$$\boxed{\begin{aligned} H_c = \frac{1}{2n} \sum_{l=0}^{n} (-1)^l (n-l)^{p-2} \sum_{l_1+\cdots+l_p=l} \prod_{i=1}^{p} \binom{n_i}{l_i} \\ \cdot \left[(n-l)-(n_i-l_i)\right]^{n_i-l_i} \cdot \left[(n-l)^2 - \sum_{j=1}^{p} (n_i-l_i)^2\right]. \end{aligned}} \tag{1}$$

$$\begin{aligned} H_c = \boxed{\frac{1}{2n} \sum_{l=0}^{n} (-1)^l (n-l)^{p-2} \sum_{l_1+\cdots+l_p=l} \prod_{i=1}^{p} \binom{n_i}{l_i}} \\ \cdot \left[(n-l)-(n_i-l_i)\right]^{n_i-l_i} \cdot \left[(n-l)^2 - \sum_{j=1}^{p} (n_i-l_i)^2\right]. \end{aligned} \tag{2}$$

$$\begin{aligned} H_c = \frac{1}{2n} \sum_{l=0}^{n} (-1)^l (n-l)^{p-2} \sum_{l_1+\cdots+l_p=l} \prod_{i=1}^{p} \binom{n_i}{l_i} \\ \cdot \left[(n-l)-(n_i-l_i)\right]^{n_i-l_i} \cdot \boxed{\left[(n-l)^2 - \sum_{j=1}^{p} (n_i-l_i)^2\right].} \end{aligned} \tag{3}$$