CALIFORNIA INSTITUTE OF TECHNOLOGY
Selected Topics in Computer Science and Economics

CS/EC/101b

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All students should complete the following problems:

1. You are managing a start–up company and have an important decision to make. And once you make the decision you cannot reverse it. You need to choose one of two software designs, A or M. The world only wants one of these but it is not obvious which. When you start the analysis you can only assume that $P(A) = P(B) = .5$. That is, there is an equal probability of A or B. If you guess right, you will make a lot of money, \$5,000,000. If you guess wrong, you will only make \$500,000. But you can collect some data before you have to choose. Each piece of data costs \$10,000. Each piece of data is a signal, a or b. The conditional probabability that a occurs given A is 0.6, that is, $P(a|A) = .6$. Also, $P(a|B) = .4$.

   (a) If you have to decide to get your data in one bunch (think batch process), how many pieces of data should you ask for? What is your decision rule for choosing A or B? [The latter question is asking what you will do if you see k a and l b in the data.] (25 pts)

   (b) Now suppose you can collect the data one piece at a time. Will you pay for the first piece? Why? Under what conditions would you stop after the first piece and choose A or M? Under what conditions would you stop after two pieces? (25 pts)

   [Extra credit: Can you figure out a general decision rule for this problem? That is can you solve for a function $d(k, t-k)$ where t is the number of data pieces you have bought (paying \$10,000 for each), k is the number of a's you have seen, and $d(k, t-k) = 0$ if you will buy another data piece, $d(k, t-k) = A$ if you choose A at this point, and $d(k, t-k) = B$ if you choose B at this point]

2. A seller has an object she wants to sell with an auction. She is trying to decide whether to use a first price sealed bid auction or a second price sealed bid auction. She knows the following facts as do the bidders. There will be two bidders, $i = 1, 2$. Each bidder i has a utility function of $v^i - p$ if they win, and have to pay p, and 0 if they don't win. Each v^i is uniformly distributed on the interval $[0, 100]$.

   (a) Which auction, first price or second price, will yield more expected revenue? Why? (25 pts)

   (b) Show that if she were to run a second price auction with an appropriate reserve price then she can increase her expected revenue. (25 pts)

Please, turn in the homework in the box outside Jorgensen Lab, 62.