

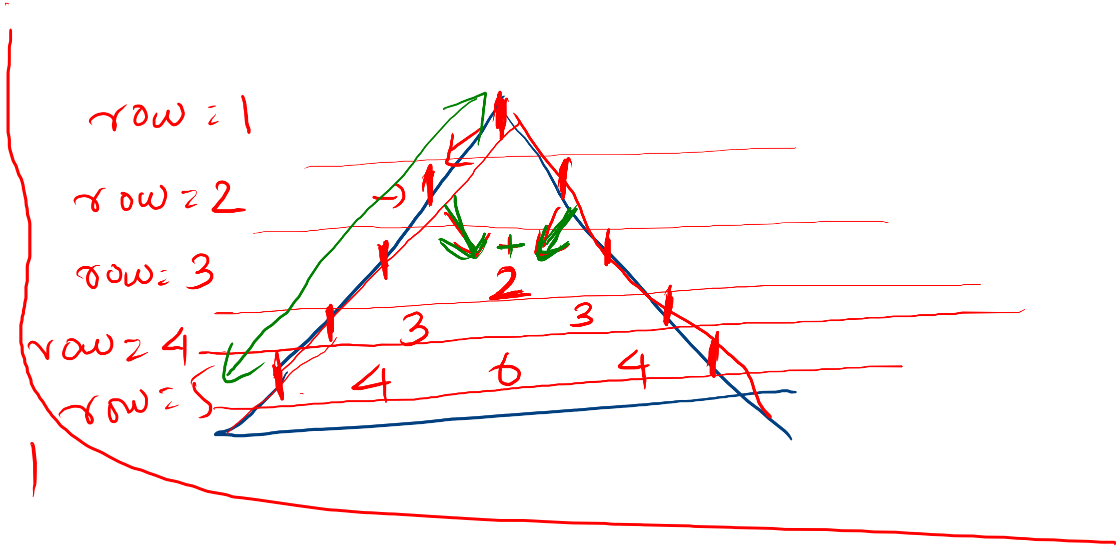
1

1 1

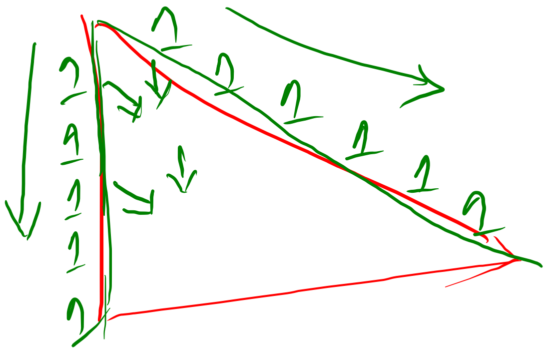
1 2 1

1 3 3 1

1 4 6 4 1



bc



$bc[i][0] = 1$

$bc[0][0] = 1$

$bc[1][0] = 1$

$bc[2][0] = 1$

$bc[3][0] = 1$

$\vdots$

$$\binom{n}{k} = \binom{n-1}{k-1} + \binom{n-1}{k} \leftarrow \text{Pascal's } \Delta$$

^nC_k

$\underline{n^{th}}$ element $\rightarrow$ $\underline{\binom{n}{k}}$ subsets

K elements

$(k-1)$ elements $\Rightarrow$ $n-1$

n^{th} element $\not\rightarrow$ $\binom{n}{k}$ subsets

K elements $\Rightarrow$ $n-1$

$i=0$ 1

$i=1 \Rightarrow$ 1   1

$i=2 \Rightarrow$ 1   2   1

$i=3 \Rightarrow$ 1   3   3   1

$i=4 \Rightarrow$ 1   4   6   4   1

$$\binom{n}{k} = \binom{n-1}{k-1} + \binom{n-1}{k}$$

DP – specify the exact evaluation based on the inherent recurrence.

$i = 0$ to n

$bc[i][0] = 1$

$bc[0][0] = 1$

$bc[1][0] = 1$

$bc[2][0] = 1$

$\vdots$

$bc[n][0] = 1$

$bc[0][0]$

$bc[1][1]$

$bc[2][2]$

$\vdots$

$bc[n][n]$

for $i = 1$ to n

$\Rightarrow$ for $j = 1$ to $i-1$

$i=1 \rightarrow j = 1$ to 0 (no sense)

$i=2 \rightarrow j = 1$

$i=3 \rightarrow j = 1$ to 2 $= 1, 2$

$i=4 \rightarrow j = 1$ to 3 $= 1, 2, 3$

1

1 1

1 _ _

1 _ _ _

$\underline{n = m = 5}$ $bc[0][0] = 1 \cdots bc[5][0] = 1$

$bc[0][0] = 1 \quad bc[1][1] = 1 \cdots bc[5][5] = 1$

$i = 1$ to n

$\underline{j = 1 \text{ to } i-1}$

$\underline{i = 1 \quad bc[1][1]}$

$i = 2 \quad j = 1 \text{ to } 1 = 1$

$bc[2][1] = bc[1][0] + bc[1][1] = 1+1 = 2$

$i = 3, \quad j = 1 \text{ to } 2$

$bc[3][1] = bc[2][0] + bc[2][1] = 1+2 = 3$

$bc[3][2] = bc[2][1] + bc[2][2] = 2+1 = 3$

$\underline{i=4}$ $j = 1, 2, 3$

$bc[4][1] = bc[3][0] + bc[3][1] = 1 + 3 = 4$

$bc[4][2] = bc[3][1] + bc[3][2] = 3 + 3 = 6$

$bc[4][3] = bc[3][2] + bc[3][3] = 3 + 1 = 4$

$\underline{i=5}$ $j = 1, 2, 3, 4$

$bc[5][1] = bc[4][0] + bc[4][1] = 1 + 4 = 5$

$bc[5][2] = bc[4][1] + bc[4][2] = 4 + 6 = 10$

$bc[5][3] = bc[4][2] + bc[4][3] = 6 + 4 = 10$

$bc[5][4] = bc[4][3] + bc[4][4] = 4 + 1 = 5$

Space :- $bc[n][m]_{n>m} \approx \Theta(n^2)$ $\quad {}^nC_m$

$i = n$

$j = 1$ to $n-1$

$\approx \underline{n^2}$

Time :- $\Theta(n^2)$

$\Omega(n^2)$

Parsing CFG

CFG → $\boxed{\text{grammar}}$

context free

T.O.C.

English Grammar

" I you text gent a ___ " ⇝ Grammatically Incorrect

↓

G establishes a set of rules for creating meaningful strings in a language.

$G = \{ V, \Sigma, R, S \}$

- V → set of variables / nonterminals
- Σ → set of terminals
- R → set of rules / productions
- S → start symbol $\in V$

$R : \{ S \to A, \; A \to a \}$ ⟸ G1

$V = \{ S, A \}$

$\Sigma = \{ a \}$

S : start symbol

All target strings are made up of terminal symbols.

I want to gen/yield "a" from grammar G1

$S \to A$

$\to a$

→ beginning w/t the start symbol, replace/substitute RHS of appropriate productions to reach the final string

G2 $\{ S \to A$
$A \to aA$
$A \to a \}$

start = S

$V = \{S, A\}$

$\Sigma = \{a\}$

w = target string = "aa"

$$S \to A \to aA \to aa$$

$w = aaa$:- $S \to A \to aA \to aaA \to aaa$

Q3 $\left\{ \begin{array}{l} S \to aAb \\ A \to aAb \\ A \to ab \end{array} \right\}$ rule

$V = \{S, A\}$ start = S

$\Sigma = \{a, b\}$ $w = aaabbb$

substitution

$S \to aAb \to a\,\underline{aAb}\,b \to aaabbb$ ✓

yielding / generation

if cond1 ← syntax error

print(   )

Rule sets of Python lang

Compiler

LHS → RHS

Prg

yes/no

legal string in prog lang.

if → cond1 :

if → cond1 & cond 2 :

if → cond1 || cond 2 :

⋮