UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Physics

**Physics 221A** **Quantum Field Theory** **Fall 2007**

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Course web page: http://www.kitp.ucsb.edu/∼joep/Web221A/221A.html

ASSIGNMENT #8

Due: Friday, Nov. 30, 5pm in TA's mailbox (5th floor Broida). See course web page for late homework policy.

1. Srednicki 27.1

2. Srednicki 28.1.

3. An extension of 28.1. In $d = 4$, using the one-loop $\beta$-function for $\lambda$, find $\lambda(\mu)$ assuming that the value is known at some scale $\hat{\mu}$, $\lambda(\hat{\mu}) = \hat{\lambda}$. Sketch the solution. Now do the same in $d = 3$, keeping the order $\epsilon$ term in $\mu\partial_\mu\lambda$.

4. Srednicki 28.3.

5. An extension of 28.3. In the $g, h$ plane, sketch the vector field $(\mu\partial_\mu g, \mu\partial_\mu h)$. As one moves to higher energies, the coupling flows along this vector field. As one moves to lower energies, it flows against it. (You might want to use Mathematica for this problem). Do the same for nonzero $\epsilon$, keeping the order $\epsilon$ terms in the $\beta$-function. Consider both $\epsilon = +1$ and $\epsilon = -1$. One question that is particularly interesting is where the vector field vanishes: these are fixed points, where the coupling can be constant. It is also interesting what parts of the coupling constant plane flow toward each fixed point, both at low energy and high energy.