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I pledge my honor that I've abided by the Stevens Honor System.

Homework #1 - Due 29 September 2023

FE-570

September 18, 2023

Problem 1.1
Assume that the limit order book is as shown in the table below.

1) What is the bid-ask spread in cents?

2) If you buy 100 shares with a market order, an immediately sell them also with a market order, what is your P&L (profit/loss)?

3) A limit order to buy 250 shares at $25.50 arrives in the market. What transactions occur, and what is the resulting bid-ask spread in cents?

4) A limit order buy order for 2000 shares at $25.54 arrives. List all transactions, and determine the bid-ask spread after the order is executed.

1) Bid-ask spread = highest bid - lowest offer = 25.51 - 25.48 = $0.03

2) Market order => buying @ lowest offer & selling @ lowest offer =

$-100(25.51) + 100(25.48) =$ **$-\$3$**

Orders	Shares	Price
offer	2000	25.56
offer	1500	25.55
offer	1200	25.53
offer	400	25.52
offer	200	25.51
bid	1000	25.48
bid	1100	25.47
bid	1400	25.45
bid	1500	25.44
bid	2200	25.42

3) No transactions will occur w/ new spread @ 25.51 - 25.50 = **$0.01**

4) Only 1000 transactions will occur: 200 @ $25.51, 400 @ $25.52, 1200 @ $25.53

new spread = 25.55 - 25.48 = **$0.07**

Problem 1.2

Assume that the buy and sell orders shown in the table below have been submitted prior to an auction.

A single-price auction is conducted at a price p_*, chosen such that the number of exchanged shares is maximal.

1) What is the auction price p_*, and how many shares exchange hands?

2) What is the resulting Limit Order Book after the auction?

Aggregate Demand	Buyers		Order Price	Sellers		Aggregate Supply
	Order	Size		Order	Size	
0			50.3	S1	500	1300
80	B1	80	50.2	S2	350	800
190	B2	110	50.1	S3	300	450
310	B3	120	50.0			
560	B4	250	49.9	S4	100	150
1060	B5	500	49.8	S5	50	50
1810	B6	750	49.7			

Figure 1: Orders submitted for an auction.

1) $AS = 500 + 350 + 300 + 100 + 50 = 1300$

$AD = \sum_{i=1}^{6} B_i = 1810$; $AS = \sum_{i=1}^{5} S_i = 1300$

$P_* = \boxed{50.1}$ since maximum of shares exchange hands @ 190 shares (190 buyers, 450 sellers)

w/ 450−190 = 260 shares remaining

2) Limit order book stops @ B_2 since B_3 order is not executed w/ 260 shares remaining to be filled.