Answers to
Quiz 2    PS 172    March 2012

Name:

This is a closed book exam. The only thing you can take into this exam is yourself and writing instruments. No calculators, computers, cell phones, etc. are allowed. Everything you write should be your own work. Cases of academic dishonesty will be referred to the Dean of Students office, which has the power to suspend and expel students. Partial credit will be given: math mistakes will not jeopardize your grade. This exam has four parts. Each part is weighted equally (12 points each). Please show all steps of your work and explain what you are doing at each step. Correct answers alone are worth nothing without a clear and correct explanation of where the answers come from. Clarity and legibility are factors in the grade.

If you need to leave the room during the exam (to use the restroom for example), you need to sign your name on the restroom log before leaving. You can only leave the room once.

When the end of the exam is announced, please stop working immediately. The exams of people who continue working after the end of the exam is announced will have their scores penalized by 30 percent. When you hand in your exam, please write your name down on the log. Please write all answers on this exam—if you write on the reverse side of pages, please indicate this clearly. Good luck!
1. Consider the three-person game below.

![Game Diagram]

a. I have written in some strategies and beliefs in by hand below. Is this a Perfect Bayesian Nash equilibrium? Please explain your work. (3 points)

![Game Diagram with Beliefs and Strategies]

Belief Consistency OK
(3's beliefs can be anything)

Sequential rationality
OK for 3 \((2 > 0)\)
OK for 2 \((5 > 5)\)
OK for 1 \((4 > 2, 4 > 1)\)

Yes, it is a PBNE.

b. Can you argue that person 3's beliefs here make sense? If so, why? If not, why not?

One can argue that 3's beliefs don't make sense
because if 3 gets to move, she knows that
either 1 played a or 2 played e. In the beliefs above,
3 believes that 2 played e. But 2 would never
play e since playing d always gives a higher payoff
\((6 > 5 \text{ and } 6 > 4)\).
c. Find all Nash equilibria and all Perfect Bayesian Nash equilibria of this game. I write it down several times so you don’t have to spend time writing the trees over and over again. (6 points)

NE: (b, d, g), (b, e, g), (c, d, f)

Belief consistency OK
Seq rationality OK
PBNE

Not seq rational here

Belief consistency OK
Seq rationality × 2 would rather play d than e
Not PBNE

Belief consistency OK
Seq rationality OK
PBNE.
2. Consider the two-person game below.

![Game Diagram]

a. Find all Nash equilibria of this game. (6 points)

\[
\begin{array}{c|cc|cc|cc|cc|cc}
& e & f & g &\hline
\text{a} & 2,1 & 10,4 & 4,2 & 3,2 \\
\text{c} & 6,2 & 4,2 & 8,6 & 8,6 \\
\text{d} & 5,4 & 5,4 & 6,6 & 6,6 \\
\text{b} & 6,6 & 6,6 & 6,6 & 6,6 \\
\text{d} & 7,7 & 7,7 & 7,7 & 7,7 \\
\end{array}
\]

NE: \( (c,d,f) \) \\
\( (bc,e) \) \\
\( (bd,g) \)

b. Find all Perfect Bayesian Nash equilibria of this game. I write it down several times so you don’t have to spend time writing the trees over and over again. (6 points).

![Bayesian Game Diagram]

being consistent  OK
self rationality  OK
PBE
(b,c,e)

belief consistency OK
say rationality OK

(b,d,g)

belief consistency OK (any belief would be consistent with l's strategy)
say rationality OK

note that beliefs must be \([e]\)
\(\emptyset\)
\([\epsilon]\)
to make g say rational.