Basis, Matrix, ExpressionFor

Matrix Representation

최만수 (고려대 물리학과)

Matrix Representation

for State Vectors and Operators

Matrix Representation of Vectors

- Let $\{|v_1\rangle, |v_2\rangle, \cdots, |v_n\rangle\}$ be the basis.
- $|\psi\rangle = |v_1\rangle c_1 + |v_2\rangle c_2 + \cdots + |v_n\rangle c_n$

  $c_k = \langle v_k|\psi\rangle$

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$$|\psi\rangle \doteq \begin{bmatrix} c_1 \\ c_1 \\ \vdots \\ c_n \end{bmatrix}$$

Matrix Representation of Operators

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- $\hat{A} = \sum_{ij} |v_i\rangle A_{ij} \langle v_j|, \quad A_{ij} = \langle v_i | \hat{A} | v_j \rangle$

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$$\hat{A} \doteq \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & A_{22} & \cdots & A_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ A_{n1} & A_{n2} & \cdots & A_{nn} \end{bmatrix}$$

Computational Basis

- For a single qubit: $\{|0\rangle, |1\rangle\}$.
- For two qubits:
  $\{|0\rangle \otimes |0\rangle, |0\rangle \otimes |1\rangle, |1\rangle \otimes |0\rangle, |1\rangle \otimes |1\rangle\}$.

감사합니다!