

# MAIN\_DEFINITIONS.M PACKAGE DOCUMENTATION

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## 1. INTRODUCTION

This file represents a documentation for `main_definitions.m` Mathematica package. To get started proceed to GitHub repository [https://github.com/kolosovpetro/research\\_unit\\_tests](https://github.com/kolosovpetro/research_unit_tests), fork it, and find the package `main_definitions.m`. This package doesn't have any dependencies on other Mathematica packages. To get started simply install it to your Mathematica by clicking **File** -> **Install...**, click **Source** and choose corresponding file in dropped menu. Then recall the package `main_definitions.m` in Mathematica notebook using the command

`Needs["MainDefinitions"]`

Read also <http://support.wolfram.com/kb/5648>.

## 2. FUNCTIONS INSIDE THE PACKAGE MAIN\_DEFINITIONS.M

- `coeffA[m, r]` returns a real coefficient as

$$\text{coeffA}[m, r] := \begin{cases} (2r+1) \binom{2r}{r}, & \text{if } r = m \\ (2r+1) \binom{2r}{r} \sum_{d=2r+1}^m \text{coeffA}[m, d] \binom{d}{2r+1} \frac{(-1)^{d-1}}{d-r} B_{2d-2r}, & \text{if } 0 \leq r < m \\ 0, & \text{if } r < 0 \text{ or } r > m \end{cases}$$

- `L[m, n, k]` returns the polynomial of degree  $2m$

$$L[m, n, k] := \sum_{r=0}^m \text{coeffA}[m, r] k^r (n-k)^r$$

- `P[m, n, b]` returns the polynomial of degree  $2m+1$

$$P[m, n, b] := \sum_{k=0}^{b-1} L[m, n, k]$$

- `H[m, t, b]` returns a real coefficient defined as

$$H[m, t, b] := \sum_{j=t}^m \binom{j}{t} \text{coeffA}[m, j] \frac{(-1)^j}{2j-t+1} \binom{2j-t+1}{b} B_{2j-t+1-b}$$

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- $X[m, t, j]$  returns the polynomial of degree  $2m - t$

$$X[m, t, j] := (-1)^m \sum_{k=1}^{2m-t+1} H[m, t, k] \cdot j^k$$

- $S[p, n]$  returns a common power sum

$$S[p, n] := \sum_{k=0}^{n-1} k^p$$

- $\text{MacaulayPow}[x, n, a]$  returns the powered Macaulay bracket

$$\text{MacaulayPow}[x, n, a] = \langle x - a \rangle^n := \begin{cases} (x - a)^n, & x \geq a \\ 0, & \text{otherwise.} \end{cases}$$

- $\text{PiecewisePow}[x, n, a]$  gives a piecewise defined power function, involving `Boole`

$$\text{PiecewisePow}[x, n, a] := x^n \text{Boole}[x \geq a]$$

- $\text{ConvolveSum}[n, r, b]$  returns a convolutional power sum

$$\text{ConvolveSum}[n, r, b] := \sum_{k=0}^{b-1} k^r (n - k)^r$$

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