MAIN_DEFINITIONS.M PACKAGE DOCUMENTATION

Contents

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, 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

$$\text{Needs}["\,\text{MainDefinitions}\,``\,"]$$

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

2. Functions inside the package main_definitions.m

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

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

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

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

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

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

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

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

- $\mathtt{X}[\mathtt{m}, \mathtt{t}, \mathtt{j}]$ returns the polynomial of degree $2m - t$

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

- $\mathtt{S}[\mathtt{p}, \mathtt{n}]$ returns a common power sum

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

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

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

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

$$\mathtt{MacaulayPowStrict}[\mathtt{x}, \mathtt{n}, \mathtt{a}] = \{x - a\}^n := \begin{cases} (x - a)^n, & x > a \\ 0, & \text{otherwise.} \end{cases}$$

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

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

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

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

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