**Multi Agent Systems Review**

1. Trigger strategies

**Trigger** strategies are composed of 2 components

1. Offer

2. Threat

An agent who plays a trigger strategy proposes an offer to opponent and keeps playing the offer action until the opponent deviates from it. Once, the opponent deviates from offer the agent plays the threat action.

**Win-Stay-Lose-Shift** is not a trigger strategy, because it hasn’t the threat component

1. The Folk Theorem

For an infinitely repeated game, any [Nash equilibrium](http://en.wikipedia.org/wiki/Nash_equilibrium) payoff must weakly dominate the minmax payoff profile of the constituent stage game. This is because a player achieving less than his minmax payoff always has incentive to deviate by simply playing his minmax strategy at every history.

The folk theorem is a partial converse of this: A payoff profile is said to be feasible if it lies in the [convex hull](http://en.wikipedia.org/wiki/Convex_hull) of the set of possible payoff profiles of the stage game. **The folk theorem** states that any feasible payoff profile that **strictly dominates** the minmax profile can be realized as a Nash equilibrium payoff profile, with sufficiently large discount factor.

For example, in the [Prisoner's Dilemma](http://en.wikipedia.org/wiki/Prisoner%27s_Dilemma), both players cooperating is not a Nash equilibrium. The only Nash equilibrium is given by both players defecting, which is also a mutual minmax profile. The folk theorem says that, in the infinitely repeated version of the game, provided players are sufficiently patient, there is a Nash equilibrium such that both players cooperate on the equilibrium path.

**NE of a one-shot game is not necessarily a NE in the infinitely repeated game, because in some one-shot games a NE could be also its minmax strategy.**

1. Collectively Stable, Invasion

An **evolutionarily stable strategy (ESS)** is a [strategy](http://en.wikipedia.org/wiki/Strategy_(game_theory)) which, if adopted by a [population](http://en.wikipedia.org/wiki/Population_genetics) in a given environment, cannot be invaded by any alternative strategy that is initially rare.

An ESS is a [refined](http://en.wikipedia.org/wiki/Solution_concept) or modified form of a [Nash equilibrium](http://en.wikipedia.org/wiki/Nash_equilibrium).

The strategy pair (S, S) is a Nash equilibrium in a two player game if and only if this is true for both players and for all T≠S:

E(S,S) ≥ E(T,S)

In this definition, strategy T can be a neutral alternative to S (scoring equally well, but not better). A Nash equilibrium is presumed to be stable even if T scores equally, on the assumption that there is no long-term incentive for players to adopt T instead of S. This fact represents the point of departure of the ESS.

[Maynard Smith](http://en.wikipedia.org/wiki/John_Maynard_Smith) and [Price](http://en.wikipedia.org/wiki/George_R._Price)[[2]](http://en.wikipedia.org/wiki/Evolutionarily_stable_strategy#cite_note-JMSandP73-2) specify two conditions for a strategy S to be an ESS. Either

1. E(S,S) > E(T,S), or
2. E(S,S) = E(T,S) and E(S,T) > E(T,T)

for all T≠S.

The first condition is sometimes called a strict Nash equilibrium. The second is sometimes called "Maynard Smith's second condition". The second condition means that although strategy T is neutral with respect to the payoff against strategy S, the population of players who continue to play strategy S has an advantage when playing against T.

There is also an alternative definition of ESS, which places a different emphasis on the role of the Nash equilibrium concept in the ESS concept. Following the terminology given in the first definition above, we have (adapted from Thomas, 1985):[[10]](http://en.wikipedia.org/wiki/Evolutionarily_stable_strategy#cite_note-Thomas85-10)

1. E(S,S) ≥ E(T,S), and
2. E(S,T) > E(T,T)

for all T≠S.

4.