Single-sided single-unit auctions

- A single-sided auction takes place between the auctioneer, acting for a single seller, and a collection of buyers known as the bidders.
- The goal of the auction is for the auctioneer to allocate a single unit of a good to one of the bidders.
- In most settings the auctioneer desires to maximise the price; bidders desire to minimise price.
  - English Auction
  - Dutch Auction
  - First-price sealed-bid (FPSB) auction
  - Second-price sealed-bid (SPSB), aka Vickrey auction

	First price	Second price
Open	Dutch	English
Closed	FPSB	SPSB

The English Auction

- Procedure: The auctioneer starts off by posting a reserve price. If no buyer bids the reserve price, then no deal is done; otherwise, bids are invited from the buyers, who must bid higher than the current highest bid. When no buyer is willing to raise the bid, the buyer who made the highest bid wins the object and pays the amount of his bid.
- Characteristics: open cry, ascending, price discovery
- Commonly used to sell: arts, antiques, properties, wine, ... Widely used in online markets.
- Susceptible to: winners curse and shills.

The Dutch Auction

- Procedure: The auctioneer starts out by asking for an artificially high price and continually lowers the asking price by a small value until some buyer makes a bid equal to the current asking price. The buyer who made the bid wins the object and pays the current price.
- Characteristics: open-cry, descending, fast.
- Typically used in: Dutch flower market, Ontario tobacco market, fish markets in Zamibia,
- Susceptible to: winners curse.

First-Price Sealed-Bid Auctions

- Procedure: Bidders submit bids to the auctioneer. In a buyer-bid auction, the highest bidder wins the auction and pays the amount of his bid. In a seller-bid auction, the lowest bidder sells the object and is paid the amount of her bid.
- Characteristics: first-price, sealed-bid.
- Commonly used for: invited tenders, construction contracting, military procurement and private-firm procurement, refinancing credit, London Gold Exchange, ...
- Susceptible to: winners curse.

Second-Price Sealed-Bid Auction (Vickrey Auction)

- Procedure: Bidders submit bids to the auctioneer. In a buyer-bid auction, the highest bidder wins the auction and pays the amount of the second highest bid. In a seller-bid auction, the lowest bidder sells the object and is paid the amount of the second lowest bid.
- Characteristics: second-price, sealed-bid, truth telling.
- Usage: not as common as other auctions but eBay's proxy bidding and Google's AD auction use similar idea.

William Vickrey, 1996 Nobel Economics Prize winner

The Revenue Equivalence Theorem

- As a seller, which type of auction mechanisms should you choose to gain the highest revenue?
- Independent private values(IPV) model:
  - Bidders: $N = \{1, 2, 3, \cdots, n\}$
  - Each bidder i values the object on sale at v_i, which is private information to her but it is common knowledge that each v_i is independently drawn from the same continuous distribution $F(v)$ on $[\underline{v}, \overline{v}]$ (so $F(\underline{v}) = 0$, $F(\overline{v}) = 1$) with density $f(v)$.
  - Each bidder is risk-neutral.

The Revenue Equivalence Theorem

- Revenue Equivalence Theorem: Any mechanism in IPV model yields the same expected revenue if
  - the object always goes to the bidder with highest value;
  - any bidder with lowest value expects zero utility
- The four standard auction mechanisms give the same expected revenue.

Revenue Equivalence Theorem was initially proposed by Vickrey (1962). Myerson (1981) extended it into more general setting, which formed the most fundamental result in mechanism design.