

## Homework 9

1. (60 points) Derive the commutation / anticommutation properties of second - quantization operators for free Bosons and Fermions in the momentum space.

2. (40 points) .

(a) Calculate  $N | p_1 p_2 p_3 \rangle = 3 | p_1 p_2 p_3 \rangle$ ,  
where  $N$  is the Bosonic number operator

defined as  $\int a^\dagger(p) a(p) d^3 p$

(b) Show the same for two fermion wave function  
for the state of  $| p_1 p_2 \rangle$  where  $N = \int b^\dagger(p) b(p) d^3 p$