Exercise 6

1. Consider the theory

	$SU(N)$	$SU(5)$	$SU(N+1)$	$U(1)_1$	$U(1)_2$	$U(1)_R$
A	$\square\!\!\square$	$\mathbf{1}$	$\mathbf{1}$	0	-10	$\frac{-12}{N}$
Q	$\square$	$\square$	$\mathbf{1}$	1	$N-5$	$2-\frac{6}{N}$
$\overline{Q}$	$\overline{\square}$	$\mathbf{1}$	$\square$	$\frac{-5}{N+1}$	5	$\frac{6}{N}$

,

for even N. Find a deconfined description with a $Sp(N-2)$ gauge group, an extra ("fictitious") global $SU(2)$ symmetry, and one gauge singlet field. Check that the superpotential gives masses to the correct composites to recover the original theory, and check that the non-Abelian gauge and global anomalies work correctly.

2. Check that all the global (including mixed gravitational) anomalies match between $SU(5)$ with three generations (i.e 3 $\left(\square\!\!\square + \overline{\square}\right)$) as in the following table:

	$SU(5)$	$SU(3)$	$SU(3)$	$U(1)$	$U(1)_R$
A	$\square\!\!\square$	$\square$	1	1	0
$\bar{Q}$	$\overline{\square}$	1	$\square$	-3	$\frac{2}{3}$

;

and its s-confined description:

	$SU(3)$	$SU(3)$	$U(1)$	$U(1)_R$
$(A\bar{Q}^2)$	$\square$	$\overline{\square}$	-5	$\frac{4}{3}$
$(A^3\bar{Q})$	$\square\!\!\square$	$\square$	0	$\frac{2}{3}$
(A^5)	$\square\!\!\square$	1	5	0

with superpotential

$$W_{dyn} = \frac{1}{\Lambda^9}\left[(A^5)(A^3\overline{Q})(A\overline{Q}^2) + (A^3\overline{Q})^3\right] .$$