PHYSICS 827

Home Work Assignment # 7   11/12/2010

Due: Mon., Nov. 22, 2010 (by 5:00 PM in the grader's mail box).

The exercise numbers below are from Shankar's book (2nd edition).

1. Ex. 7.3.3 (page 196).

2. Ex. 7.3.6 (page 197).

3. Ex. 7.4.1 (page 212). [You do not need to do Ex. 7.3.4 on p. 196, but do read it to see how much easier it is to obtain these results using a and $a^\dagger$ rather than Hermite polynomials].

4. Ex. 7.4.2 (page 212).

5. Ex. 7.4.3 (page 212). [You do not need to do the classical mechanics part of this problem, but do read it and understand what is being said].

6. Ex. 7.4.5 (page 212). [For part (c), you will need to go through the derivation of Ehrenfest's theorem, equation (6.2), on p. 179].

7. Ex. 7.4.6 (page 212).

8. (a) For any two finite dimensional matrices A and B, show that:
$\text{Tr}\,[A, B] = 0$.
(b) If you naively use this result and take the trace of the commutation relation $\left[a, a^\dagger\right] = \widehat{1}$, you seem to get a meaningless result.

Use the *infinte dimensional* matrices for a and $a^\dagger$ to calculate $aa^\dagger$ and $a^\dagger a$ and explain how to make sense of this result.

9. Ex. 16.1.2 (page 434). [You will need to review the Variational Principle on p. 429, 430 before you can do this problem and the next].

10. Ex. 16.1.3 (page 434).