**The Binomial Slide Rule** by *István Szalkai*, Veszprém, Hungary, szalkai@almos.uni-pannon.hu , **2017.05.24**.

<http://math.uni-pannon.hu/~szalkai/Binom-lec4.docx> ,

<http://math.uni-pannon.hu/~szalkai/Binom-lec4.pdf>

 **| 1 1 1 1 2 1 3 4 4**

 **| 1 1 1 2 3 3 1 3 5 6 1 4 8 1 2 2 6 2 9 4 3 8 8 1 3 8**

 **| 1 1 2 2 1 3 4 2 4 7 9 2 7 2 7 3 0 0 0 4 1 4 3 0 0 4 1 5 8 3 0 4 8 1 6 3 1 3 4 3 1 8 0 5 5 8 7 6**

 **| 1 1 2 2 3 2 5 7 3 8 2 4 2 1 5 1 5 6 3 6 1 6 2 9 9 2 1 7 8 1 8 1 1 9 6 0 0 0 3 1 0 5 6 0 0 3 1 2 6 2 6 0 4 7 1 3 8 8 8 7 4 1 1 5 1 6 6 6 2 5 2**

**(nk)| 1 1 2 1 3 1 4 6 1 5 0 1 6 5 0 1 7 1 5 1 8 8 6 0 1 9 6 4 6 1 10 5 0 0 2 1 1 5 5 0 2 1 2 6 0 5 2 4 1 3 8 6 5 7 6 1 4 1 4 1 2 3 2 1 5 5 5 5 3 5 5 1 6 0 0 0 8 8 0 0 1 7 6 0 0 8 6 8 0 1 8 3 6 0 8 4 4 8 0 . . .**

**...+...............................................................................................................................................................................................................................................................................................................**

 **n | 1 2 2 3 3 4 4 4 5 5 5 6 6 6 6 7 7 7 7 8 8 8 8 8 9 9 9 9 9 10 10 10 10 10 10 11 11 11 11 11 11 12 12 12 12 12 12 12 13 13 13 13 13 13 13 14 14 14 14 14 14 14 14 15 15 15 15 15 15 15 15 16 16 16 16 16 16 16 16 16 17 17 17 17 17 17 17 17 17 18 18 18 18 18 18 18 18 18 18 . . .**

**k≤n/2 | k≤n/2 | 0 1 2 3 4 5 6 7 8 9**

**Description and use**

 The **binomial coefficients** $\left(\begin{array}{c}n\\k\end{array}\right)$ := $\frac{n\left(n-1\right)…(n-k+1)}{k!}$ are defined for all natural numbers *n,k*∈N, 0≤*k*≤*n* .

By the *symmetry property* $\left(\begin{array}{c}n\\k\end{array}\right)$ = $\left(\begin{array}{c}n\\n-k\end{array}\right)$ we have to compute their values only for 0≤*k*≤*n*/2.

 The slide rule above contains *three scales*: the scales denoted by "**(nk)"** and by "**n**" are on the stator,

the third one (below the dotted line), denoted by "**k≤n/2**" is on the slide. The digits of the numbers on the

*first scale* are printed *vertically*, e.g. the three digits 1,2,6 above the last 9 (just before the red 10 ) represent

the number 126 .

 To compute $\left(\begin{array}{c}n\\k\end{array}\right)$ choose first *n* , say 10. Move the slide (scale "**k≤n/2**") so that the **0** sign on it would be exactly

under the *first*, red **10** sign of scale "**n**", as it shown now on the slide rule. Now you can read the values $\left(\begin{array}{c}10\\k\end{array}\right)$ above,

on the top scale "**(nk)"** as: $\left(\begin{array}{c}10\\0\end{array}\right)$=$\left(\begin{array}{c}10\\10\end{array}\right)$=1, $\left(\begin{array}{c}10\\1\end{array}\right)$=$\left(\begin{array}{c}10\\9\end{array}\right)$=10, $\left(\begin{array}{c}10\\2\end{array}\right)$=$\left(\begin{array}{c}10\\8\end{array}\right)$=45, $\left(\begin{array}{c}10\\3\end{array}\right)$=$\left(\begin{array}{c}10\\7\end{array}\right)$=120, $\left(\begin{array}{c}10\\4\end{array}\right)$=$\left(\begin{array}{c}10\\6\end{array}\right)$=210 and $\left(\begin{array}{c}10\\5\end{array}\right)$=252.

You may also imagine brackets around the figures on scales "**n**" and "**(nk)"** to see "$\left(\begin{array}{c}10\\k\end{array}\right)$" printed on the slide rule.

(Clearly you can *not* use values of *k* under the next (red or black) *n*+1, i.e. for *k*>*n*/2.)

 When using a text editor, you are able to *move* the slide with scale "**k≤n/2**" by deleting/inserting spaces from/to

the line "**k≤n/2**" (since the font used is not proportional).

Further, using smaller font size the above slide rule can be extended for *n* larger than 18.

Have a nice time, and let me know any comment you have!

*István*