

Homework Assignment # 7

NOT TO BE GRADED  
ANSWERS TO BE POSTED ON WEB SITE

- 1) Assuming no other degrees of freedom, find the allowed state vectors of a system of two spin-3/2 particles that are simultaneous eigenvectors of the operators  $\mathbf{S}^2$  and  $\mathbf{S}_z$ , where  $\mathbf{S}$  is the total spin operator of the system. What are the allowed values of the quantum numbers? Hint: consider the ladder operator method starting from the highest spin state.
- 2) Show that for a system of two identical particles, each of spin  $s$ , the ratio of the number of symmetrical to the number of antisymmetrical states is  $(s+1)/s$ .
- 3) Cohen-Tannoudji, Chapter XIV, Complement D, p. 1447, Exercises 1, 2. For exercise 2, it is easiest to write out symmetric/antisymmetric combinations of space and of spin separately with known values of  $L$  and  $S$ , and then multiply them together to get the required symmetry. Remember that a term symbol is defined by  $^{2S+1}L$ .  
Repeat exercise 2 for spin-1/2 fermions.