The Answer of Assignment 2

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Problem 1 Solution

(1) 根据线性空间的同构理论，任何维数相同的线性空间都是同构的。因此可知 $\sum_{i,j=0}^{1} c_{ij}\,|i,j\rangle$ 与 $\{(x_1,x_2,x_3,x_4)\}, x \in C$ 同构。即 $v_1 = (c_{00}, c_{01}, c_{02}, c_{03})^*$,$v_2 = (d_{00}, d_{01}, d_{10}, d_{11})^*$

(2) $\langle\psi_1|\psi_2\rangle = v_1^\dagger v_2$ 成立, 这是因为

(3)

(4)

Problem 2 Solution

(1)

(2)

(3)

(4)

Problem 3 Solution

(1)

(2)

(3)

(4) how should the Pauli operators σ_i^+ and σ_i^z can be written in terms of the f operators? we have the definition that:

$$f_i^\dagger = \left(\prod_{j<i} \sigma_j^z\right) \sigma_i^+$$

so from $\langle\overline{n_{1'}n_{2'}\cdot n_{i'}}|f_i^\dagger|\overline{n_1n_2n_3\cdot n_i}\rangle$=$\langle\overline{n_1n_2\cdot n_i}|f_i|\overline{n_{1'}n_{2'}\cdot n_{i'}}\rangle^*$ we can get the relation between f_i and σ_i^+, σ_i^z as follows:

$$f_i = \left(\prod_{j<i} \sigma_j^z\right) \sigma_i^-$$

then try to represent σ_i^z and σ_i^+ in terms of f_i:

$$\sigma_i^z = \left(\prod_{j<i} f_j^\dagger\right) f_i^\dagger f_i \left(\prod_{j<i} f_j\right)$$