SET 11

(1) If $n > 3$ is not prime, show that there exist positive integers a, b, c, such that $n = ab + bc + ca + 1$.

(2) How many triples (A, B, C) are there of sets with

$$A \cup B \cup C = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

and

$$A \cap B \cap C = \emptyset?$$

(3) If a_n is a sequence of positive reals satisfying $a_n \leq a_{2n} + a_{2n+1}$ for all $n \geq 1$, prove that $a_1 + a_2 + a_3 + \cdots$ diverges.