

## 1 Free energy of a two state system

- (a) Find an expression for the free energy as a function of  $T$  of a system with two states, one at energy 0 and one at energy  $\varepsilon$ .
- (b) From the free energy, find expressions for the internal energy  $U$  and entropy  $S$  of the system.
- (c) Plot the entropy versus  $T$ . Explain its asymptotic behavior as the temperature becomes high.
- (d) Plot the  $S(T)$  versus  $U(T)$ . Explain the maximum value of the energy  $U$ .