

Things you should be able to do for exam:

- Analyze and describe situations using bra/ket & vector notation
 - States
 - Measurements
 - Unitaries
 - Cryptographic protocols
 - Bomb protocol / Interferometers
 - No cloning proof
- including qubit
- know common abbreviations:
 - $|0\rangle, |1\rangle, |-\rangle$ etc.
 - I, X, Y, Z etc.

• Analyze 2-qubit scenarios

- Use tensor product appropriately
- Identify entangled / product systems
- Determine outcomes & probabilities of measurements (including partial + measurements where Alice + Bob each measure part.)
- Apply 2-qubit unitaries
- Analyze non-local games
- Analyze cloning strategies for Eve.

• Bloch Sphere: Identify correspondence between

- states + vectors on B.S.
- unitaries + rotations on B.S.

• Manipulate complex numbers

You do not need to know eigenvector/eigenvalue correspondance.

Phases: $x \in \mathbb{C} : |x|^2 = 1$

$$e^{i\omega}, e^{i\phi}, e^{i\pi}, 1, -1, i, -i$$

← global phase

- $|\psi\rangle$ is physically same as $e^{i\omega}|\psi\rangle$
 - $a|\psi_1\rangle + b|\psi_2\rangle$ is not physically the same as $a|\psi_1\rangle + e^{i\omega}b|\psi_2\rangle$
- ↖ amplitude phase

$$|0\rangle \rightarrow |1\rangle$$

$$|1\rangle \rightarrow |0\rangle$$

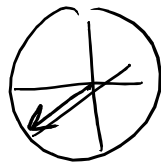
vs

$$|0\rangle \rightarrow i|1\rangle$$

$$|1\rangle \rightarrow |0\rangle$$

Bloch Sphere

$$|+\rangle \rightarrow$$

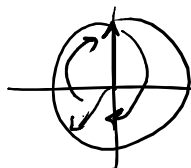


$$|0\rangle \rightarrow$$

...

$$H|0\rangle \rightarrow |+\rangle$$

$$H|+\rangle \rightarrow |0\rangle$$



Plug in $|0\rangle, |+\rangle, |-\rangle$
and analyze how the
unitary transforms.