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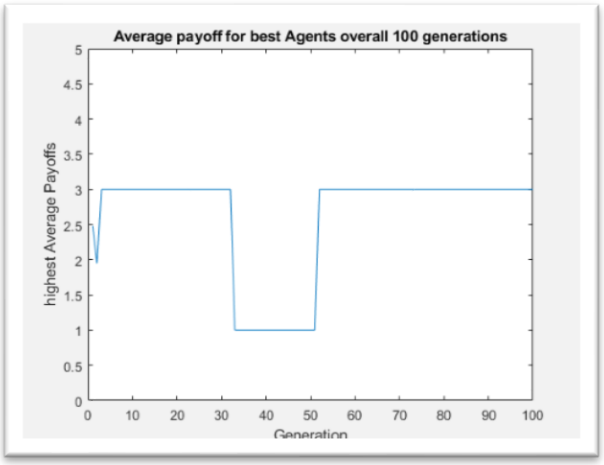
COURSEWORK 1

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

ANALYSIS OF GAME PLAY PROBLEMS

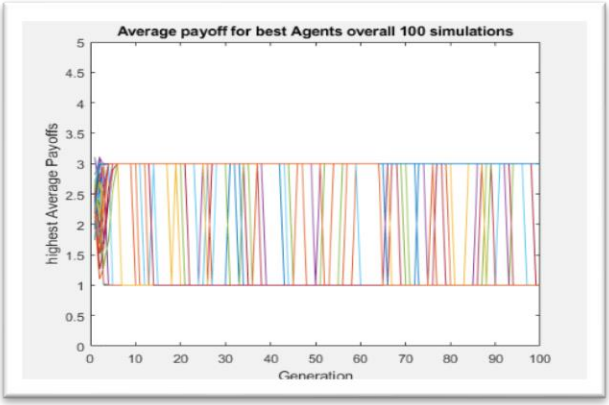
Que 1 (part 1)-average payoff for best players over 100 generations



The above graph shows the average payoff of the best agents in each generation for each of the two choices cooperate and Defect. I initialized my population for 20 agents with random strategy. Each player implementing a different strategy and playing with all the other 19 opponents. The setup of my game design you can see in MATLAB code files as I explained everything in the comment section. Also used mutation operator for 1% for each of the next 99 generations and 1st generation having no mutation as we have to find 10 best players from our first generation who are going to be parents for the next generation due to which I got the above result. From my observation of the above pattern it shows that at first the population was evolving for mutual cooperation and till 30 generations they played with mutual cooperation and then because of the mutation operator which I used in the game the population tend to fall and start playing mutual defection for about 20 generations and end up again playing mutual cooperation. I tried plotting my graph by changing the seed numbers and I analyzed different results showing up to mutual defection and then because of mutation trying to evolve to cooperate but end up to defecting.

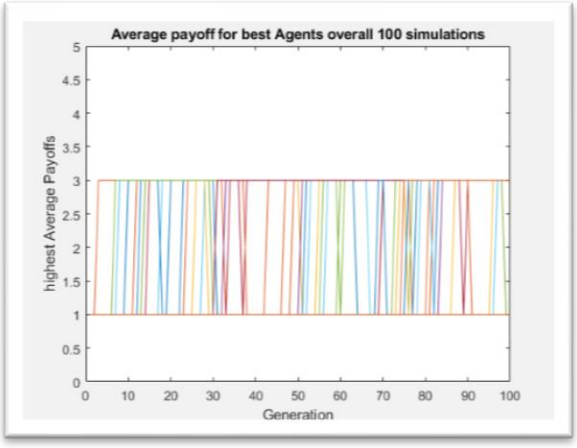
Que 1 (part 2)-average payoff for best players in 100 simulations

Below graph I got is by repeating my simulation for about 100 times that is plotting individual trial for about 10,000 generations with different seed numbers and what I observed is that not all trials had converged to fully cooperative strategies within 10,000 generations. Some cooperated while others converged to defection. I paused my simulation again and again after 2,3 10,50 generations and each time I observed different results showing up. According to my observation and how I introduced mutation in my simulation shows that some play mutual cooperation and at a certain level tries to defect and then again cooperate. And some starts and ends complete defection. Some starts and ends complete cooperation, and some plays mutual defection and at certain point evolves to cooperate and then ends up defection again.



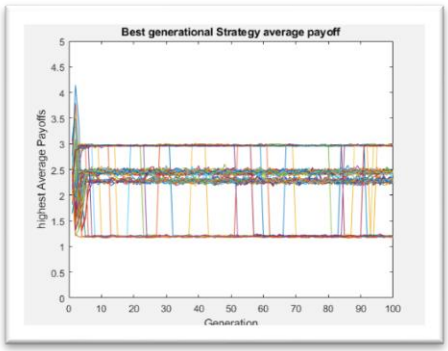
Que 1 (part 3)-All Defect

The below graph I got is by initializing my population to play all defect strategy. From the below result which I got is I observed that it is possible whereby the population evolves to cooperate. I observed if I don't use mutation at all the agents play mutual defection for all the 10,000 generations. As I used mutation at 1 percent for the offspring strategies to change their strategy I observed they start playing defection but at a certain point starts playing mutual cooperation. This evolution to cooperate can occur as there is one percent chance to change the strategy from all defect to all cooperate. Also, if both player and opponent defect they get payoff P=1 and if both end up mutual cooperation they get R=3 so better to cooperate then to defect. According to my result I see that all the players starts at defecting but then evolves to cooperate.

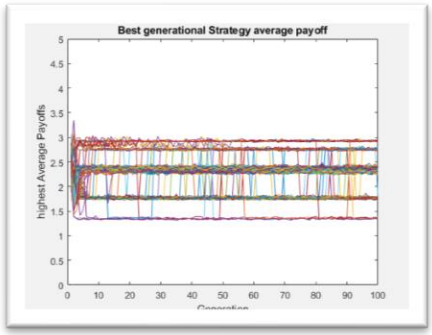


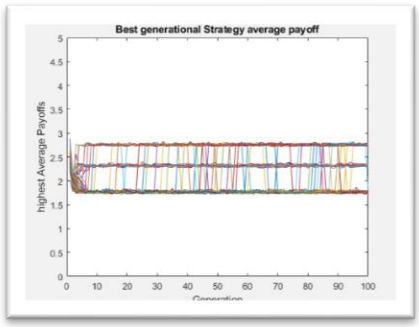
Que 2 (part 1)-Introducing noise

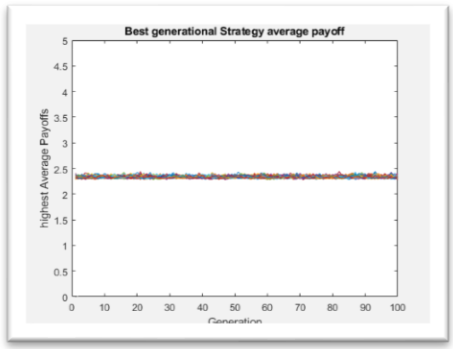
5%



10%

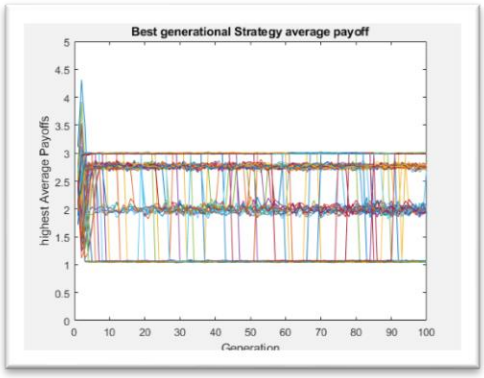






25%

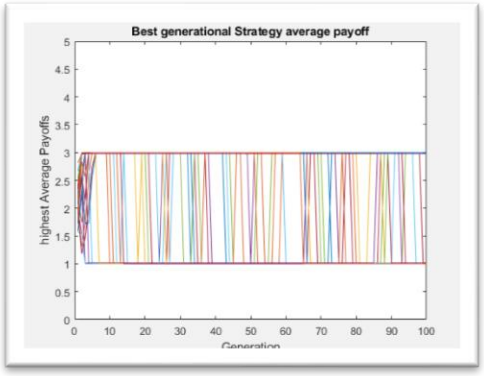
50%

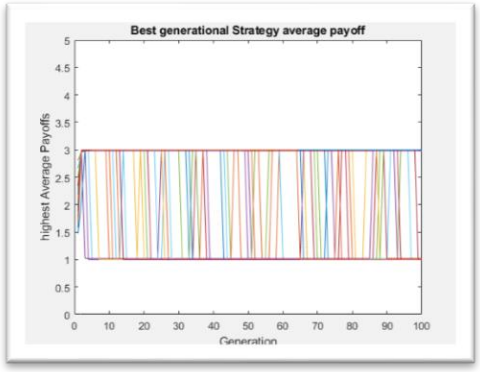


1%

If we introduce noise in our game. If the noise is just 1% I observed according to my above results the result is more unstable and as long as the probability of noise increases the results become less unstable.

Que 2(part 2)-Change payoff for T to +0.5, -0.5, +1, -1 of R



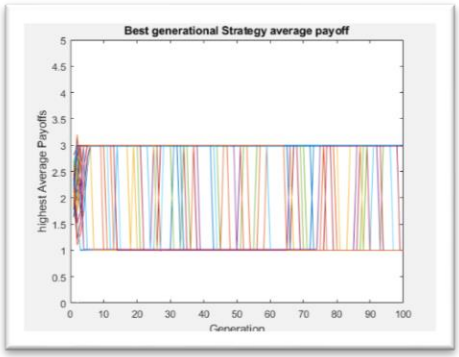


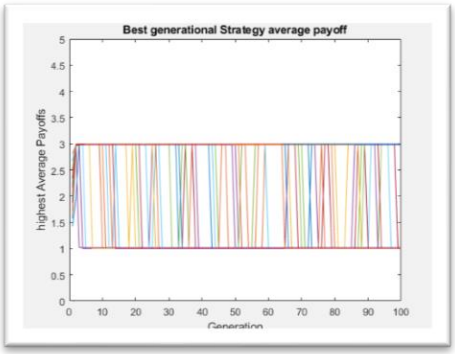
+0.5

If we use +0.5 to R to change our payoff for T Still it satisfies both conditions.

-0.5

If we use -0.5 to R to change the payoff for T one of the conditions Is no longer satisfied.





+1.0

If we use +1.0 to R to change our payoff for T Still it satisfies both conditions.

-1.0

If we use -1.0 to R to change the payoff for T one of the conditions Is no longer satisfied.

if we change the payoff for temptation where no longer one of the constraints for the IPD game is satisfied. I observed that if I pause my simulation and analyze the results some of the agents play cooperation and then starts defecting, some at a certain point evolves to cooperate. So after running 10,000 generations I obtained the above results not totally cooperating also not totally defecting.