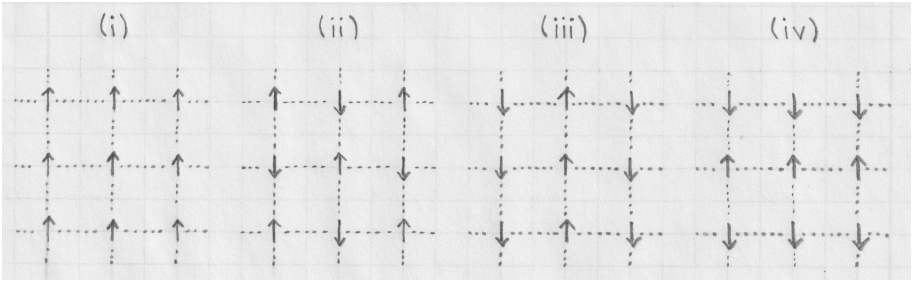
[lex133] Magnetic dipole interaction III

This exercise is an extension of [lex130]. Consider four arrays of magnetic dipole moments **m** on a square lattice. The lattice constant is a. The moments are oriented up or down in different regular patterns: (i) all moments are aligned, (ii) all nearest neighors are anti-aligned, (iii) moments within a column are aligned and colums anti-aligned, (iv) moments within a row are aligned and rows anti-aligned.
Calculate the interaction potential energy of one moment on each lattice with each four nearest-neighbors and its four next-nearest neighbors. Express the four results in units of $\mu_0 m^2/4\pi a^3$.



Solution: