(6) Explain why the leading contribution to the k-tuples cluster operator has order k-1 for $k \geq 2$.

T_k is connected and has excitation level k.
$\psi^{(0)} = \Phi$ has ex. level 0 so T_k can't contribute at order 0 for $k \geq 2$. What about order 1?

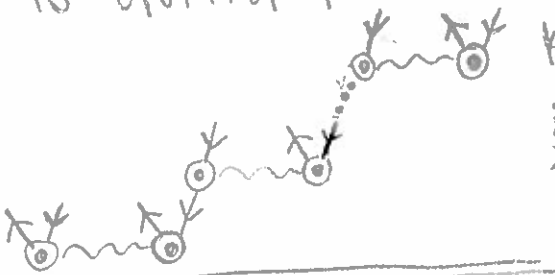
$\psi^{(1)} = R_0 V_0 \Phi$ → Max. connected excitation level  → is 2

so T_2 has a first order leading contribution

Now consider an arbitrary $\psi^{(k)}$, $k > 1$.

$\psi^{(k)} = \underbrace{(R_0 V_0)^k}_{\text{max excitation levels come from this part.}} + \langle \rangle$

When we're considering all possible connected contributions to $(R_0 V_0)^k$, the max. connected excitation level is going to come from this diagram:



this term is a part of T_{k+1}. Since $k+1$ is the max. connected excitation level in $\psi^{(k)}$,

excitation level $2+(k-1) = \boxed{k+1}$

T_{k+1} cannot contribute at any order lower than k. Thus the leading contribution of T_{k+1} has order k for $k > 1$, or in other words T_k has leading order $k-1$ for $k > 2$. Since we have already shown that T_2 has leading order 1,

T_k has leading order $k-1$ for $k > 1$. ▨