SUSY PHENOMENOLOGY

Sheet 3

Exercice 1: Sfermions

The sfermion mass matrix in the MSSM is given by

$$\mathcal{L}_{\tilde{f}} = -\tilde{f}^\dagger M^2_{\tilde{f}} \tilde{f} \qquad \text{with } \tilde{f} = \begin{pmatrix} \tilde{f}_L \\ \tilde{f}_R \end{pmatrix} \tag{1}$$

$$M^2_{\tilde{f}} = \begin{pmatrix} m_f^2 + M^2_{\tilde{f}_L} + M_Z^2(\frac{1}{2} - e_f s_W^2)\cos 2\beta & m_f(A_f - \mu r_f) \\ m_f(A_f - \mu r_f) & m_f^2 + M^2_{\tilde{f}_R} + M_Z^2 e_f s_W^2 \cos 2\beta \end{pmatrix},$$

with

$$r_f = \begin{cases} \cot\beta & \text{for up-type fermions} \\ \tan\beta & \text{for down-type fermions} \end{cases} . \tag{2}$$

Determine the mass eigenvalues and mass eigenstates.