CMSC 643
QUANTUM TELEPORTATION EXERCISES

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(1) Indicate in detail how Alice can use the standar teleportation protocol to teleport a qubit in the state

$$|\psi\rangle = \frac{(4+3i)\,|0\rangle + (4-3i)\,|1\rangle}{5\sqrt{2}}$$

to Bob. Show all intermediate states, and also all unitary transformations and observables used by Alice and Bob.

(2) Devise a quantum protocol for teleporting two qubits in the arbitrary state

$$|\psi\rangle = a\,|00\rangle + b\,|01\rangle + c\,|10\rangle + d\,|11\rangle \ ,$$

where

$$|a|^2 + |b|^2 + |c|^2 + |d|^2 = 1 \ .$$

Can the standard quantum teleportation protocol be used twice to accomplish this?

(3) Devise a quantum teleportation protocol for teleporting two qubits whose state is always of the form

$$|\psi\rangle = a\,|00\rangle + b\,|11\rangle \ ,$$

where

$$|a|^2 + |b|^2 = 1 \ .$$

Can the protocol of problem 2) be simplified for states of this form?