Compute the implementation shortfall for the following algorithm executed trades:

Algorithm 1: Arrival Price.

Order given to purchase 6,000 shares a 9:00am. Transaction costs for the trade (e.g. trading fees) is $0.01

Time of Day	Total Volume Traded in the market	Traded Price at point in time	No. of shares Mr. A bought (& price)
9:00am	10,000	$4.50	3,000 (@ $4.50)
10:00am	10,000	$4.60	2,000 (@$4.60)
11:00am	10,000	$4.70	1,000 (@$4.70)
12:00pm	10,000	$4.00	

Algorithm 2: Closing Price.

Order given to purchase 9,000 shares using closing price algorithm on Monday. Order instructed to be executed over 3 days in equal volume.

Time of Day	Total Volume Traded in the market for the day	Closing Price for the day	No. of shares Mr. A bought (& price)
5:00pm (Monday)	1,000,000	$10.50	3,000 (@ $10.40)
5:00pm (Tuesday)	1,500,000	$10.60	3,000 (@$10.70)
5:00pm (Wednesday)	1,300,000	$10.60	2,000 (@$10.60)
5:00pm (Thursday)	1,300,000	$10.80	1,000 (@$10.80)

Algorithm 3: VWAP Order given at 9:00am to sell 4,500 shares using VWAP by 12:00pm

Time of Day	Total Volume Traded in the market	Avg. price for that hour	No. of shares Mr. A sold (& price)
9:00am	1,500,000	$3.00	1,300 (@ $3.00)
10:00am	1,000,000	$2.90	1,000 (@$2.90)
11:00am	1,000,000	$2.80	1,000 (@$2.80)
12:00pm	1,000,000	$2.70	1,200 (@$2.70)

Algorithm 4: TWAP Order given at 9:00am to sell 4,000 shares using TWAp by 12:00pm. The transaction cost is $0.01 per share.

Time of Day	Total Volume Traded in the market	Avg. price for that hour	No. of shares Mr. A sold (& price)
9:00am	1,500,000	$3.00	1000 (@$3.10)
10:00am	1,000,000	$2.90	1000 (@$2.90)
11:00am	1,000,000	$2.80	1000 (@$2.70)

12:00pm	1,000,000	$2.70	1000 (@$2.60)

Solutions

Question 1

Note inclusion of transaction costs

IS = Profit (or losses) from ideal – Profit (or losses from actual)

= 6000(x-4.5) – [3000*(x-4.51)+2000*(x-4.61)+1000*(x-4.7)]

= -(6000*4.5)-(3000*-4.51+2000*-4.61+1000*-4.71)

= 460 (shortfall)

Question 2

IS = Profit (or losses) from ideal – Profit (or losses from actual)

= [3000(x-10.50)+3000(x-10.60)+3000(x-10.60)] – [3000(x-10.4)+3000(x-10.7)+2000(x-10.6)+1000(x-10.8)]

=-(3000*10.5+3000*10.6+3000*10.6)+(3000*10.4+3000*10.7+2000*10.6+1000*10.8)

= 200 (shortfall)

Question 3

IS = Profit (or losses) from ideal – Profit (or losses from actual)

= [1500(3-x)+1000(2.9-x)+1000(2.8-x)+1000(2.7-x)]-[1,300(3-x)+1000(2.9-x)+1000(2.8-x)+1200(2.7-x)]

= (1500*3+1000*2.9+1000*2.8+1000*2.7)-(1300*3+1000*2.9+1000*2.8+1200*2.7)

= 60 (Shortfall)

Question 4

Note inclusion of transaction costs

IS = Profit (or losses) from ideal – Profit (or losses from actual)

= [1000(3-x)+1000(2.9-x)+1000(2.8-x)+1000(2.7-x)]-[1000(3.09-x)+1000(2.89-x)+1000(2.69-x)+1000(2.59-x)

= (1000*3+1000*2.9+1000*2.8+1000*2.7)-(1000*3.09+1000*2.89+1000*2.69+1000*2.59)

= 140 (shortfall)