

$$n[\overbrace{a_p a_q a_r^\dagger} a_s a_t^\dagger a_u^\dagger] = \text{sgn}(P) \overbrace{a_p a_r^\dagger} \overbrace{a_q a_t^\dagger} n[a_s a_u^\dagger]$$

where P

$$pqrstu \xrightarrow{P} prqtsu$$

Therefore, $\text{sgn}(P) = 1$

$$\begin{aligned} n[\overbrace{a_p a_q a_r^\dagger} a_s a_t^\dagger a_u^\dagger] &= \delta_{pr} \delta_{qt} n[a_s a_u^\dagger] \\ &= -\delta_{pr} \delta_{qt} a_u^\dagger a_s \end{aligned}$$