41. For the harmonic oscillator calculate $< 0|\, T\left((\hat{x}(t)\hat{x}(0)\right)|0>$.

42. In Minkowski space consider a scalar field with cubic self interaction

$$\mathcal{L} = \frac{1}{2}(\partial_\mu\phi)(\partial^\mu\phi) - \frac{1}{2}m^2\phi^2 - \frac{1}{3!}g\phi^3$$

and calculate $\frac{Z[J]}{Z[0]}$ to $O(g)$.

43. For the above model calculate $< 0|\, T\left(\hat{\phi}(x_1)\hat{\phi}(x_2)\right)|0>$ and $< 0|\, T\left(\hat{\phi}(x_1)\hat{\phi}(x_2)\hat{\phi}(x_3)\right)|0>$ to $O(g)$. Perform the Fourier transform to momentum space and give an interpretation in terms of Feynman diagrams.

44. For the above model calculate all terms of $\frac{Z[J]}{Z[0]}$ which are relevant for $< 0|\, T(\phi(x_1)\phi(x_2)|0>$ and $< 0|\, T(\phi(x_1)\phi(x_2)\phi(x_3)|0>$ to $O(g^2)$. Obtain theses ground state expectation values and give an interpretation in terms of Feynman diagrams.