

**INTRODUCTION TO QUANTUM FIELD THEORY**  
**(KREIMER, WINTER 17/18)**

EXERCISE 3 (NOV 29 2017, TO BE HANDED IN DEC 13 2017)

- 1.(20 points)

Prove Dysons formula on the time-ordered interaction Hamiltonian  $H_I$ ,

$$i\partial_t U(t, t_0) = H_I(t)U(t, t_0)$$

is solved by

$$U(t, t_0) = T e^{-i \int_{t_0}^t H_I(x) dx}.$$

- 2. (20 points)

Prove Wicks theorem:

$$T(\phi(x_1) \dots \phi(x_n)) =: \phi(x_1) \dots \phi(x_n) : + : \text{all possible contractions} : .$$

- 3. (10 points)

Prove: There are  $(2k - 1)!!$  ways to form  $k$  pairs from  $2k$  identical objects.