IR divergent parts of scaleless integrals

$$A^{r=-1}(0) = \frac{-2}{\epsilon} \quad \text{only.}$$

all others IR finite.

$$B^{r=0}_{\underbrace{1\cdots1}_{n}}(0,0,0) = B_{\underbrace{1\cdots1}_{n}}(0,0,0)\Big|_{\substack{UV\\DIV}} + B_{\underbrace{1\cdots1}_{n}}(0,0,0)\Big|_{\substack{IR\\DIV}} = 0$$

$$= \frac{(-1)^{2+n}}{\cancel{2^0\,0!}}\binom{0}{0}\frac{\cancel{(0^0 0^0 0^0)}}{n+1}\frac{1}{\epsilon} + B_{\underbrace{1\cdots1}_{n}}(0,0,0)\Big|_{\substack{IR\\DIV}} = 0$$

$$\therefore\ B_{\underbrace{1\cdots1}_{n}}(0,0,0) = \frac{(-1)^{n+1}}{n+1}\frac{1}{\epsilon}$$

$B^{r=-1}_{\underbrace{1\cdots1}}$ are coll. singular if one or masses are zero.

$$C_{00\,1\cdots1\,2\cdots2}(0,0,0;0,0,0) = C_{00\,1\cdots1\,2\cdots2}\Big|_{\substack{UV\\DIV}} + C_{00\,1\cdots1\,2\cdots2}\Big|_{\substack{IR\\DIV}} = 0$$

$$= \frac{(-1)^{n_1+n_2}}{2^1\cancel{(1-1)!}}\cancel{\binom{0}{0}}\frac{n_1!\,n_2!}{(n_1+n_2+2)!}\frac{1}{\epsilon} + C_{00\,1\cdots1\,2\cdots2}\Big|_{\substack{IR\\DIV}} = 0$$

$$\therefore\ C_{00\,1\cdots1\,2\cdots2}(0,0,0;0,0,0)\Big|_{\substack{IR\\DIV}} = \frac{(-1)^{n_1+n_2+1}}{2}\frac{n_1!\,n_2!}{(n_1+n_2+2)!}\frac{1}{\epsilon}$$

If $r \le 0$, use IR-6, IR-3 for standard IR divergent configurations

If $r \le -1$, use alt. PV reduction for mass singularity.

$$D_{0000\,1\cdots1\,2\cdots2\,3\cdots3}(0,0,0,0;0,0;0,0,0,0)\Big|_{IR\,DIV}$$

$$= -D_{0000\,1\cdots1\,2\cdots2\,3\cdots3}\Big|_{\substack{UV\\DIV}} = -\left[\frac{(-1)^{n_1+n_2+n_3}}{2^2(2-2)!}\binom{0}{0}\frac{n_1!\,n_2!\,n_3!}{(n_1+n_2+n_3+3)!}\frac{1}{\epsilon}\right]$$

$$= \frac{(-1)^{n_1+n_2+n_3+1}}{4}\frac{n_1!\,n_2!\,n_3!}{(n_1+n_2+n_3+3)!}$$