FCI Questions

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1 one difference between two determinants

$$\langle\Psi|V|\Psi(k\to k')\rangle = v^{\alpha\beta\gamma\delta}\,(-1)^{\varepsilon\left(\kappa_1,\ldots,\kappa_i',\ldots,\kappa_n\right)} \tag{1}$$

$$\langle 0|\left(\prod_{\kappa=(\kappa_n\ldots\kappa_2)} a_\kappa\right) a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger a_\gamma a_\delta a_{\kappa_1'}^\dagger \left(\prod_{\kappa'=(\kappa_2\ldots\kappa_n)} a_{\kappa'}^\dagger\right)|0\rangle \tag{1}$$

omitting into QUAL and face factor for now

$$\langle 0|\left(\prod_{\kappa=(\kappa_n\ldots\kappa_2)} a_\kappa\right) a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger a_\gamma \delta_{\delta\kappa_1'} \left(\prod_{\kappa'=(\kappa_2\ldots\kappa_n)} a_{\kappa'}^\dagger\right)|0\rangle \tag{1}$$

$$-\langle 0|\left(\prod_{\kappa=(\kappa_n\ldots\kappa_2)} a_\kappa\right) a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger a_\gamma a_{\kappa_1'}^\dagger a_\delta \left(\prod_{\kappa'=(\kappa\ldots\kappa_n)} a_{\kappa'}^\dagger\right)|0\rangle \tag{1}$$

$$=\langle 0|\left(\prod_{\kappa=(\kappa_n\ldots\kappa_2)} a_\kappa\right) \delta_{\delta\kappa_1'} a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger \delta_{\gamma\kappa_2} \left(\prod_{\kappa'=(\kappa_3\ldots\kappa_n)} a_{\kappa'}^\dagger\right)|0\rangle \tag{1}$$

$$-\langle 0|\left(\prod_{\kappa=(\kappa_n\ldots\kappa_2)} a_\kappa\right) \delta_{\delta\kappa_1'} a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger a_{\kappa_2}^\dagger a_\gamma \left(\prod_{\kappa'=(\kappa_3\ldots\kappa_n)} a_{\kappa'}^\dagger\right)|0\rangle \tag{1}$$

$$- \langle 0| \left(\prod_{\kappa=(\kappa_n \dots \kappa_2)} a_\kappa \right) a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger \delta_{\gamma\kappa_1'} a_\delta \left(\prod_{\kappa'=(\kappa_2 \dots \kappa_n)} a_{\kappa'}^\dagger \right) |0\rangle \tag{1}$$

$$+ \langle 0| \left(\prod_{\kappa=(\kappa_n \dots \kappa_2)} a_\kappa \right) a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger a_{\kappa_1'}^\dagger a_\gamma a_\delta \left(\prod_{\kappa'=(\kappa_2 \dots \kappa_n)} a_{\kappa'}^\dagger \right) |0\rangle \tag{1}$$

$$= \langle 0| \left(\prod_{\kappa=(\kappa_n \dots \kappa_2)} a_\kappa \right) \delta_{\delta\kappa_1'} \delta_{\gamma\kappa_2} \delta_{\alpha\kappa_1} a_\beta^\dagger \left(\prod_{\kappa'=(\kappa_3 \dots \kappa_n)} a_{\kappa'}^\dagger \right) |0\rangle \tag{1}$$

$$- \langle 0| \left(\prod_{\kappa=(\kappa_n \dots \kappa_2)} a_\kappa \right) \delta_{\delta\kappa_1'} \delta_{\gamma\kappa_2} a_\alpha^\dagger a_{\kappa_1} a_\beta^\dagger \left(\prod_{\kappa'=(\kappa_3 \dots \kappa_n)} a_{\kappa'}^\dagger \right) |0\rangle \tag{1}$$

$$+ \langle 0| \left(\prod_{\kappa=(\kappa_n \dots \kappa_3)} a_\kappa \right) \delta_{\delta\kappa_1'} a_{\kappa_1} a_\alpha^\dagger a_\beta^\dagger a_\gamma \left(\prod_{\kappa'=(\kappa_3 \dots \kappa_n)} a_{\kappa'}^\dagger \right) |0\rangle \tag{1}$$

$$- \langle 0| \left(\prod_{\kappa=(\kappa_n \dots \kappa_2)} a_\kappa \right) \delta_{\gamma\kappa_1'} \delta_{\alpha\kappa_1} a_\beta^\dagger a_\delta \left(\prod_{\kappa'=(\kappa_2 \dots \kappa_n)} a_{\kappa'}^\dagger \right) |0\rangle \tag{1}$$

$$+ \langle 0| \left(\prod_{\kappa=(\kappa_n \dots \kappa_2)} a_\kappa \right) \delta_{\gamma\kappa_1'} a_\alpha^\dagger a_{\kappa_1} a_\beta^\dagger a_\delta \left(\prod_{\kappa'=(\kappa_2 \dots \kappa_n)} a_{\kappa'}^\dagger \right) |0\rangle \tag{1}$$

$$+0 \tag{1}$$

$$= \delta_{\delta\kappa_1'} \delta_{\gamma\kappa_2} \delta_{\alpha\kappa_1} \delta_{\beta\kappa_2} \tag{1}$$

$$- \langle 0| \left(\prod_{\kappa=(\kappa_n \ldots \kappa_2)} a_\kappa \right) \delta_{\delta \kappa'_1} \delta_{\gamma \kappa_2} a^\dagger_\alpha \delta_{\beta \kappa_1} \left(\prod_{\kappa'=(\kappa_3 \ldots \kappa_n)} a^\dagger_{\kappa'} \right) |0\rangle \tag{1}$$

$$+ \langle 0| \left(\prod_{\kappa=(\kappa_n \ldots \kappa_2)} a_\kappa \right) \delta_{\delta \kappa'_1} \delta_{\gamma \kappa_2} a_{\kappa_1} a^\dagger_\alpha a^\dagger_\beta \left(\prod_{\kappa'=(\kappa_3 \ldots \kappa_n)} a^\dagger_{\kappa'} \right) |0\rangle \tag{1}$$

$$+ \langle 0| \left(\prod_{\kappa=(\kappa_n \ldots \kappa_3)} a_\kappa \right) \delta_{\delta \kappa'_1} \delta_{\rho \kappa_1} a^\dagger_\beta a_\gamma \left(\prod_{\kappa'=(\kappa \ldots \kappa_n)} a^\dagger_{\kappa'} \right) |0\rangle \tag{1}$$

$$- \langle 0| \left(\prod_{\kappa=(\kappa_n \ldots \kappa_{30})} a_\kappa \right) \delta_{\delta \kappa'_1} a^\dagger_\alpha a_{\kappa_1} a^\dagger_\beta a_\gamma \left(\prod_{\kappa'=(\kappa_3 \ldots \kappa_n)} a^\dagger_{\kappa'} \right) |0\rangle \tag{1}$$