

Preface

Auctions are popular trading mechanisms, where bidders (buyers) offer money for some product or service, usually referred to as a “lot”. After going through a process of taking bids from members of an audience, the auctioneer (facilitator) awards the “lot” to the highest bidder.

Auctions have a long history which goes back as far as 500 B.C. and were a daily part of the economic lives of the Babylonians and Ancient Romans. Over the centuries, auctions have become more and more mature and sophisticated. Generally, auctions are recognized as a fair and efficient means of trading which give equal opportunities to both buyer and seller. They are also economically viable as the lots are awarded to those who bid the highest, which means the winner values the contested lot over the other bidders. This in turn means higher revenue for the seller and auctioneer.

However, we do not aim to make a comprehensive survey of auction theory, as there are already plenty of books and papers on the subject. Rather our emphasis is the field where auctions and wireless networks intersect, therefore after we give a preliminary introduction to auction theory, we then turn to wireless networks. The purpose of Chap. 1 is to present the fundamental knowledge of our study. It is suggested for the readers, especially non-professionals, to study this chapter to gain some understanding. We hope readers catch the two main points when reading this book. First, what makes the auctions different in wireless networks and in general scenarios? Second, how are new auction mechanisms for wireless networks designed? Chapter 2 answers the first question, and Chaps. 3–5 present three examples to show how we design auctions for new wireless scenarios.

Spectrum auction is widely applied in spectrum redistributions, especially under the dynamic spectrum management context. Different from traditional auctions, spectrum auctions possess unique properties, such as interference relationship, reusability, divisibility, composite effect and marginal effect, which have not yet been well studied in previous works. Due to the newly developed properties, auction mechanism has to be tailored to wireless spectrum scenarios.

In this book, we first introduce the auction mechanisms for the wireless spectrum market. Chapter 1 is written to ensure even the non-professional readers understand

the basics of auction mechanism and wireless networks. Chapter 2 summarizes the current research process of spectrum auctions. We introduce many papers published in top conferences and journals from the year 2008 until 2013. We present their ideas, make comparisons and summarize their advantages and disadvantages. Indeed we can see the inherit relationships among these works. Then we discuss three special scenarios where we design new auction mechanisms. In Chap. 3, we design a new truthful double auction framework for spectrum trading considering both the heterogeneous propagation properties of spectrums of different frequencies and spatial reuse. In Chap. 4, we design a framework to enable spectrum group buying for secondary users with limited budgets. Our framework points out how to select the bidders inside a group, allocate channel capacity and charge them, and reasonably decide the group bid. In Chap. 5, we design a flexible auction mechanism for operators to purchase the right amounts of spectrum at the right price according to their dynamic demands. Flexauc can also be applied to cases where the marginal decreasing effect works for the bidder. By applying this, the auctioneer may be able to obtain the optimal allocation result before going through all the bids, which significantly reduces the computational overhead. Flexauc can even run in linear time.

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