Summer of Code - Machine Learning with Economics

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1. Introduction to Logical Thinking and Simulations - The Evolution of Trust:
2. Auction Theory - Branch of economics
3. Probability Fundamentals - Seeing Theory

Probability is a branch of mathematics that deals with uncertainty and randomness. "Seeing Theory" is a visually appealing and interactive website that offers a great introduction to probability concepts. Through visual explanations and examples, you can grasp fundamental probability concepts like random variables, distributions, conditional probability, and more.

Probability Course - Pishro-Nik (Chapters 1 to 7)

The "Probability Course" by Pishro-Nik covers probability theory in-depth. By going through the first seven chapters, you will delve into probability distributions, expected values, variance, conditional probability, Bayes' theorem, and more advanced concepts.

6. Optional Resource - Can You Outsmart an Economist by Steven E Landsburg:
This optional resource presents various thought-provoking economic puzzles and how to approach them logically. It challenges you to think critically and apply economic principles to real-world scenarios.

7. Project Idea - OR-Gym and Reinforcement Learning:
OR-Gym is a reinforcement learning library designed for solving Operations Research (OR) problems. It provides a platform to apply reinforcement learning techniques to optimization problems and simulations in the OR domain. This project idea introduces the exciting intersection between OR and reinforcement learning.

8. Bandits Introduction - Multi-Armed Bandits
Multi-Armed Bandits (MAB) is a classic problem in sequential decision-making where agents need to select arms (actions) to maximize rewards over time. Sections 1, 5, 6, and 8 of the paper "Introduction to Multi-Armed Bandits" introduce various algorithms used in MAB problems, focusing on learning strategies without diving into regret analysis (the mathematical part).

9. Bandit Algorithms and Papers:
The Bandit Algorithms section introduces several bandit algorithms and their applications. Papers like "EXP3 - The Nonstochastic Multiarmed Bandit Problem" and "EXP3++ - One Practical Algorithm for Both Stochastic and Adversarial Bandits" cover important concepts and approaches in bandit problems. "LinUCB - A Contextual-Bandit Approach to Personalized News Article Recommendation" presents a contextual bandit algorithm applied to personalized recommendation systems.

10. Additional Resources:
This section includes links to additional resources, such as lectures, slides, and scribe notes from reputable institutions, providing supplementary material to enhance the understanding of bandit algorithms and their applications.

11. Assigned Tasks to Mentees - SoC EconML:
Mentees are given specific tasks related to the School of AI's "EconML" (Economic Machine Learning) project. This hands-on experience allows them to apply the concepts they've learned and contribute to real-world projects.

This comprehensive document introduces you to logical thinking, Python basics, probability theory, and bandit algorithms. These topics provide a strong foundation in mathematics, programming, and machine learning concepts, enabling you to explore various exciting domains and applications. Happy learning!

Double Auctions in Online Advertising: Determining the Price of Ad Impressions

Introduction:

Most internet companies that are free for their consumers make money on advertisements. This alone accounts for $700 B in total digital ad spend. It has become a vital component of the digital economy, revolutionizing the way businesses promote their products and services to a global audience.
As the online advertising ecosystem continues to evolve, the determination of ad prices has become a crucial aspect of this dynamic industry.
Double auctions, a market mechanism widely employed in online advertising, play a fundamental role in determining the price of ad impressions, ensuring fair competition, and optimizing resource allocation.

The objective of this project is to comprehensively explore the utilization of double auctions in the online advertising domain, focusing specifically on their application in determining the price of ad impressions.

By delving into the underlying mechanisms, investigating the factors influencing bidding behaviors, and analyzing the impact on market efficiency, this study aims to provide a deep understanding of how double auctions shape the pricing dynamics in online advertising.

Understanding the functioning of double auctions in the context of online advertising is of utmost importance, as it influences the revenue generation for publishers, the effectiveness of advertising campaigns for advertisers, and the overall sustainability of the digital advertising ecosystem.

Through a combination of theoretical analysis, empirical research, and case studies, this research aims to shed light on the intricacies of double auctions and their role in determining ad prices.

This thesis seeks to address several key research questions, including the following:

1. How do double auctions operate in the context of online advertising, considering the roles of advertisers, publishers, and ad exchanges?
2. What are the factors influencing bidding behaviors in double auctions for ad impressions?
3. How do the characteristics of the auction mechanism impact market efficiency and fairness in online advertising?
4. What are the implications of double auctions on the revenue generation for publishers and the effectiveness of advertising campaigns for advertisers?
5. How can the understanding of double auctions in online advertising inform the development of effective pricing strategies and optimization techniques?

By addressing these research questions, this study aims to contribute to the existing body of knowledge in the field of online advertising and auction theory. The findings of this research will provide valuable insights for industry practitioners, advertising platforms, and policymakers, assisting them in making informed decisions to enhance market efficiency, transparency, and sustainability in the online advertising ecosystem.

In conclusion, this thesis endeavors to provide a comprehensive analysis of the role of double auctions in determining the price of ad impressions in online advertising. By examining the mechanisms, factors, and implications associated with these auctions, this research aims to deepen our understanding of the pricing dynamics in the digital advertising industry and pave the way for more effective and efficient advertising practices.