**Introduction**

Mathematics is the language of the sciences. That is the one and the initial perspective that most have about mathematics. However, the Mathematics of Equity class drastically shifted this perception. It was easily the most necessary classes because it initiated an intellectual metamorphosis as it pertained to mathematical knowledge and broadened my scope on mathematics and social justice. I still remember an introductory lecture focused on the historical work of W.E.B Dubois as a statistician. Pie charts, bar graphs, and other modern statistical models were used by Dubois, in the early 20th century, to quantify the detrimental effects of systematic oppression and the state of race relations. In his famous work known as the Souls of Black Folk, he derives the labor efficiency of negroes from the severity of home and family conditions. He also utilizes economics to illustrate how the white land-owner, post-emancipation, would use positive and negative incentives to exploit the negro for labor while keeping their standard of living relatively low. I’ve always remained highly aware of the plight of Black Americans and I have also been highly interested in mathematics but I never thought that the two disciplines could intersect.

**Summary of Game Theory**

Game theory is the economical and mathematical study of strategic decision making, interactions, and agent behaviors in what is generally termed as a rational decision-making context. In game theory, as well as artificial intelligence studies and, more broadly, decision theory, rationality refers to an actor's preferences that will support an optimal outcome for this actor in the various scenarios, or contexts, that this actor may be required to make decisions or enact behaviors. Countless examples of these options have been modeled and examined using the Prisoner's Dilemma, a well-known game theory problem at the intersection of mathematics, economics and the decision sciences. At its core, the Prisoner's Dilemma is a question of individuality in the context of cooperation (to betray or not to betray). Many mathematicians and economists have discussed these themes as well as critiques of this model, however.

\***Summary of Prisoner's Dilemma**

The Prisoner's Dilemma was introduced by Merrill Flood and Melvin Dresher in 1950 while the two were at the RAND Corporation. RAND stands for ``research and development".

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**Rational Choice Theory**

Rationality has always been one of the more questionable aspects of game theory because the assumption that is made when two players are playing a game is that they are rational. A decision-maker is rational if he makes decisions consistently in pursuit of his own objectives (Myerson 2013). In other words, self-preservation is rational. This definition raises questions about rationality because outside of game theory, hedonism is seen as irrational. Specifically, the political philosopher Thomas Hobbes is the one who posited the idea that man is naturally irrational because man is hedonistic and will pursue his own objectives by any means necessary. Therefore, man needs a sovereign leader with absolute power to mitigate the state of nature. However, by contrasting both definitions of rationality and irrationality we still have the question of what is true rationality? Is it living for yourself or living for others?

**Critical Theory**

In order to broaden the scope of this question, we looked at Game Theory through the lens of a of Critical Theory. Critical Theory is a seminal framework and area of inquiry developed by many scholars of color. Critical Race Theory (CRT) evolved as a critique of critical legal studies (CLS), a movement focused on the various ways that laws are used to maintain the status quo through the extension of power structures and systemic inequities. CRT situates the role of race in the maintenance of these power structures and examine the legal contexts to which many of these powers are maintained. This line of thinking and practice has been an important component to advancing social and civil rights to historically marginalized communities, such as Indigenous communities and Native Americans, African Americans, and as well as Latina/o and south and southeast Asian communities. The common relation to these various groups contrasts with the development of a white racial group.

**Race**

When you hear someone say that ``Race is a social construct' with material influences and implications, thus it is real - what you are seeing is the intersection of and development around philosophy, sociology, and futurity. Specifically, race is a concept developed to forward various political motivations in the need to group populations. However, its impacts are felt in real and material ways by communities and individuals, each of vulnerably and historically marginalized groups, among others.

**Mathematical Application of Critical Race Theory**

Traponomics: A sub-field of microeconomics concerned with the production, distribution, and protection of an unofficial good or service.

An idea of “trappin” or “The Trap” was coined by early hip-hop artists like Outkast and T.I, but the term gained mainstream attention after it was introduced to the world by University of Chicago economist Steven Levitt in his book *Freakonomics.* Traponomics is commonly practiced among marginalized racial groups seeing as it is a direct product of the War on Drugs. The overcriminalization of formerly recreational drugs led to increased incarceration rates that disproportionately impacted black and latinx communities. Yet, due to the severe lack of employment that black and latinx people faced in corporate America they had to resort to selling drugs to feed their families and provide for themselves even with the looming risk of getting arrested. And similar to most major corporations in America the profitability of the business matters more than the employee, so once one gets caught in the trap the only way to out is to go to jail or die. The logic of traponomics to the Prisoner’s Dilemma in place of rational choice theory.

Let's assume that the two actors in the Prisoner’s Dilemma were suspects in a functioning drug cartel and they have put the two suspects in separate interrogation rooms to prevent them from communicating with one another. With that scenario established, one of the main philosophies that are instilled within employees of this business is to never cooperate with the police or snitch because the intelligence that the police obtain will allow them to destroy the business. In the Prisoner’s Dilemma, snitching is the equivalent of defection, therefore, cooperation would be staying silent or not complying with the police to prevent them from gaining substantial evidence to shut down the Trap. The payoffs, which are years in prison, are generated by the institution of the prison industrial complex. Fundamental laws of economics state that a plea deal or a positive incentive of doing less time in prison for a confession should incentivize the actors to betray one another. However, traponomics challenges this theory in economics because there is a negative incentive on defection, if they snitch and cause the Trap to be raided by the police then they will deal with a harsh punishment from non-convicted members, this punishment is often death. Therefore, amid that interrogation, the actors must weigh their options and determine the better opportunity cost a secured stream of revenue at the expense of more prison time for not complying (cooperating) or doing less time in prison at the expense of looking over your shoulder for the rest of your life for aiding the police in destroying a lives and livelihoods.

**Conclusion and Future Work**

Cooperation is a critical factor in our lives as it supports improving and advancing society through better and evolving sets of mutual agreements. However, cooperation is becoming less of a factor in discussions of equity and social justice due to long histories of injustice, especially in the United States. Across the world, mathematics is generally considered as a computational and investigative strategy that can be primarily used to advance abstract and applied or scientific advances in knowledge. However, mathematics has become an increasingly insightful tool when utilized in the social, cultural, and economic sciences. One standard and original example of this powerful connection in the economic sciences is known as the Prisoner’s Dilemma. This game sets a framework for questions about when it is worth trusting someone, where worth is generally measured in a series of ``payoffs" that creates an interesting quandary.

More generally, the Prisoner's Dilemma is a standard example of the type of game that would be analyzed in game theory. These games were initially situated around conceptions of how two {rational} individuals might behave if given the opportunity to cooperate with or betray a friend or acquaintance. Some have viewed this game as a potential measure of loyalty. Importantly, discussions of the original model are often situated around the issue of the two prisoners who, in their precarious position, must decide to betray or cooperate this other person. However, no information is provided about the prison and its role as an institution, or the reasoning behind the different payoffs, and the specific payoffs provided to the prisoners was not originally discussed.

In this article, we build on the work of critical economists and mathematicians to discuss our research at the intersection of game theory and critical theory. We explore how classic philosophical thought may have informed game theory, and the resulting questions around what it means to be rational and the idea of cooperation. To relate this work to our current moment, we the issue of race in the United States and beyond.