Physics 412—Practice S–4 (Due Feb. 10, 4 pm) Name:

S–4: I can interpret the density matrix for a quantum ensemble and use it to make predictions about the results of measurements.

Unsatisfactory Progressing Acceptable Polished

(1) A mixed ensemble of spin-1/2 particles is described by the density matrix

$$\rho \leftrightarrow \frac{1}{8}\begin{bmatrix} 4 & -2 \\ -2 & 4 \end{bmatrix}.$$

This matrix is expressed in the z-state basis.

(a) How would you describe this mixed ensemble in words? What states could it be constructed from, and with what weights? Explain.

(b) If you measured the x-component of the spin of the particles in this ensemble, what would the average of your measurements be?

(c) If you measured the y-component of the spin of the particles in this ensemble, what would the average of your measurements be?

(d) If you measured the z-component of the spin of the particles in this ensemble, what would the average of your measurements be?