

ProudBs [ $n_$ , 0] := {BR [ $n$ , {}]};

ProudBs [ $n_$ , 1] := BR [ $n$ , {#}] & /@ (Range [ $n - 1$ ] ∪ (-Range [ $n - 1$ ]));

ProudBs [ $n_$ ,  $m_$ ] /;  $m > 1$  :=

Flatten [ProudBs [ $n$ ,  $m - 1$ ] /. BR [ $n$ , { $\sigma$ \_\_\_,  $\sigma_$ }] => (BR [ $n$ , { $\sigma$ ,  $\sigma$ , #}] & /@ PF [ $n$ ,  $\sigma$ ])]