I repeat two exercises from Sheet 2 because they were about some material I did not cover in my second lecture.

**Exercise 1.** Let $(\Sigma, \alpha, \beta, z)$ be a pointed Heegaard diagram, $x$ a Heegaard Floer generator, $P$ a periodic domain and $[P] \in H_2(M; \mathbb{Z})$ the homology class associated to it. Prove that
\[ c_1(s_z(x)) = e(P) + 2n_x(P). \]

**Exercise 2.** Let $(\Sigma, \alpha, \beta, z)$ be a pointed Heegaard diagram and let $z'$ be another basepoint separated by $\alpha_i$ from $z$ by the curve $\alpha_i$.

\[ \bullet \quad z \]

\[ \bullet \quad z' \]

Compute $s_z(x) - s_{z'}(x)$ for a Heegaard Floer generator $x$.

**Exercise 3.** Let $x$ and $y$ be Heegaard Floer generators. prove that
\[ s_z(y) - s_z(y) = \epsilon(x, y). \]

Be careful with the next exercise because I couldn’t solve it, but it should be doable.

**Exercise 4.** Choose (arbitrary) orientations of the $\alpha$- and $\beta$- curves. Then to each intersection point $x$ we assign $\sigma(x) = \pm 1$ depending on the sign of the intersection (since the sign depends on the order in dimension two, we fix the convention that $\alpha$ is first and $\beta$ second). Given an a Heegaard Floer generator $x = \{x_1, \ldots, x_n\}$ we define $\sigma(x) = \prod \sigma(x_i)$.

Prove that, for every $u \in \mathcal{M}(x, y)$, we have that $I(D(u) \equiv 0 \pmod 2$ if $\sigma(x)\sigma(y) = 1$ and $I(D(u) \equiv 1 \pmod 2$ if $\sigma(x)\sigma(y) = -1$.

**Exercise 5.** Let $(T^2, \alpha, \beta, \gamma, z)$ be the triple Heegaard diagram where, for some orientation of $\alpha$, $\beta$ and $\gamma$, $\alpha \cdot \beta = 1$ and $\gamma = \alpha + n\beta$ for $n \in \mathbb{Z}$. The placement of $z$ is up to you. Compute the maps $F_{\alpha, \beta, \gamma}$. 
