1. Is eBay's bidding mechanism closer to a second price auction or a first price auction? Explain very briefly.

   It is closer to a second price auction.

2. Suppose there are m web pages of type 1 and n web pages of type 2. Let the type 1 web pages be $A_1, A_2, ..., A_m$ and let the type 2 web pages be $B_1, B_2, ..., B_n$. Each web page of type 1 has a link to a web page of type 2. Also, each web page of type 2 has a link to a web page of type 1. What is the naive PageRank of each page in terms of m and n?

   By symmetry, all type 1 pages will have the same PageRank, say $\pi(A)$, and all type 2 page will have the same PageRank, say $\pi(B)$.

   $$\pi(A) = \frac{n}{m}\pi(B)$$
   $$m\pi(A) + n\pi(B) = 1$$

   Thus, $\pi(A) = 1/(2m)$ and $\pi(B) = 1/(2n)$.

3. Which of the following Bernoulli random networks are connected with high probability as N goes to infinity?

   (a) The probability p is 0.1
   (b) The average degree is 10
   (c) The average degree varies as $\sqrt{N}$.

   We use the fact that the graph is connected with high probability if $p > \log N/N$ or equivalently $p \cdot N > \log N$, where $p \cdot N$ is the average degree. Thus, (a) and (c) will be connected with high probability, while (b) will not.

4. Consider a line network with N nodes in which each node knows its two neighbors. Further, there is an edge between the i-th and j-th nodes with probability $1/|j - i|$. Describe a simple message forwarding protocol on this network such that the expected time for a message to get delivered from node a to node b is proportional to $\log N$ (again, rough order of growth is all that is required). Explain your reasoning.

   Each node k that gets the message forwards it to closest node on the left of b that k is directly connected to. It was shown in class that the average path length is $\log N$.

5. Which of the following are likely to benefit from network neutrality? Which are not? Explain very briefly.

   (a) AT&T
   (b) Comcast
   (c) Amazon
   (d) Netflix
   (e) Skype
   (f) BitTorrent

   AT&T and Comcast would not benefit (as Internet Service Providers). Amazon, Netflix, Skype, and BitTorrent would benefit.