

Exercise 3.1: Approximation Ratio

Recall

- $n = 2$ buyers, values $U[0, 3]$, expected welfare of second price auction is 2 (Exercise 1.4)
- $n = 2$ buyers, values $U[0, 8]$, expected welfare of backwards induction is 5 (Exercise 1.5)

Exercise 3.1: Approximation Ratio

Setup:

- $n = 2$ buyers, values $U[0, 1]$
- **optimal offline**: give item to buyer with highest value.
- **online backwards induction**: give item to first buyer if first buyer's value is at least the expected value of second buyer, otherwise give item to second buyer.

Question: What is the ratio of the expected welfares of the **optimal offline** to the **online backwards induction**? (Answer on Canvas)

Lecture 3: Online Approximation

Last Time:

- second-price auction (cont.)
- online allocation: backwards induction
- online mechanisms: sequential pricing

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- second-price auction (cont.)
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Today:

- online allocation (cont.)
- approximation
- prophet inequality
- secretary problem

Exercise 3.2: Gambler's Threshold

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Setup:

- online gambler's problem
- two prizes, values $v_1, v_2 \sim U[0, 1]$

Question: What is the threshold $\hat{v}$ of the prophet inequality, i.e., with probability of no prize equal to $1/2$. (Answer on Canvas)