Exam Questions

(1) Conceptual/Short Answer: understanding what a Nash equilibrium is or a strategic game is, for example.

(2) Find a Nash equilibrium in a 2 player finite strategy game. May include mixed strategies.

(3) (!) Arguing for/against strategy profiles being pure strategy Nash equilibria. Examples may include

- Stag Hunt
- Bertrand Competition
- Voter Participation

These are usually the hardest problems. Remember that a pure strategy profile S is a Nash equilibrium if and only if

$$v_i(s_i, s_{-i}) \geq v_i(s_i', s_{-i})$$

(i) Find the payoff in Nash equilibrium.

(ii) Argue that any deviation on the part of any player does not improve one's payoff.

(iii) In order to show that a strategy profile *isn't* a Nash equilibrium, find a profitable deviation.

If a strategy is *dominated*, then there is a strategy profile of other strategies that has a payoff that is *strictly greater than* the given strategy.

(4) Find a pure strategy Nash equilibrium in a game with a continuous strategy space. (find the intersection of the best response functions).

- Cournot Competition
- Tragedy of the Commons

(5) Finding a mixed strategy Nash equilibrium in a game bigger than 2×2.

- Voter participation with unequal participants
- To Catch a Thief
- Public Good Games
- Rock, Paper, Scissors

To solve, find the answer to this question: How does every other participant have to mix in order to be indifferent between the two strategies?

n-Player Cournot with Quadratic Costs

$$v_i = q_i \left(20 - q_i - \sum q_{-i}\right) - q_i^2$$

Finding Best Response:

$$\begin{aligned}
v_i &= 20q_i - 2q_i^2 - q_i \sum q_{-i} \\
0 &= \frac{\partial v_i}{\partial q_i} \\
0 &= 20 - 4q_i - \sum q_{-i} \\
q_i &= \frac{20 - \sum q_{-i}}{4} \\
BR_i(q_{-i}) &= \frac{20 - \sum q_{-i}}{4}
\end{aligned}$$

Symmetric Shortcut:

$$\begin{aligned}
q_i^* &= \frac{20 - (n-1)q_i^*}{4} \\
4q_i^* &= 20 - (n-1)q_i^* \\
q_i^* &= \frac{20}{n+3}
\end{aligned}$$