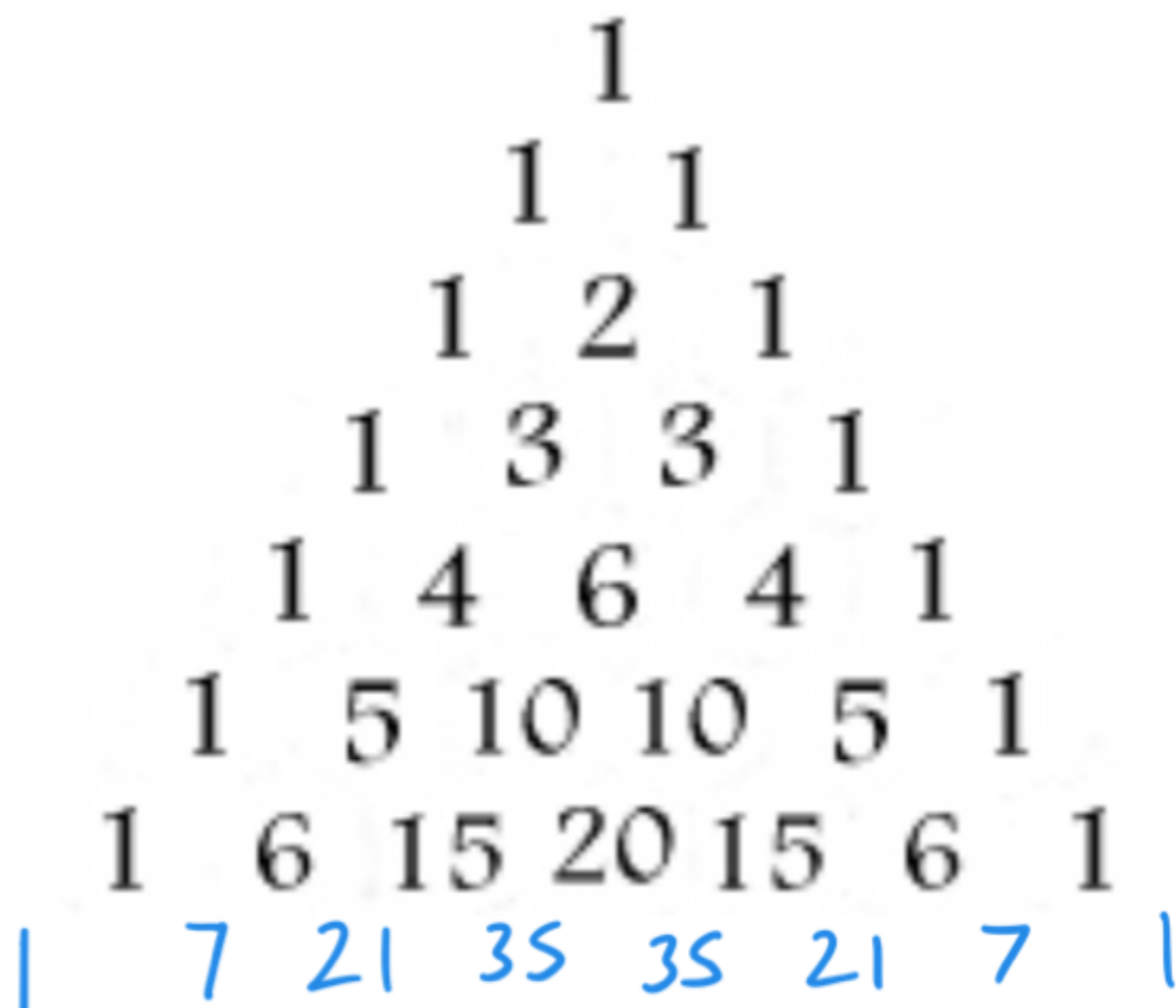


Binomial Theorem

Pascal's Triangle



Expand using the Binomial Theorem

$$(3x - 4)^5$$

$$\begin{aligned}1 (3x)^5 (-4)^0 &= 1 \cdot 243x^5 \cdot 1 = 243x^5 \\5 (3x)^4 (-4)^1 &= 5 \cdot 81x^4 \cdot -4 = -1620x^4 \\10 (3x)^3 (-4)^2 &= 10 \cdot 27x^3 \cdot 16 = 4320x^3 \\10 (3x)^2 (-4)^3 &= 10 \cdot 9x^2 \cdot -64 = -5760x^2 \\5 (3x)^1 (-4)^4 &= 5 \cdot 3x \cdot 256 = 3840x \\1 (3x)^0 (-4)^5 &= 1 \cdot 1 \cdot -1024 = -1024\end{aligned}$$

$$243x^5 - 1620x^4 + 4320x^3 - 5760x^2 + 3840x - 1024$$

| |
|------------------|
| 1 |
| 1 1 |
| 1 2 1 |
| 1 3 3 1 |
| 1 4 6 4 1 |
| 1 5 10 10 5 1 |
| 1 6 15 20 15 6 1 |

Expand using the Binomial Theorem

$$(x + 3)^4$$

$$\begin{array}{ccccccc} & & & & & & 1 \\ & & & & & & 1 & 1 \\ & & & & & 1 & 2 & 1 \\ & & & 1 & 3 & 3 & 1 \\ & 1 & 4 & 6 & 4 & 1 \\ 1 & 5 & 10 & 10 & 5 & 1 \\ 1 & 6 & 15 & 20 & 15 & 6 & 1 \end{array}$$

Expand using the Binomial Theorem

$$(x + 3)^4$$

$$\begin{aligned} 1 x^4 3^0 &= 1 \cdot x^4 \cdot 1 = x^4 \\ 4 x^3 3^1 &= 4x^3 \cdot 3 = 12x^3 \\ 6 x^2 3^2 &= 6 \cdot x^2 \cdot 9 = 54x^2 \\ 4 x^1 3^3 &= 4 \cdot x \cdot 27 = 108x \\ 1 x^0 3^4 &= 1 \cdot 1 \cdot 81 = 81 \end{aligned}$$

$$x^4 + 12x^3 + 54x^2 + 108x + 81$$

| | | | | | | | | | |
|---|---|----|----|----|---|---|--|--|--|
| | | | | | | | | | |
| | | | | 1 | | | | | |
| | | | 1 | 1 | | | | | |
| | | 1 | 2 | 1 | | | | | |
| | 1 | 3 | 3 | 1 | | | | | |
| 1 | 4 | 6 | 4 | 1 | | | | | |
| 1 | 5 | 10 | 10 | 5 | 1 | | | | |
| 1 | 6 | 15 | 20 | 15 | 6 | 1 | | | |

Expand using the Binomial Theorem

$$(5x + 2)^3$$

$$\begin{array}{ccccccc} & & & & & & 1 \\ & & & & & & 1 & 1 \\ & & & & & 1 & 2 & 1 \\ & & & 1 & 3 & 3 & 1 \\ & 1 & 4 & 6 & 4 & 1 \\ 1 & 5 & 10 & 10 & 5 & 1 \\ 1 & 6 & 15 & 20 & 15 & 6 & 1 \end{array}$$

Expand using the Binomial Theorem

$$(5x + 2)^3$$

$$1 (5x)^3 2^0 = 1 \cdot 125x^3 \cdot 1 = 125x^3$$

$$3 (5x)^2 2^1 = 3 \cdot 25x^2 \cdot 2 = 150x^2$$

$$3 (5x)^1 2^2 = 3 \cdot 5x \cdot 4 = 60x$$

$$1 (5x)^0 2^3 = 1 \cdot 1 \cdot 8 = 8$$

$$125x^3 + 150x^2 + 60x + 8$$

| | | | | | | | |
|---|---|----|----|----|---|---|--|
| | | 1 | | | | | |
| | | 1 | 1 | | | | |
| | 1 | 2 | 1 | | | | |
| | 1 | 3 | 3 | 1 | | | |
| | 1 | 4 | 6 | 4 | 1 | | |
| | 1 | 5 | 10 | 10 | 5 | 1 | |
| 1 | 6 | 15 | 20 | 15 | 6 | 1 | |