Exercises

1. Review the handout on two component spinors, if the notation of Wess and Bagger (with dotted and undotted indices is familiar).

2. Verify the commutators of the Q's and the D's written as differential operators in superspace. Verify the action of the exponentiated supercharges on superfields.

3. Check that with the definition of y, Φ is chiral. Show that any function of chiral fields is a chiral field. Work out the expansion of a chiral field in powers of $\theta, \bar{\theta}$.

4. Verify that W_α transforms as in the adjoint representation, and that $\mathrm{Tr} W_\alpha^2$ is gauge invariant.

5. Derive the expression for the component lagrangian including gauge interactions and the superpotential by doing the superspace integrals.

6. Derive the supersymmetry current for a theory with several chiral fields. For a single field, Φ, and $W = 1/2\ m\Phi^2$, verify, using the canonical commutation relations, that the Q's obey the supersymmetry algebra. Work out the supercurrent for a pure supersymmetric gauge theory.

7. Work out out the spectrum of the O'Raifeartaigh model. Show that the spectrum is not supersymmetric, but verify the sum rule, $\sum(-1)^F\ m^2 = 0$.

8. Work out the spectrum of a model with a Fayet-Iliopoulos D-term and supersymmetry breaking. Again verify the sum rule.

9. Check equations for the minimum of the potential of the Polonyi model