Chem 442: Homework for lecture L8

(only turn in **BOLD** assignment first lecture next week; do <u>all</u> assignments)

1. Turn in Problem 1.8 (Page 25)

Note that this wavefunction could also be written $\Psi(x) = e^{-|x|}$, where the bars denote the 'absolute value of x.' This type of wavefunction is conventionally called "1s orbital" by quantum chemists.

2. Problem 1.9 (Page 25)

3. As mentioned in class, you can use postulate (4) not just to show that $|\Psi(x)|^2$ gives the probability of finding the particle at position x, but also to calculate the average value of any operator $\hat{A}$ corresponding to observable A. This average value is always a real number, and is the closest thing in quantum mechanics to the "classical value" of an observable A.

a. Explain in words why <A> = $\Sigma\, a_n\, P(A=a_n)$ is the average value of A, if A can only have values a_0, a_1, … a_n.

b. Let's check this with an example: Let's say A is the value of various bills (Like \$1, \$5, \$10, \$20 etc). You have three \$1 bills and one \$5 bill, so $a_0=1$, $a_1=5$, $P(A=a_0=1) = 3/4$, $P(A=a_1=5) = 1/4$. What is <A>? Does this match your intuition for the average value of one of the four bills?

Likewise, since postulate (4) tells you what the probabilities of measuring a_n are, you can use it to calculate <A>.

c. According to postulate (4) what is the probability $P(A=a_n, t)$, of measuring the value of observable A to be equal to a_n at time t?