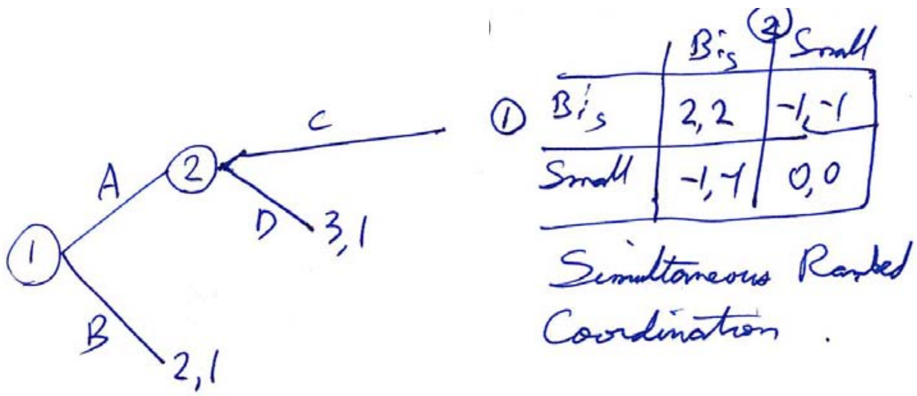
February 27, 2014

**G751, Spring 2014: Test 1**

There are 100 points in total. Please start each of the 3 questions on a new sheet of paper. This is a closed-book exam. Question 2d is by far the hardest, and I wouldn't be surprised if most of you don't finish it, so don't be too upset if you don't. Eugene, please collect the tests at 6pm and give them to Mary Jones the next day to give to me.

*Two of the scores were less than 20. The highest was 76.*




Question 1 (40 points).

(a) Fully specify the subgame perfect equilibrium of the game below in which Player 1's payoff is highest, including a complete strategy for each player.

*Player 1: A, Small.*
*Player 2: D, Small.*

*Method: First, note that the payoff of 3 is attractive. Is there an equilibrium that could support that outcome? It would have to have Player 2 choosing D instead of C. Why would Player 2 choose D, with its payoff of 1? Only if choosing C would lead to a lower payoff. Can that happen? Yes, if Player 1 plays Small in the 2x2 subgame.*

*Strategies such as A, Large|Large, Small|Small are not possible, since player 1 does not know whether player has picked Small or Large and so cannot condition his strategy on that. If the game reaches the coordination game, he has to pick either Small or Large.*

*Ranked Coordination has two pure-strategy Nash equilibria. It also has a mixed-strategy equilibrium, and that is part of another equilibrium that is just as good for*
*Player 1: A, Small with probability 3/4*
*Player 2: D, Small with probability ¾*
*The mixing probabilities are found by equating the pure-strategy payoffs. Let X be the probability of Small.*
*Payoff(small) = X(0) + (1-X) (-1) = payoff (Big) = X(-1) + (1-X)(2)*
$-1 + X = -X + 2 - 2X,$
$4X = 3$
$X = 3/4.$
*Notice that in equilibrium,*
*Payoff(small) = X(0) + (1-X) (-1) = 0 + 1-3/4)(-1) = - ¼.*

(b) Fully specify a pure-strategy Nash equilibrium which is NOT perfect, including a complete strategy for each player.

*Player 1: B, Small*
*Player 2: C, Big*
*Given that the coordination game is never reached, the players are indifferent about what action they take there. In fact, Player 2 doesn't care about ANY of his strategy, because none of it matters in equilibrium--- Player 1 will pick B and the game will end. It's only in subgames off the equilibrium path that Player 2's strategy matters.*

Question 2 (60 points).

Charles Munger Senior seems to be good at picking stocks, contrary to efficient markets theory, though since he made most of his money with only 10 stock picks, he likely has achieved statistical significance without upsetting efficient markets theory unduly. Sample selection bias is another problem; how many would-be Mungers out there have lost all their money instead?

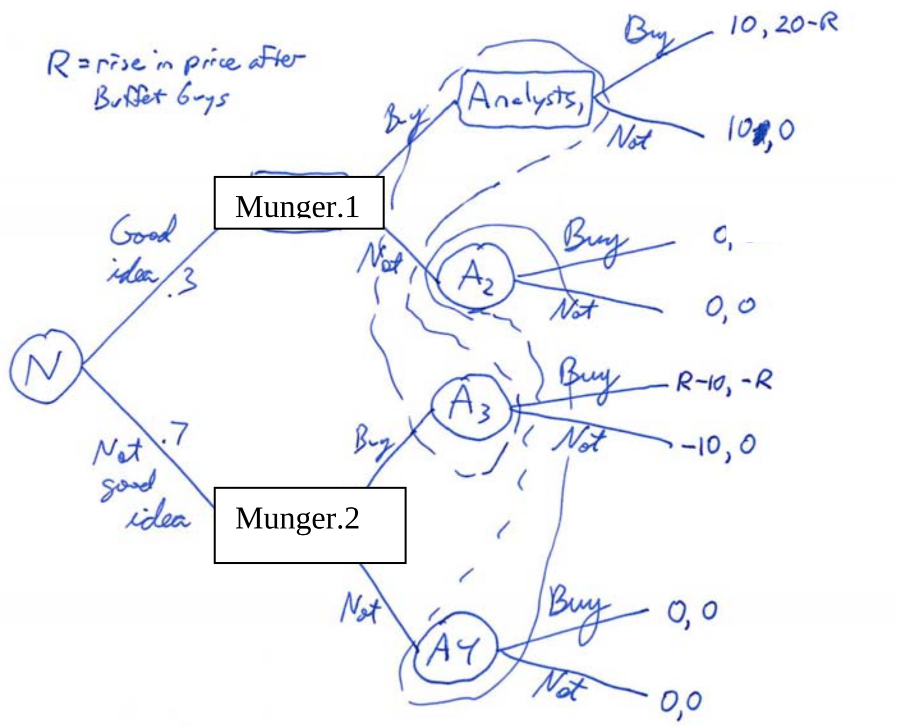
But this will be a game theory question, not an econometrics question. Suppose Munger doesn't have a good idea every single year; in fact, his only good stock-picking day is Valentine's Day, and then in only 30% of years, but if he has a good Valentine's Day he finds a stock worth 20% more than its market price.

Because he buys so much of a company when he buys, he incurs a 10% transactions cost. This 10% cost is not due to the price rising as he buys, but to the resources spent talking with the company, keeping it secret that he's buying, buying without moving the market, and so forth. He can keep it secret which company he is buying until the next day. All companies are the same size, and if he does have a good Valentine's Day, everyone learns that some months later on December 1. Munger can also sell secretly, with zero transactions cost.

All of this is common knowledge, except for whether in a given year he has a good idea, which only he knows. Analysts all over the world look on eagerly.

(a) Draw an extensive form for this game suitable for analyzing the question of how much the market will rise the day after Valentine's Day.

*The analysts do not have full information, so their information sets are not singletons.*
*The probabilities for Nature's moves need to be specified.*
*Specify the payoffs for all end nodes, including if Munger decides not to buy.*
*I didn't take off for having the wrong payoffs, for this question.*



(b) Suppose first that the analysts are morons and do not look forward at all. What will happen to stock prices over the course of the year?

*Prices do not change when Munger buys, which he will do the 30% of the time that he has a good idea. They will rise 20% in December if he did buy, once his information becomes public information.*

*Note that in this case "price pressure" will not exist, and the stock price will not rise just because Munger buys a lot of it.*

(c) Suppose next that the analysts do realize that Munger's action tells them something about the value of the company, but aren't smart enough to realize that he can take advantage of their knowledge of his talent.

*Munger will always buy, and the price will always rise 20% the day after Valentine's Day. He will then quietly sell, at least if he didn't have a good idea. Then, on December 1, the price will fall 20% if it turns out he didn't have a good idea and was just guessing.*

(d) Finally, suppose everyone is fully rational. What will happen to stock prices over the course of the year? Note that the equilibrium will be in mixed strategies.

*The price will rise by some amount R the day after Valentine's Day. Then on December 1 it will rise by 20-R or fall by R, depending on whether Munger had a good idea or not.*

*Munger will always buy when he has a good idea. If the price rises by more than .10 he would always buy with a bad idea too. If the price rises by less than .10 he would never buy with a bad idea. Thus, it must be that **R=.1,** so he is willing to mix.*

*Let x be the probability with which Munger buys when he doesn't have a good idea. The value of x must be exactly so that the analysts are indifferent between buying and not buying.*

*Analyst Payoff (buy) = $[.3/(.3+.7x)](.2-R) + [.7x/(.3+.7x)](-R)$ = Analyst Payoff (don't buy) =0.*

*Thus, $.3(.2-R) - .7x(R) = 0$ and $.3(.1) - .7x(.1) = 0$ and $.3 = .7x$, so **x= 3/7.***

*Note that **Prob(Munger buys) =** $.3 + .7x = .3 + .7(3/7) = .3 + .3 =$ **.6.***
*Also, **Prob(Munger had a good idea |Munger buys)** $= .3/.6 =$ **.50.***
*The analysts know that half the time Munger buys, he does have a good idea, and half the time he's bluffing.*

*If Munger could and did commit to only buying in years when he has a good idea, then the market would rise 20% whenever he buys. His average yearly gain, not substracting transaction cost, would be $.3(.20) = .06$. Subtracting transaction cost, it would be $.3(.20-.10) = .03$.*

*If Munger cannot commit, then his yearly gain is either .10 or .20, not subtracting transaction cost, which comes to an average of $.3(.20) + .7(3/7).10 = .06 + .03 = .09$. Subtracting transaction cost, it would be $.3(.20-.10) + .7(3/7)(.10-.10) = .03$.*

*Thus, Munger's ability to use a mixed strategy neither helps him nor hurts him.*