MPL's Map Operator

The *Map* operator provides another way to apply an operator to all operands of the main operator of an expression.

Definition 1 *Let u be a compound expression with*

$$n = Number\_of\_operands(u),$$

and let $F(x)$ and $G(x, y, \ldots, z)$ be operators. The Map operator has two forms:

$$Map(F, u),$$

$$Map(G, u, y, \ldots, z).$$

The statement $Map(F, u)$ obtains the new expression with main operator $Kind(u)$ and operands

$$F(Operand(u, 1)),\ F(Operand(u, 2)), \ldots, F(Operand(u, n)).$$

The statement $Map(G, u, y, \ldots, z)$ obtains the new expression with main operator $Kind(u)$ and operands

$$G(Operand(u, 1), y, \ldots, z),\ G(Operand(u, 2), y, \ldots, z), \ldots,$$
$$G(Operand(u, n), y, \ldots, z).$$

If u is not a compound expression, the Map operator returns the global symbol **Undefined**.

Example 1 For the operator

$$F(x) \overset{\text{function}}{:=} x^2,$$

we have

$$Map(F, a + b) \to a^2 + b^2.$$

For the operator

$$G(x, y, z) \overset{\text{function}}{:=} x^2 + y^3 + z^4,$$

we have

$$\begin{aligned} Map(G, a+b, c, d) &\rightarrow G(a,c,d) + G(b,c,d) \\ &= \left(a^2 + c^3 + d^4\right) + \left(b^2 + c^3 + d^4\right) \\ &= a^2 + b^2 + 2\,c^3 + 2\,d^4. \end{aligned}$$

Most computer algebra systems have a form of the Map operator:

MPL	Maple	Mathematica	MuPAD
$Map(F,u)$	`Map(F,u)`	`Map[F,u]`	`Map(u,F)`
$Map(G,u,y,z)$	`Map(G,u,y,z)`	`Map[G[#,y,z]&,u]`	`Map(u,G,y,z)`

(Implementation: Maple (mws), Mathematica (nb), MuPAD (mnb).)

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