Exercise 1.4 Experiments with sorting

```
1    {a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x,y,z#}::Indices(position=independent).
2
3    \partial{#}::PartialDerivative.
4
5    expr := C^{f}
6            w^{e}
7            B^{d}
8            v^{c}
9            A^{b}
10           u^{a}.                          # cdb (ex-0104.100,expr)
11
12   sort_product (expr)                     # cdb (ex-0104.101,expr)
13
14   expr := \Omega_{f}
15           \gamma_{e}
16           \Pi_{d}
17           \beta_{c}
18           \Gamma_{b}
19           \alpha_{a}.                     # cdb (ex-0104.200,expr)
20
21   sort_product (expr)                     # cdb (ex-0104.201,expr)
22
23   expr := C^{f}
24           w^{e}
25           B^{d}
26           v^{c}
27           A^{b}
28           u^{a}
29           \Omega_{f}
30           \gamma_{e}
31           \Pi_{d}
32           \beta_{c}
33           \Gamma_{b}
34           \alpha_{a}.                     # cdb (ex-0104.300,expr)
35
36   sort_product (expr)                     # cdb (ex-0104.301,expr)
```

```
expr := \partial_{f}{C^{f}}
        w^{l}
        \partial_{d}{B^{d}}
        v^{k}
        \partial_{b}{A^{b}}
        u^{j}
        \Omega_{i}
        \partial^{e}{ \gamma_{e}}
        \Pi_{h}
        \partial^{c}{\beta_{c}}
        \Gamma_{g}
        \partial^{a}{\alpha_{a}}.      # cdb (ex-0104.400,expr)

sort_product (expr)                    # cdb (ex-0104.401,expr)

expr := \partial{C}
        w
        \partial{B}
        v
        \partial{A}
        u
        \Omega
        \partial{ \gamma}
        \Pi
        \partial{\beta}
        \Gamma
        \partial{\alpha}.              # cdb (ex-0104.500,expr)

sort_product (expr)                    # cdb (ex-0104.501,expr)

expr := A_{b}
        A_{a}
        A_{c d e}
        A_{f g}.                       # cdb (ex-0104.600,expr)

sort_product (expr)                    # cdb (ex-0104.601,expr)
```

```
75   expr :=  A_{a} A^{a}
76          + A^{a} A_{a}.                    # cdb (ex-0104.700,expr)
77
78   sort_product (expr)                       # cdb (ex-0104.701,expr)
```

$$\texttt{ex-0104.100} := C^f w^e B^d v^c A^b u^a$$

$$\texttt{ex-0104.101} := A^b B^d C^f u^a v^c w^e$$

$$\texttt{ex-0104.200} := \Omega_f \gamma_e \Pi_d \beta_c \Gamma_b \alpha_a$$

$$\texttt{ex-0104.201} := \Gamma_b \Omega_f \Pi_d \alpha_a \beta_c \gamma_e$$

$$\texttt{ex-0104.300} := C^f w^e B^d v^c A^b u^a \Omega_f \gamma_e \Pi_d \beta_c \Gamma_b \alpha_a$$

$$\texttt{ex-0104.301} := A^b B^d C^f \Gamma_b \Omega_f \Pi_d \alpha_a \beta_c \gamma_e u^a v^c w^e$$

$$\texttt{ex-0104.400} := \partial_f C^f w^l \partial_d B^d v^k \partial_b A^b u^j \Omega_i \partial^e \gamma_e \Pi_h \partial^c \beta_c \Gamma_g \partial^a \alpha_a$$

$$\texttt{ex-0104.401} := \Gamma_g \Omega_i \Pi_h \partial_b A^b \partial_d B^d \partial_f C^f \partial^a \alpha_a \partial^c \beta_c \partial^e \gamma_e u^j v^k w^l$$

$$\texttt{ex-0104.500} := \partial C w \partial B v \partial A u \Omega \partial \gamma \Pi \partial \beta \Gamma \partial \alpha$$

$$\texttt{ex-0104.501} := \Gamma \Omega \Pi \partial A \partial B \partial C \partial \alpha \partial \beta \partial \gamma u v w$$

$$\texttt{ex-0104.600} := A_b A_a A_{cde} A_{fg}$$

$$\texttt{ex-0104.601} := A_a A_b A_{fg} A_{cde}$$

$$\texttt{ex-0104.700} := A_a A^a + A^a A_a$$

$$\texttt{ex-0104.701} := 2 A_a A^a$$