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1 Generating Functions

$$(1+v)^{N-j}(1-v)^j = \sum_{i=0}^{N} v^i \, \phi_i(j)$$

1.0.1 where the functions ϕ_i are polynomials in j

1.1 i.e., Krawtchouk polynomials

First, we look at the values of the polynomials.

`N=2`

$$(v+1)^2$$
$$v^2+2v+1$$

$$(1-v)\,(v+1)$$
$$1-v^2$$

$$(1-v)^2$$
$$v^2-2v+1$$

`N=3`

$$(v+1)^3$$
$$v^3+3v^2+3v+1$$

$$(1-v)\,(v+1)^2$$
$$-v^3-v^2+v+1$$

$$(1-v)^2\,(v+1)$$
$$v^3-v^2-v+1$$

$$(1-v)^3$$
$$-v^3+3v^2-3v+1$$

N=4

$(v+1)^4$
$v^4+4v^3+6v^2+4v+1$

$(1-v)\,(v+1)^3$
$-v^4-2v^3+2v+1$

$(1-v)^2\,(v+1)^2$
v^4-2v^2+1

$(1-v)^3\,(v+1)$
$-v^4+2v^3-2v+1$

$(1-v)^4$
$v^4-4v^3+6v^2-4v+1$

N=5

$(v+1)^5$
$v^5+5v^4+10v^3+10v^2+5v+1$

$(1-v)\,(v+1)^4$
$-v^5-3v^4-2v^3+2v^2+3v+1$

$(1-v)^2\,(v+1)^3$
$v^5+v^4-2v^3-2v^2+v+1$

$(1-v)^3\,(v+1)^2$
$-v^5+v^4+2v^3-2v^2-v+1$

$(1-v)^4\,(v+1)$
$v^5-3v^4+2v^3+2v^2-3v+1$

$(1-v)^5$
$-v^5+5v^4-10v^3+10v^2-5v+1$