1. (10) Jeremy has taken 8 quizzes in this course and has recorded for each quiz his grade $g_i$ and also $h_i$, the number of hours that he studied. He has never gotten a perfect score. How can he estimate how many hours he needs to study for quiz 9 in order to get a perfect score (20 points)?

(10 points for a correct answer involving inverse interpolation; max of 8 points for other reasonable answers.)
2. (10) An auto engineer wants to design a car bumper to withstand a 2 mph impact without damage.

- There are 10 design parameters $x_i, i = 1, \ldots, 10$ that she can vary to change the shape of the bumper and its material composition.
- She has 10 crash situations, corresponding to impact at different positions on the bumper.
- If the bumper is displaced by less than $\epsilon = .01$ inch, then there is “no damage”.
- To see what happens in crash situation $j$ ($j = 1, \ldots, 10$), she solves a partial differential equation, discretized to a system of 1,000,000 equations in 1,000,000 unknowns, and computes $d_j(x) = \text{the maximum displacement of any part of the bumper by the crash}$.
- No other information, such as derivative values, are returned by the software that produces the value $d_j(x)$.
- The engineer wants to determine good design parameters $x$ by solving the nonlinear system of equations
  \[ F_j(x) = \max(d_j(x) - \epsilon, 0), \quad j = 1, \ldots, 10. \]

Advise the engineer on what algorithm should be used to solve $F(x) = 0$ and what difficulties might be encountered.