

Exercise 1.11 Cycling free indices – preferred solution

```
1 {a,b,c,d,e,f,u,v,w}::Indices.  
2  
3 expr := A_{a b c}. # cdb (ex-0111.101,expr)  
4  
5 rule := T_{a b c} -> @(expr).  
6 expr := T_{b c a}. # cdb (ex-0111.102,expr)  
7  
8 substitute (expr, rule) # cdb (ex-0111.103,expr)
```

A_{abc}	(ex-0111.101)
T_{bca}	(ex-0111.102)
A_{bca}	(ex-0111.103)

Exercise 1.11 Cycling free indices – alternative solution

This alternative solution uses two rounds of Kronecker deltas. It does the job but is not as simple as the previous solution.

```

1  {a,b,c,d,e,f,u,v,w}::Indices.
2
3  \delta{#}::KroneckerDelta.
4
5  expr := A_{a b c}. # cdb (ex-0111.201,expr)
6
7  expr := \delta^a_u \delta^b_v \delta^c_w @ (expr). # cdb (ex-0111.202,expr)
8
9  eliminate_kronecker (expr) # cdb (ex-0111.203,expr)
10
11 expr := \delta^u_b \delta^v_c \delta^w_a @ (expr). # cdb (ex-0111.204,expr)
12
13 eliminate_kronecker (expr) # cdb (ex-0111.205,expr)

```

A_{abc}	(ex-0111.201)
$\delta^a_u \delta^b_v \delta^c_w A_{abc}$	(ex-0111.202)
A_{uvw}	(ex-0111.203)
$\delta^u_b \delta^v_c \delta^w_a A_{uvw}$	(ex-0111.204)
A_{bca}	(ex-0111.205)