The following two problems are both NP-complete:

The Set Partition Problem (SPP) asks the following: Given a set
S of integers is it possible (yes or no) to divide S into two
disjoint subsets so that the sum of the values in one set equals
the sum of the values in the other set?

Another version of the Subset Sum Problem (SSP) asks the
following: Given a set S of integers and integers K_1 and K_2 is
there (yes or no) a subset $A \subset S$ such that the sum of all of the
integers in A is $\geq K_1$ and $\leq K_2$?

In problems 1 and 2 give informal arguments -- you need not use
binary encodings.

1.   Show that SPP $\leq_P$ SSP.

2.   Show that SSP $\leq_P$ SPP.

3.   Write an encoding for graphs.

4.   A (formal) problem $p:\mathcal{B}^+ \to \mathcal{B}$ has certification $c:\mathcal{B}^+ \times \mathcal{B}^+ \to \mathcal{B}$ with
the unusual property that c(s, t) is false for all strings s and
t. Is this possible? If yes what does it tell us about p and
if no explain why not.