CS221 HW1

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1. Optimization and probability

   (a) a

   (b) $f(x)$ is equal to the greater of the sum of all the numbers or the sum of the negative of all the numbers. On the other hand, $g(x)$ takes $max(x_j, -x_j)$, otherwise known as the absolute value. The only situation in which $f(x) = g(x)$ is if all of the terms are positive numbers or all the terms are negative numbers. Therefore, $\boxed{g(x) \geq f(x)}$

   (c) $E(x) = \frac{4+5+6}{6} = 2.5$, so the expected value of the final counter is $\boxed{2.5n}$

   (d) First take the log of $p^3(1-p)^2$, which results in $3\log p + 2\log(1-p)$. Then derive $\log L(p)$ which results in $\frac{3}{p} + \frac{2}{p-1} = \frac{5p-3}{p(p-1}$. Set it to zero, and we find that the value of p that maximizes $L(p)$ is $\boxed{\frac{3}{5}}$

   (e) TBD

2. Complexity

   (a) There are four possible tags and n words; therefore, there are $\boxed{4^n}$ possible tag sequences available.

   (b) There are $\sum_{x=1}^{n}(n+1-x)\sum_{y=1}^{n}(n+1-y)$ possible rectangles that can be formed, which comes out to $\frac{1}{4}n^2(n+1)^2$ which is essentially $O(n^4)$. Because we want to form three rectangles, we end up with an overall runtime of $\boxed{O(n^{12})}$