Problem 1.

(a) The deutron's mass is 1875.6 MeV/c^2. What is its binding energy? is this a relativistic system?
(b) If you take the up- and down-quark masses to be those given in Table 4.4, what is the binding energy of a pion? is this a relativistic system?

Solution
(a) One neutron + One proton - 1875.6 MeV/c^2
Neutron : 939.565 MeV/c^2
Proton : 938.272 MeV/c^2
Mass difference = 2.2 MeV/c^2

Q. A relativistic system?
A. mass difference $\times$ c^2 = binding energy = 2.2 MeV (in wikipedia, it says 2.2 MeV, yes)

(b) Figure 1 Quark masses.

$$M(meson) = m_1 + m_2 + A\frac{(S_1 \cdot S_2)}{m_1 m_2}$$

(will continue)

Table 4.4 Quark masses (MeV/c^2)

Quark flavor	Bare mass	Effective mass
u	2	336
d	5	340
s	95	486
c	1300	1550
b	4200	4730
t	174 000	177 000

Warning: These numbers are somewhat speculative and model dependent [12].

Figure 1: Table4.4.