In this homework we consider the following three problems:

- SET-SPLITTING: On input a set $S$ and a collection of subsets $C \subseteq \wp(S)$, determine if there is a way to color the nodes in $S$ with two colors (say, red or blue) in such a way that no $C \in C$ has all its elements colored with the same color.

- DOUBLE-SAT: Given a formula $\phi$, determine if there are at least two (distinct) satisfying assignments for it.

- 2SAT: Given a CNF formula $\phi$ such that every clause contains exactly 2 literals, determine if the formula is satisfiable.

Problem 1

Formulate the above problems as languages, and prove that all three of them are in NP.

Problem 2 & 3

Two of the above three problems are NP-complete. Determine which problems are NP-complete, and prove your answer. (Since you already proved that all three problems are in NP, here you only need to show that the problems are NP-hard. Also, for the remaining problem, you do not need to prove anything.)