Homework guidelines: You may work with other students, as long as (1) they have not yet solved the problem, (2) you write down the names of all other students with which you discussed the problem, and (3) you write up the solution on your own. No points will be deducted, no matter how many people you talk to, as long as you are honest. It's ok to look up famous sums and inequalities that help you to solve the problem, but don't look up an entire solution.

1. Given a function $f : [n] \to \{0, 1\}$. Given $0 < \epsilon < 1$, show an algorithm that runs in $O(1/\text{poly}(\epsilon))$ queries to f, with the following behavior:

   - If f is monotone, then the algorithm always outputs "pass".

   - If f is ϵ-far from monotone, then the algorithm outputs "fail" with probability at least $3/4$.

2. How much can adaptivity help?

   - Assume that your computational model is such that a query returns a single bit. In such a model, show that any algorithm making q queries can be made into a *nonadaptive* (i.e., where the queries do not depend on the results of any previous queries) tester that uses only 2^q queries.

   - (Canonical forms for graph property testers for the adjacency matrix model). Define a graph property to be a property that is preserved under graph isomorphism – i.e., if G has the property and G' is isomorphic to G, then G' must also have the property. Show that any adaptive algorithm for property testing which makes q queries, can be made nonadaptive algorithm using only $O(q^2)$ queries.