

### 1 Spin One Half Unknowns (Brief)

With the Spins simulation set for a spin  $1/2$  system, measure the probabilities of all the possible spin components for each of the unknown initial states  $|\psi_3\rangle$  and  $|\psi_4\rangle$ . (Since  $|\psi_3\rangle$  has already been covered in class, please only do  $|\psi_4\rangle$  )

- (a) Use your measured probabilities to find each of the unknown states as a linear superposition of the  $S_z$ -basis states  $|+\rangle$  and  $|-\rangle$ .
- (b) *Articulate a Process:* Write a set of general instructions that would allow another student in next year's class to find an unknown state from measured probabilities.
- (c) *Compare Theory with Experiment:* Design an experiment that will allow you to test whether your prediction for each of the unknown states is correct. Describe your experiment here, clearly but succinctly, as if you were writing it up for a paper. Do the experiment and discuss your results.
- (d) *Make a Conceptual Connection:* In general, can you determine a quantum state with spin-component probability measurements in only two spin-component-directions? Why or why not?