Exercise 4.3 Polynomial products

```
{a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w\#}::Indices(position=independent).
     def get_term (poly,n):
         x^{a}::Weight(label=xnum). # assign weights to x^{a}
         foo := @(poly).
                                        # make a copy of poly
         bah = Ex("xnum = " + str(n)) # choose a target
         keep_weight (foo,bah)
                                        # extract the target
10
11
         return foo
12
13
     def poly_product (p,q,n):
14
15
         pq = Ex("0")
16
17
         for i in range (0,n+1):
18
            for j in range (0,i+1):
19
               termA = get_term (p,j)
               termB = get_term (q,i-j)
21
               termAB := @(termA) @(termB).
22
               pq = pq + termAB
23
         sort_product
                        (pq)
25
         rename_dummies (pq)
26
         factor_out (pq,$x^{a?}$)
27
28
         return pq
29
30
31
32
     # two polynomials
33
34
     polyA := c^{a}
35
            + c^{a}_{b} x^b
```

```
+ c^{a}_{b} c x^b x^c
           + c^{a}_{b} c d x^b x^c x^d
           + c^{a}_{b} c d e x^b x^c x^d x^e. # cdb(ex-0403.100, polyA)
40
     polyB := d^{f}
41
           + d^{f}_{b} x^b
42
           + d^{f}_{b} c x^b x^c
           + d^{f}_{b c d} x^b x^c x^d
           + d^{f}_{b} c d e} x^b x^c x^d x^e. # cdb(ex-0403.101, polyB)
46
     # multiply polynomials and truncate
47
    polyAB = poly_product (polyA,polyB,3)
                                                 # cdb(ex-0403.102,polyAB)
```

$$p = c^{a} + c^{a}{}_{b}x^{b} + c^{a}{}_{bc}x^{b}x^{c} + c^{a}{}_{bcd}x^{b}x^{c}x^{d} + c^{a}{}_{bcde}x^{b}x^{c}x^{d}x^{e}$$

$$q = d^{f} + d^{f}{}_{b}x^{b} + d^{f}{}_{bc}x^{b}x^{c} + d^{f}{}_{bcd}x^{b}x^{c}x^{d} + d^{f}{}_{bcde}x^{b}x^{c}x^{d}x^{e}$$

$$(ex-0403.101)$$

$$pq = c^{a}d^{f} + x^{b}\left(c^{a}d^{f}{}_{b} + c^{a}{}_{b}d^{f}\right) + x^{b}x^{c}\left(c^{a}d^{f}{}_{bc} + c^{a}{}_{b}d^{f}{}_{c} + c^{a}{}_{bc}d^{f}\right) + x^{b}x^{c}x^{d}\left(c^{a}d^{f}{}_{bcd} + c^{a}{}_{b}d^{f}{}_{cd} + c^{a}{}_{bc}d^{f}\right)$$

$$(ex-0403.102)$$