DS 574 Algorithmic Mechanism Design **Lecture #1 Worksheet**
Fall 2022 Prof. Kira Goldner

Mechanism Design Basics

Definition 1. Each bidder i has a private *valuation* v_i that is its maximum willingness-to-pay for the item being sold.

Our default assumption is that a bidder's utility is modeled by quasilinear utility.

Definition 2. For a deterministic mechanism with at most one winner, a bidder with *quasilinear utility* has utility

$$u_i(\cdot) = \begin{cases} v_i - p_i & \text{if } i \text{ wins and pays } p_i \\ 0 & \text{otherwise.} \end{cases}$$

Definition 3. A *dominant strategy* is a strategy (bid) that is guaranteed to maximize a bidder's utility *no matter what* the other bidders do.

Sealed-Bid Auctions:

(1) Each bidder i privately communicates a bid b_i to the auctioneer—in a sealed envelope, if you like.

(2) The auctioneer decides who gets the good (if anyone).

(3) The auctioneer decides on a selling price.

How should we do (2) and (3)?

What we'll do for (2):

What about (3)? Some potential auctions:

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How should we bid in these auctions?

Claim 1 (Dominant-Strategy Incentive Compatibility)**.** In a second-price auction, every bidder has a *dominant strategy*: set its bid b_i equal to its private valuation v_i. That is, this strategy maximizes the utility of bidder i, no matter what the other bidders do.