UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Physics

Physics 221B **Quantum Field Theory** **Winter 2015**

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ASSIGNMENT #7
Due: Mon., March 2, in class.

1. Srednicki 14.3

2. Evaluate $\mathbf{V}_4$ up to one loop in $\lambda\phi^4$ theory, in the $\overline{\rm MS}$ scheme. In particular, determine the value of Z_λ to leading order. Do the Feynman parameter integral for the case $m^2 = 0$.

3. Suppose that we have N scalar fields ϕ_i, with

$$\mathcal{L} = -\frac{1}{2}\partial_\mu\phi_i\partial^\mu\phi_i - \frac{1}{2}m^2\phi_i\phi_i - \frac{1}{8}\lambda\phi_i\phi_i\phi_j\phi_j$$

(summation convention on i, j).

a) Give the Feynman rules for this theory.

b) Evaluate $\mathbf{V}_{4ijkl}$ at tree level and one loop (using $\overline{\rm MS}$). (No need to do the Feynman parameter integral, anyway it's the same as above).