Exercise 2
Equivariant localization in QFT
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For the conventions and explanations see the lectures.

1. Consider QM example from the lectures with the sypersymmetry

$$
\begin{aligned}
\delta X^\mu &= \Psi^\mu \\
\delta \Psi^\mu &= \partial_\tau X^\mu
\end{aligned} \tag{1}
$$

Please work out the linearization of these transformations around constant maps and take into account the problems with diffeomorphisms. Calculate the square of the linearized transformations.

2. Show that the transformations

$$
\begin{aligned}
\delta A &= \Psi + d_A c \\
\delta \Psi &= \iota_R F + i d_A \sigma + \{c, \Psi\} \\
\delta \sigma &= -i \iota_R \Psi + [c, \sigma] \\
\delta \chi &= H + [c, \chi] \\
\delta H &= \mathcal{L}_R^A \chi + [\sigma, \chi] + [c, H] \\
\delta c &= \sigma + \frac{i}{2}\{c, c\} + i \iota_R A \\
\delta \bar{c} &= b + \{c, \bar{c}\} \\
\delta b &= \mathcal{L}_R \bar{c} + [c, b] + [\sigma, \bar{c}]
\end{aligned} \tag{2}
$$

satisfy the simple algebra $\delta^2 = i\mathcal{L}_R$ (maybe modulo conventions). For all notations, see lectures.