This assignment is **due on Apr 14**. You are allowed (even encouraged) to discuss these problems with your fellow classmates. All submitted work, must be *written individually* without consulting someone else's solutions.

Problem 1: The maximum submodular coverage (MSC) problem is to find a set S such that $|S| \leq k$ maximizing $f(S)$, where f is a monotone submodular function. Show that GREEDY is a 2-approximation for MSC.

Problem 2: The partial minimum weight set cover (PMWSC) problem is a generalization of minimum subset cover where the objective is to find a minimum weight collection of sets that covers at least an α fraction of the elements, for some given $\alpha \in (0, 1)$.

  i) Model PMWSC as a submodular set cover (SSC) problem: define V, f, and Δ.

 ii) Re-state the greedy algorithm for SSC in terms of PMWSC.

iii) Show that the following "more natural" greedy algorithm for PMWSC has an arbitrarily large approximation ratio.

Algorithm 1 GREEDY-ALT
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1. $\mathcal{C} \leftarrow \emptyset$
2. **while** $| \cup_{T \in \mathcal{C}} T| < \alpha |\mathcal{U}|$ **do**
3.   let S be the set maximizing $\frac{|S \setminus \cup_{T \in \mathcal{C}} T|}{w(S)}$.
4.   add S to $\mathcal{C}$
5. **return** $\mathcal{C}$