

3. BATCH MARKETS: PROBLEMS

1. Consider the set of orders submitted during an Exchange's pre-opening phase:

Buys:

Buyer	Price	Q
alan	\$50	3
beth	\$49	2
charlie	\$49	1
dana	\$46	1
ed	\$45	1
flo	\$44	1
george	\$42	1
hannah	\$41	1

Sells:

Seller	Price	Q
ira	\$40	2
janis	\$43	4
kerry	\$43	1
linda	\$44	1
mike	\$44	1
nora	\$45	1
oliver	\$49	1
pam	\$50	1

- Construct the supply and demand curves. Determine the market clearing price and volume under the assumption that the Exchange tries to maximize the volume of trade, and that for prices that give the same volume of trade, the price with the minimum net order imbalance is preferred. (Often if this does not determine a unique price, the Exchange will use the one closest to the previous day's close.)
- Determine who actually trades, and how much they actually buy and/or sell.
- Determine the buyer and seller surpluses.
- For the same set of orders, construct the outcome of a matching procedure in which the average of the buyer's and seller's price (rounded to the nearest whole number) is used as the matching price. Compute the buyers' and sellers' surpluses for the match.

Answer

(a) The supply and demand curves are:

Price	CumDemand	CumSupply	Volume	Imbalance	Clearing
\$40	11	2	2	9	
\$41	11	2	2	9	
\$42	10	2	2	8	
\$43	9	7	7	2	
\$44	9	9	9	0	*
\$45	8	10	8	2	
\$46	7	10	7	3	
\$49	6	11	6	5	
\$50	3	12	3	9	

(b) The buyers are:

Buyer	Price	Q	Q Bought	Buyer surplus
alan	\$50	3	3	\$18
beth	\$49	2	2	\$10
charlie	\$49	1	1	\$5
dana	\$46	1	1	\$2
ed	\$45	1	1	\$1
flo	\$44	1	1	\$0
george	\$42	1	0	\$0
hannah	\$41	1	0	\$0
				\$36

The sellers are:

Seller	Price	Q	Q Sold	Seller surplus
ira	\$40	2	2	\$8
janis	\$43	4	4	\$4
kerry	\$43	1	1	\$1
linda	\$44	1	1	\$0
mike	\$44	1	1	\$0
nora	\$45	1	0	\$0
oliver	\$49	1	0	\$0
pam	\$50	1	0	\$0
				\$13

(c) The surpluses are given in the tables above.

(d) The matching details are:

Buyer	Buyer's price	Seller	Seller's price	Match price	Buyer surplus	Seller surplus	Q Bought	Q Sold
alan	\$50	ira	\$40	\$45	\$5	\$5	1	1
alan	\$50	ira	\$40	\$45	\$5	\$5	1	1
alan	\$50	janis	\$43	\$47	\$3	\$4	1	1
beth	\$49	janis	\$43	\$46	\$3	\$3	1	1
beth	\$49	janis	\$43	\$46	\$3	\$3	1	1
charlie	\$49	janis	\$43	\$46	\$3	\$3	1	1
dana	\$46	kerry	\$43	\$45	\$1	\$2	1	1
ed	\$45	linda	\$44	\$45	\$0	\$1	1	1
flo	\$44	mike	\$44	\$44	\$0	\$0	1	1
george	\$42	nora	\$45					
hannah	\$41	oliver	\$49					
		pam	\$50					
					\$23	\$26		

4. PIT (FLOOR) MARKETS - PROBLEMS

1. The best bid in the pit is 42.00 for 3 contracts; 5 contracts offered at 42.05. Member Alice has just been flashed a customer market buy order for 2 contracts and a customer market sell order for 2 contracts (identical contracts, different customers). Can she match the customers at 42.00? Can she match the customers at 42.02?

Ans: To effect a match (at either price) Alice must first bid and offer (at the price of the intended match), and allow other members to take all or part of either side. If nobody does, she can match the customers “in the presence of, and with approval of, an Exchange official” (Rule 533).

2. Suppose the circumstances in the last problem are the same, except that Alice’s buy and sell orders are originating from the *same* customer. Can either match be effected?

Ans: Accepting such orders would be a violation. (Rule 534).

3. In the pit, Beth is bidding 42.02. Charlie bids 42.00 and Dana hits his bid, leading to a trade at 42.02. Which of the following are true?

- (a) Charlie’s bid is an infraction.
- (b) Given Charlie’s bid, the trade (through Beth’s bid) is not an infraction.
- (c) The trade is a price infraction. A possible remedy is for Charlie and Dana to reset the price of their trade to 42.02.
- (d) The trade is a price infraction. A possible remedy is for Charlie and Dana to cancel their trade.
- (e) The trade is a price infraction. A possible remedy is for Dana to sell to Beth at 42.00.
- (f) The trade is a price infraction. A possible remedy is for Dana to sell to Beth at 42.02.

Ans:

- (a) True (Rule 514)
- (b) False
- (c) True (Rule 528)
- (d) True (Rule 528)
- (e) False
- (f) False

5. DEALER MARKETS**6. ELECTRONIC LIMIT ORDER BOOKS****7. HYBRID MARKETS: EURONEXT - PROBLEMS**

1. Suppose that a Euronext market opened based on the orders described in problem 1 of section 3. What would be the bid and ask immediately after the open?

Ans: The most aggressive bid left unexecuted after the open is George's at 42. The most aggressive offer is Nora's at 45. So immediately after the open, the market is 42 bid; offered at 45.

2. The limit order book in XYZ looks like this:

Buy Amounts	Price	Sell Amounts
9,000	100.00	
10,000	100.02	
2,000	100.04	
1,000	100.06	
	100.08	1,500
	100.10	1,000
	100.12	2,000
	100.14	8,000
	100.16	10,000

- (a) What is the market bid and ask?
- (b) What would happen if a limit order to buy 4,000 shares at a limit price of 100.16 entered the market (on Island or the Paris Bourse)?
- (c) If this were the book on a Paris Bourse stock, how would a market-to-limit order to buy 2,000 shares be handled?
- (d) If this were the book on a Paris Bourse stock, what are the highest and lowest prices at which a block trade of 10,000 shares could be crossed?

Answers:

- (a) 100.06 bid for 1,000 shares; 1,500 shares offered at 100.08
- (b) In either market, the order would walk through the book: 1,500 trades at 100.08, 1,000 at 100.10, 1,500 at 100.12
- (c) 1,500 shares trades at 100.08; the remaining 500 shares is converted to a limit order at 100.08. The new bid is 100.08 for 500 shares.
- (d) The lowest price is $(1,000 \times 100.06 + 2,000 \times 100.04 + 7,000 \times 100.02)/10,000 = 100.028$; The highest is $(1,500 \times 100.08 + 1,000 \times 100.10 + 2,000 \times 100.12 + 5,500 \times 100.14)/10,000 = 100.123$

7. Hybrid markets: Euronext - Problems - 6 -

3. ABC is now trading at a price of 25. I enter a stop order to sell with a stop price of 20. Does this ensure that if the price drops, I'll receive at least 20 when I sell?

Answer: No; the order becomes a market order when the stock trades at 20. If the market is falling rapidly, this market order may not be executed at 20.

4. There top of the book is €50 bid for 200 shares; 500 shares offered at €50.10. The last sale was at €50 at 10:01am. At 10:02am a customer enters a stop-loss order, with a trigger price of €50. Is it immediately executed against the bid?

Answer: No. A trade at or below €50 has to occur for the order to be elected.

5. On a Euronext market, the best bid and offer are €150 bid for 3,000 shares; 4,000 shares offered at €152. A broker has both a buyer and seller for 3,000 shares.

- (a) Can she cross the trade at a price of €151?
(b) Can she cross the trade at a price of €150?

Answer:

- (a) yes;
(b) no. See rule 2.3.1

8. NYSE I: ORGANIZATION AND BASIC PROCEDURES - PROBLEMS

1. Can a floor broker give a specialist a limit order? E.g., “Buy 5,000 shares for my customer, limit \$40.”
Ans: Yes. The specialist (clerk) will enter the order in the book, just as if it came over SuperDot electronically.
2. Can a floor broker give a specialist an order where there’s some discretion? E.g., “Buy up to 5,000 shares for my customer. Don’t go over \$40 unless you have to. Use your judgment.”
Ans: The specialist cannot accept this sort of discretionary (“not held”) order.
3. Can a specialist sell short?
Ans: Yes; they often do.
4. The market is \$50 bid for 200 shares; 300 shares offered at \$50.10. The bid is the specialist’s; the offer represents the book. The last sales were \$50.10, followed by \$50.05.
 - (a) Can the specialist purchase 100 shares from the book at \$50.10?
 - (b) If a 100-share market sell order arrives, can the specialist buy at \$50.05?Ans:
 - (a) Generally no: a purchase on an uptick would constitute a destabilizing trade.
 - (b) Yes. The specialist is purchasing on a zero-downtick.
5. There is nothing on the book in ABC. The specialist is bidding \$50 for 500 shares and offering 300 shares at \$50.10. A customer limit order arrives to buy 300 shares limit \$50.
 - (a) Can the specialist change the bid to \$50 for 300 shares?
 - (b) Can the specialist change the bid to \$50.05 for 200 shares?Ans:
 - (a) No. The specialist should change the size of the bid to reflect the additional customer interest: \$50 bid for 800 shares.
 - (b) Yes. This is a more competitive bid, higher than the customer’s price.

9. NYSE II: SPECIAL TRADES AND PROCEDURES - PROBLEMS

1. At an NYSE post, the best bid in the limit order book is 99.70, which is also the NYSE bid. At this price there is one order that arrived at 10:01 another that arrived at 10:02, and another at 10:03. A floor broker arrives at 10:05, also bidding 99.70 on behalf of a customer. The last trade was at 99.80. A market order to sell arrives at 10:06
- (a) Describe a scenario that would violate strict time priority.
- (b) Describe a scenario that would result in “price improvement” for the market sell order.

Answer:

- (a) The market sell order will go to the first order in the book (the one that arrived at 10:01). Thereafter the floor broker and the book are on parity. If another market sell order arrives, it may be split between the floor broker and the 10:02 order. Thus, the 10:05 floor broker trades before the 10:03 limit order.
- (b) Price improvement can arise when the specialist (or a floor broker) takes the other side of the market sell order by buying at 99.75.
2. At 10:00 AM, the last trade was at 10.40 and the NYSE limit order book in a small stock looks like this:

Buy	Price	Sell
	10.40	1,000 shares
	10.30	2,000
1,000 shares	10.20	
2,000	10.10	
2,000	10.00	
1,000	9.90	
2,000	9.80	

The NYSE quotes are the book’s (10.20 bid, offered at 10.30. What will result from the following *sequence* of orders? (Give the sequence of quotes and any trades. Assume that the specialist and floor traders don’t participate in any of the trades.)

- (a) “Buy 500 shares at the market.”
- (b) “Sell short 1,000 shares at the market.”
- (c) “Sell 1,000 shares, stop 10.10”
- (d) “Sell 2,000 shares, stop 10.10, limit 9.90”
- (e) “Sell 2,000 shares at the market”

Ans:

Order (a) executes. 500 shares trades at 10.30; No change in the bid. New offer size is 1,500. Order (b) can’t be executed immediately; it is held pending. Orders (c) and (d) are pending, but not yet elected. Order (e) executes: 1,000 shares trades at 10.20; 1,000

shares trades at 10.10. The bid side of the market is now 10.10 for 1,000 shares. This last trade elects orders (c) and (d). Order (c) executes: 1,000 shares trades at 10.10. This leaves the best bid as 10.00 for 2,000 shares. Order (d) executes: 2,000 shares trades at 10.00. Order (b) is still unexecuted.

3. At 9:59, the Rule 80A collar is triggered by a rise in the Dow. At 10:00a, 200 shares of ABC trades at \$50. The next sale (at 10:01a) is at \$50.05. The market is \$50.05 bid for 400 shares; 200 offered at \$50.25. A market order arrives to buy 100 shares, designated “index arbitrage”. What happens?

Ans: A trade at the ask would violate the rule that index arbitrage purchases have to be made on a downtick or zero-downtick. The order will only be executed when this is possible.

10. NASDAQ - PROBLEMS

1. The bid side of the SuperMontage book consists of:

MPID	Price	Visible quantity	Reserve quantity	Time of entry
SYLH	50.10	300	2,000	10:01
ASXH	50.10	400	5,000	10:02
KLSM	50.05	700	1,000	9:59
DDLJ	50.05	800	200	10:00

Market participant JSHZ is an order-entry firm. What will happen in each of the following circumstances? These are mutually exclusive orders – not sequential.

- Order entry market participant JSHZ sends a non-directed order market sell order for 500 shares.
- JSHZ sends a 200 share market sell order preferenced to KLSM.
- JSHZ sends a 200 share market sell order directed to KLSM.
- JSHZ sends a 1,000 share non-directed market sell order.
- JSHZ sends a 1,000 share non-directed order to buy, limit 50.11.

Answers:

- 300 shares trades against SYLH; 200 shares trades against ASXH. (Visible quantities have priority over reserve quantities).
- KLSM is not at the inside; the order is returned unexecuted.
- KLSM has the options of selling at 50.10 or returning the order.
- 300 shares trades against SYLH; 400 shares trades against ASXH. 300 shares will trade against the reserve quantities. Who gets what depends on how SYLH and ASXH specified their replenishment algorithms. If both specified that their size was to be replenished, then SYLH will buy 300 more shares. If both specified that their size was to be replenished to 100 shares, then SYLH will buy 200 and ASXH will buy 100 more.
- If the offer is at 50.11, then the limit order is at least partially marketable (and will execute). But any unexecuted portion will be returned to JSHZ. Not being a market-maker, JSHZ can't post a limit order.

11. NASDAQ: THE TRANSITION TO THE PRESENT