

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)
```

```

37
38 expr := \partial_{f}{C^{f}}
39         w^{l}
40         \partial_{d}{B^{d}}
41         v^{k}
42         \partial_{b}{A^{b}}
43         u^{j}
44         \Omega_{i}
45         \partial^{e}{\gamma_{e}}
46         \Pi_{h}
47         \partial^{c}{\beta_{c}}
48         \Gamma_{g}
49         \partial^{a}{\alpha_{a}}.      # cdb (ex-0104.400,expr)
50
51 sort_product (expr)          # cdb (ex-0104.401,expr)
52
53 expr := \partial{C}
54         w
55         \partial{B}
56         v
57         \partial{A}
58         u
59         \Omega
60         \partial{ \gamma}
61         \Pi
62         \partial{\beta}
63         \Gamma
64         \partial{\alpha}.      # cdb (ex-0104.500,expr)
65
66 sort_product (expr)          # cdb (ex-0104.501,expr)
67
68 expr := A_{b}
69         A_{a}
70         A_{c d e}
71         A_{f g}.      # cdb (ex-0104.600,expr)
72
73 sort_product (expr)          # cdb (ex-0104.601,expr)
74

```

```

75 expr := A_{a} A^{a}
76       + A^{a} A_{a}.
77
78 sort_product (expr)

```

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

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

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

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

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

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

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

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

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

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

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

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

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

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