Homework #5. Due Tue 9/25.

#1 – Exercise 4.5.3, page 135.
#2 – Exercise 5.2.3, page 147.
#3 – Exercise 5.3.4, page 157.
#4 – Exercise 5.4.3, page 159. (Note: take (ii) as the definition of $H$ if the definition has not been given elsewhere.)
#5 – Exercise 5.4.9, page 165.

Fifth week summary

Tue 9/11. [this is a repeat from Handout 5, because we followed the plan there so closely] Start with summary on page 114. Look at their two examples, and the notion of superposition. Then, Section 4.2: observables. These correspond to Hermetian operators. The eigenvalues are the possible measurements. Note postulates 1–3. Pages 417–425 are labeled as tangential to quantum computation; they culminate with a statement of Heisenberg Uncertainty in terms of variances and commutators of matrices.

Also, passed out some sample maple output. You might want to use a system of this ilk for matrix multiplication and so on. Mathematica and matlab are two strong contenders; there is a freely available mathematica online – wolframalpha.com.

Wed 9/12. Brought in some more maple output, so we could see a calculation of means and variances from start to finish.

Thu 9/13. Cultural bonus: Read from von Neumann’s “Mathematical Foundations of Quantum Mechanics.” Worked exercise 2.4.8, after including the corrective factor $i$. Went over the first two Pauli matrices, $S_x$ and $S_y$, working out eigenvectors and eigenvalues. Had a nice discussion about both spin and polarized light.
Sixth week topics

Tue 9/18. What is the main thing to remember from Section 4.4 on dynamics? The tensor product with two-state components. Separable and entangled states in the 2-dimensional case. The quantum computer model as seen by a computer scientist (or, by a designer of quantum algorithms). (these topics follow approximately Sections 4.5 and 5.1). Note that a quantum computer seems to embody two much studied techniques from classical computing: parallelism and probabilistic algorithms. But the programming seems something new.

Wed 9/19. Classical gates, and reversible gates. (sections 5.2 and 5.3)

Thu 9/20. Quantum gates (Section 5.4), student presentation topics.