Due: Wednesday, November 26, 3PM EST

The assignment is worth 15% of the final grade. If you have no idea how to answer a question, you will receive 20% of the credit for that question by leaving the question blank. If your answer makes no sense, you will not receive any credit. Any answer that shows some understanding of the question will receive some credit.

1. Suppose $P = NP$. Consider the weighted independent set optimization problem.

   The input is an encoding of a vertex weighted graph $G = (V, E, w)$ where $w(v) \in \mathbf{N}$. $\mathbf{N} = \{0, 1, 2, \ldots\}$. Let $n = |V|$ and assume $w(v) \leq 2^n$ for all $v \in V$.

   The objective is to compute an independent set $V' \subseteq V$ so as to maximize the value $\sum_{v \in V'} w(v)$. Explain your answers to the following questions.

   - (10 points)
     How would you compute the maximum value of an independent set in G in polynomial time? That is, we can encode the graph $G = (V, E, w)$ with $O(n^2 \log n)$ and we want the time for computing a maximum value independent set to take time $T(n)$ for some polynomial T.
   - (10 points)
     Given the maximum value of an independent set in G, how would you compute such a maximum value independent set in polynomial time.

2. Suppose $P = NP$

   - (5 points) Explain why it might not be possible to do public key encryption.
   - (5 points)
     Explain why it might still be possible to do public key encryption.

3. (10 points)

   In the Backstrom and Kleinberg paper, they report on a number of obervations from their experiments. See table on slide 15. For you personally, which is the most interesting or surprising observation?
   Explain why you find this to be the most interesting or surprising observation and how would you explain this observation?