

1. (22 points) Of the following statements, identify all that hold about markets.
- A. Markets respect the autonomy of participants: they can bid as they please
 - B. Markets respect the heterogeneity of participants: details of their construction don't matter
 - C. Markets respect the dynamism of open environments: participants can change their bids arbitrarily
 - D. Market mechanisms guarantee that each participant gains value
 - E. Markets are a closed architecture, because they have well-defined components and interconnections
 - F. Markets are a centralized architecture because the essential functions are performed in the marketplace
 - G. Marketplaces such as eBay are endogenous because they require specifying ending times for all auctions, in contrast to stock markets which go on forever
 - H. Marketplaces such as eBay provide support for nonrepudiation
 - I. Given M sell and N buy bids, at the $(M-1)^{st}$ highest price, supply may exceed demand
 - J. Given M sell and N buy bids, at the $(M+2)^{nd}$ highest price, demand would necessarily exceed supply
 - K. When there is exactly one buy and one sell bid, auction theory proves that there is no way to make a trade in an individually rational, incentive compatible, and budget balanced way

Solution: A, B, F, H, I, K

C is false because in general bids cannot be changed arbitrarily

D is false because in general no participant may gain value by participating: a deal may not take place

J is false because the supply and demand be equal at the $(M+2)^{nd}$ highest price

2. (8 points) Of the following statements, identify all that hold about optimality. For each of these, assume that (1) certain goods and money are initially allocated among some participants; (2) all the numbers involved are finite; (3) each participant has enough money to buy all the above goods, if need be.
- A. Either the initial allocation is Pareto optimal or another Pareto optimal allocation exists
 - B. At most one Pareto optimal allocation exists
 - C. All Pareto optimal allocations yield the same total valuation (if summed over the participants)
 - D. If a Pareto optimal allocation exists, then a Pareto optimal allocation can be found by exchanging goods and money between pairs of participants, each at a price that is rational for both members of a pair

Solution: A, D

3. (12 points) Consider an auction in which prices are treated somewhat differently than traditionally. Assume $M \geq 1$ sell bids and $N \geq 1$ buy bids are placed. The $(M+1)^{st}$ price is received by each seller who bids below that price. The $(M+1)^{st}$ price is paid by each buyer who bids above that price. Matching sellers who bid the $(M+1)^{st}$ price are paid \$1 more than they bid. Matching buyers who bid the $(M+1)^{st}$ price pay \$1 less than they bid.
- A. At least one bid equals the $(M+1)^{st}$ price
 - B. This auction is individually rational for all participants
 - C. This auction is budget balanced when no seller bids the $(M+1)^{st}$ price
 - D. This auction always runs a budget deficit
 - E. This auction is incentive compatible either for the sellers or for the buyers
 - F. This auction is efficient

Solution: A, B, F

E is false because the payoff for anyone who bids the $(M+1)^{st}$ price depends on what they bid

C is false because it is possible to have a deficit even if no seller bids the $(M+1)^{st}$ price. For example, let the sell bids be 12, 11, and 8, and the buy bids are 9 and 9. The $(M+1)^{st}$ price is 9. The buyer who is matched pays 8, whereas the seller who bid 8 received 9. Hence a deficit.

D is false because it is possible to have an auction that is budget balanced. For example, let the sell bids be 10 and 8, and the buy bids are 12 and 9. The $(M+1)^{st}$ price is 9, which is paid by the buyer who bid 12 and received by the seller who bid 8. The buyer who bids 9 doesn't match any seller.