COMPUTATIONAL FINANCE & RISK MANAGEMENT

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Introduction to Trading Systems

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Outline

Lecture references

Textbook references:

- Algorithmic Trading and DMA, Barry Johnson
  - chapter 4
- Trading & Exchanges, Larry Harris
  - chapter 4

Lecture references

Exchange references:

- Websites
  - NYSE Arca order types
    - `http://www.nyse.com/equities/nysearcaequities/1157018931913.html`
  - NASDAQ order types and routing
    - `http://www.nasdaqtrader.com/content/ProductsServices/Trading/Workstation/rash_strategy.pdf`
  - CME order types
    - `http://www.cmegroup.com/globex/files/GlobexRefGd.pdf`

Lecture references

Broker order management system references:

- Websites
  - Interactive Brokers
    - `http://www.interactivebrokers.com/en/index.php?f=4985`
  - TradeStation Securities
    - `http://help.tradestation.com/09_00/tradestationhelp/tradestationhelp.htm`

Outline

Market order

A Market order is an order to buy or sell at the market bid or offer price. A market order may increase the likelihood of a fill and the speed of execution, but unlike the Limit order a Market order provides no price protection and may fill at a price far lower/higher than the current displayed bid/ask.

Products		Availability		Routing		TWS	
Bonds	☑	US Products	☑	Smart	☑	Attribute	☐
CFDs	☑	Non-US Products	☑	Directed	☑	Order Type	☑
EFPs	☑					Time in Force	☐
Forex	☑						
Funds	☑						
Futures	☑						
FOPs	☑						
Options	☑						
Stocks	☑						
Warrants	☑						

Interactive Brokers

Market order example

- market order to buy 2000
  - bought 1000 at $101
  - bought 1000 at $102
  - average cost $101.5

- market orders with a quantity larger than the best price
  "walk the book"

Initial orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	1500
	101	1000
1000	100	
800	99	
1500	98	

Final orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	500
1000	100	
800	99	
1500	98	

Market order example

- market order to buy 5000
  - bought 1000 at $101
  - bought 1500 at $102
  - bought 2000 at $104
  - bought 500 at $106
  - average cost $103

Initial orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	1500
	101	1000
1000	100	
800	99	
1500	98	

Final orderbook:

BID SIZE	PRICE	ASK SIZE
	106	2500
1000	100	
800	99	
1500	98	

Market order example

- market order to buy 2000
- offer of 1500 @ $102 canceled just as our order is placed
  - bought 1000 at $101
  - bought 1000 at $104
  - average cost $102.5

Initial orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	1500
	101	1000
1000	100	
800	99	
1500	98	

Final orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	1000
1000	100	
800	99	
1500	98	

Limit order

A Limit order is an order to buy or sell at a specified price or better. The Limit order ensures that if the order fills, it will not fill at a price less favorable than your limit price, but it does not guarantee a fill.

Products		Availability		Routing		TWS	
Bonds	☑	US Products	☑	Smart	☑	Attribute	☐
CFDs	☑	Non-US Products	☑	Directed	☑	Order Type	☑
EFPs	☑					Time in Force	☐
Forex	☑						
Futures	☑						
FOPs	☑						
Options	☑						
Stocks	☑						
Warrants	☑						

Note that direct-routed, non-marketable limit orders may be rejected if the specified destination does not support them.

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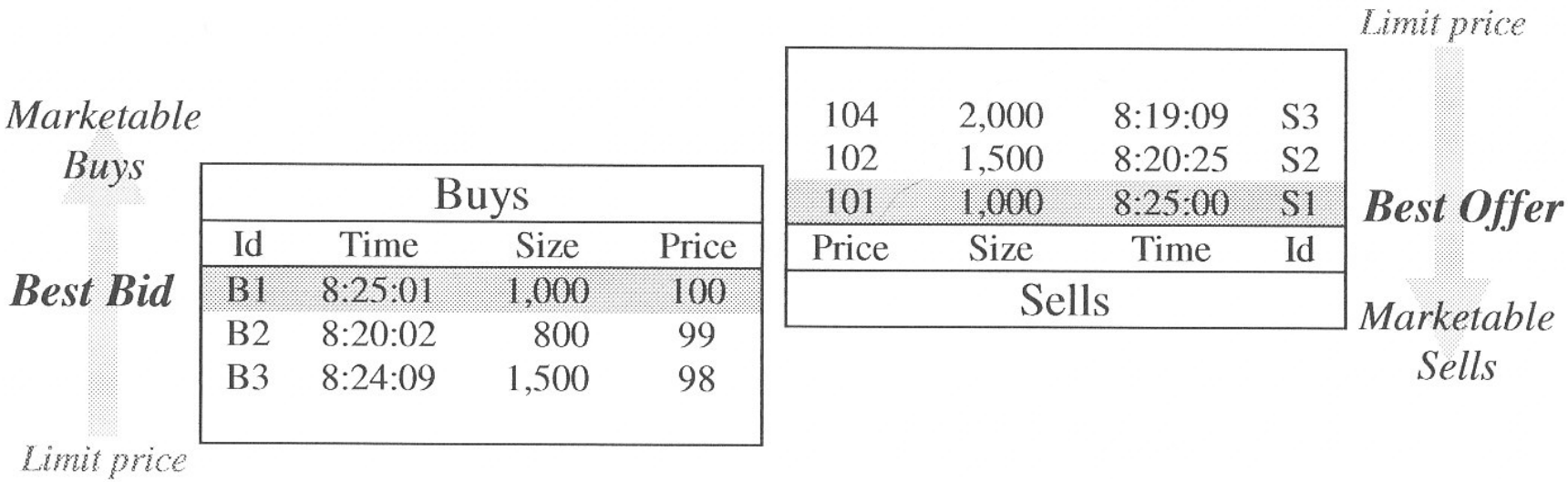
Marketable order

A *marketable* order is an order that can potentially be immediately executed

- market orders are always marketable orders
- a buy limit order is marketable if the limit price is greater than or equal to the current best offer
- a sell limit order is marketable if the limit price is less than or equal to the current best bid
- marketable orders remove liquidity from the market
- non-marketable orders get placed on the order book
- non-marketable order add liquidity to the market

Illustration of marketable limit orders



Algorithmic Trading and DMA, B. Johnson (used with permission)

Limit order example

- buy limit for 1000 at $100
  - placed on order book
    - $100 bid for 1000

Initial orderbook:

BID SIZE	PRICE	ASK SIZE
	102	2300
	101	1000
500	100	
1500	99	
2000	98	

Final orderbook:

BID SIZE	PRICE	ASK SIZE
	102	2300
	101	1000
1500	100	
1500	99	
2000	98	

Limit order example

- buy limit for 2000 at $101
  - bought 1000 at $101
  - placed on order book
    - $101 bid for 1000

Initial orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	1500
	101	1000
1000	100	
800	99	
1500	98	

Final orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	1500
1000	101	
1000	100	
800	99	
1500	98	

Limit order example

- buy limit for 2000 at $101
- offer of 1000 @ $101 canceled just as our order is placed
  - placed on order book
    - $101 bid for 2000

Initial orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	1500
	101	1000
1000	100	
800	99	
1500	98	

Final orderbook:

BID SIZE	PRICE	ASK SIZE
	106	3000
	104	2000
	102	1500
2000	101	
1000	100	
800	99	
1500	98	

Outline

Stop order

A Stop order is an instruction to submit a buy or sell market order if and when the user-specified stop trigger price is attained or penetrated. A Stop order is not guaranteed a specific execution price and may execute significantly away from its stop price. A Sell Stop order is always placed below the current market price and is typically used to limit a loss or protect a profit on a long stock position. A Buy Stop order is always placed above the current market price. It is typically used to limit a loss or help protect a profit on a short sale.

Products		Availability		Routing		TWS	
CFDs	☑	US Products	☑	Smart	☑	Attribute	☐
Combos	☑	Non-US Products	☑	Directed	☑	Order Type	☑
EFPs	☑					Time in Force	☐
Forex	☑						
Futures	☑						
FOPs	☑						
Options	☑						
Stocks	☑						
Warrants	☑						

- *Sell stop* order placed *below* the current market price
- *Buy stop* order placed *above* the current market price

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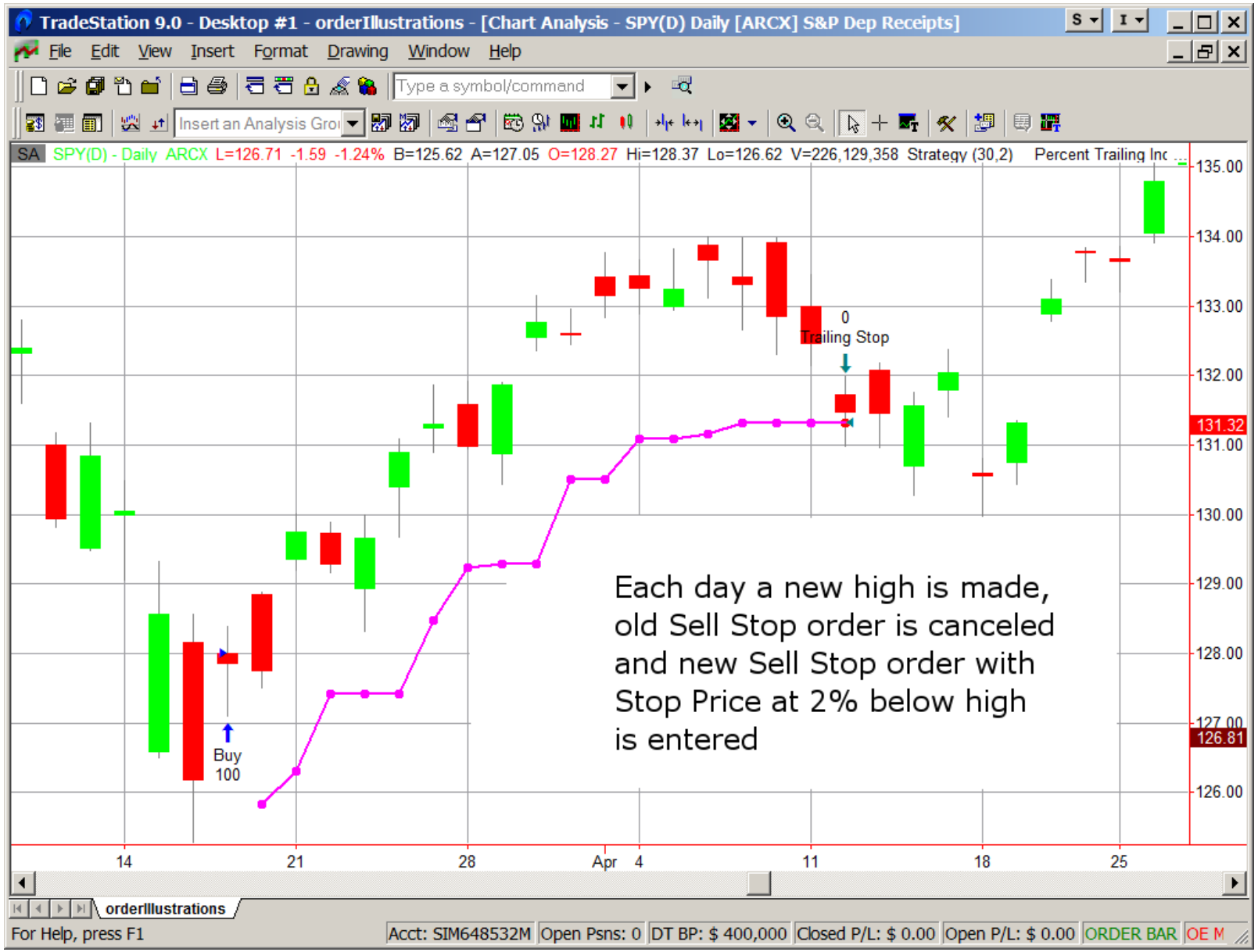
Trailing 2% stop-loss example (manually set)



Trailing stop loss order

A sell trailing stop order sets the stop price at a fixed amount below the market price with an attached "trailing" amount. As the market price rises, the stop price rises by the trail amount, but if the stock price falls, the stop loss price doesn't change, and a market order is submitted when the stop price is hit. This technique is designed to allow an investor to specify a limit on the maximum possible loss, without setting a limit on the maximum possible gain. "Buy" trailing stop orders are the mirror image of sell trailing stop orders, and are most appropriate for use in falling markets.

Products	Availability	Routing	TWS
CFDs ☑	US Products ☑	Smart ☑	Attribute ☐
EFPs ☑	Non-US Products ☑	Directed ☑	Order Type ☑
Forex ☑			Time in Force ☐
FOPs ☑			
Futures ☑			
Options ☑			
Stocks ☑			
Warrants ☑			

Comparing the limit order and the stop order

Trader is long 500 shares of MSFT

Characteristic	**Sell Limit**	**Sell Stop**
Example specification	Sell 500 MSFT, limit price = \$25	Sell 500 MSFT, stop price = \$25
Meaning of specified price	lowest acceptable price to sell	trigger price to enter a market order
Typical usage	guarantee an acceptable price (\$25)	protect against price decline below \$25
Typical situation	MSFT is trading below \$25	MSFT is trading above \$25

Uses of stop orders

- *Sell stop* order becomes a *sell market* order when the security trades at or below the *stop price*
- *Buy stop* order becomes a *buy market* order when the security trades at or above the *stop price*

	Long Position	No Position	Short Position
Sell Stop	If triggered, order will close out the long position. Used to limit loss or lock-in profit	If triggered, order initiates a short position	If triggered, order will add on to the short position
Buy Stop	If triggered, order will add on to the long position	If triggered, order initiates a long position	If triggered, order will close out the short position. Used to limit loss or lock-in profit

common use of stop order	less common use of stop

Buy stop market entry

Stop limit order

A Stop Limit order instruct the system to submit a buy or sell limit order when the user-specified stop trigger price is hit. The order has two components: the stop price and the limit price. When a trade has occurred at or through the stop price, the order becomes executable and enters the market as a limit order at the limit price.

A Stop Limit eliminates the price risk associated with a stop order where the execution price cannot be guaranteed, but exposes the investor to the risk that the order may never fill even if the stop price is reached. The investor could "miss the market" altogether.

Products	Availability	Routing	TWS
CFDs ☑	US Products ☑	Smart ☑	Attribute ☐
EFPs ☑	Non-US Products ☑	Directed ☑	Order Type ☑
Forex ☑			Time in Force ☐
Futures ☑			
FOPs ☑			
Options ☑			
Stocks ☑			
Warrants ☑			

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Comparing the stop limit order and the stop order

Trader is long 500 shares of MSFT

Characteristic	**Sell Stop Limit**	**Sell Stop**
Example specification	Sell 500 MSFT, stop price = \$25 limit price = \$24.75	Sell 500 MSFT, stop price = \$25
Typical usage	protect against price decline	protect against price decline
Advantages	may minimize losses upon exit	exits position if price declines
Disadvantages	may not completely exit position	may suffer large slippage

Market-if-Touched order

A Market if Touched (MIT) is an order to buy (or sell) a contract below (or above) the market. This order is held in the system until the trigger price is touched, and is then submitted as a market order. An MIT order is similar to a stop order, except that an MIT sell order is placed above the current market price, and a stop sell order is placed below.

Products	Availability	Routing	TWS
Bonds ☑	US Products ☑	Smart ☑	Attribute ☐
CFDs ☑	Non-US Products ☑	Directed ☑	Order Type ☑
EFPs ☑			Time in Force ☐
Forex ☑			
Futures ☑			
FOPs ☑			
Options ☑			
Stocks ☑			
Warrants ☑			

- *MIT Sell* order placed *above* the current market price
- *MIT Buy* order placed *below* the current market price

Interactive Brokers

MIT entry and exit

Comparing the Buy Stop order with the Buy MIT

Trader is looking to enter a long position

Characteristic	**Buy Stop**	**Buy MIT**
Example specification	Buy 500 SPY, Stop Price = \$113	Buy 500 SPY, Trigger Price = \$106
Meaning of specified price	trigger price to enter a market order	trigger price to enter a market order
Purpose	enter long on a price breakout	enter long on a price reversal
Situation	SPY trading below \$113	SPY trading above \$106

Outline

Time in force

An important characteristic of an order is how long it will remain active if not filled or canceled; this is called *time in force* or *duration*

DAY day order or good-for-day (GFD) - typically the default

GTC good-till-canceled

- IB: cancels automatically end of the next quarter
- TS: cancels automatically after 90 days

GTD good-till-date

GAD good-after-date

Special considerations

- trading during off-hours sessions
- handling of dividends/splits for long standing orders

On-close and on-open orders

MOC Market-on-Close

- will execute at closing cross price if sufficient supply (demand)

MOO Market-on-Open

- will execute at opening cross price if sufficient supply (demand)

LOC Limit-on-Close

- will execute at closing cross price if sufficient supply (demand) and cross price is within limit

LOO Limit-on-Open

- will execute at open cross price if sufficient supply (demand) and cross price is within limit

- These orders are only supported on the major equity exchanges

Special fill instructions

IOC Immediate-or-Cancel, also called Fill-and-Kill (FAK)

- fill executable part of the order immediately then cancel the remainder
- most instruments, most exchanges

FOK Fill-or-Kill

- fill entirety of the order immediately or cancel
- equities/options, most equity and options exchanges

AON All-or-None

- equities/options, some equity and option exchanges

Summary of special fill instructions

Instruction	**Partial Execution Allowed**	**Unexecuted part added to book**	**Expiration**
Immediate-or-Cancel	Yes	No	Immediately after submission
Fill-or-Kill	No	No	Immediately after submission
All-or-None	No	No	End of day

Outline

Market-to-Limit order

A Market-to-Limit (MTL) order is submitted as a market order to execute at the current best market price. If the order is only partially filled, the remainder of the order is canceled and re-submitted as a limit order with the limit price equal to the price at which the filled portion of the order executed.

Products		Availability		Routing		TWS	
CFDs	☑	US Products	☑	Smart	☑	Attribute	☐
EFPs	☑	Non-US Products	☑	Directed	☑	Order Type	☑
Futures	☑					Time in Force	☐
FOPs	☑						
Options	☑						
Stocks	☑						
Warrants	☑						

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Pegged (relative) order

Relative (a.k.a. Pegged-to-Primary) orders provide a means for traders to seek a more aggressive price than the National Best Bid and Offer (NBBO). By acting as liquidity providers, and placing more aggressive bids and offers than the current best bids and offers, traders increase their odds of filling their order. Quotes are automatically adjusted as the markets move, to remain aggressive. For a buy order, your bid is pegged to the NBB by a more aggressive offset, and if the NBB moves up, your bid will also move up. If the NBB moves down, there will be no adjustment because your bid will become even more aggressive and execute. For sales, your offer is pegged to the NBO by a more aggressive offset, and if the NBO moves down, your offer will also move down. If the NBO moves up, there will be no adjustment because your offer will become more aggressive and execute. In addition to the offset, you can define an absolute cap, which works like a limit price, and will prevent your order from being executed above or below a specified level.

Products	Availability	Routing	TWS
Stocks ☑	US Products ☑	Smart ☑	Attribute ☐
Options* ☑	Non-US Products ☑	Directed** ☑	Order Type ☑
Futures ☑			Time in Force ☐

* Supported only for orders directed to BOX and ASX.

** Orders with a positive offset that are directed to Island will move up and down with the market.

Orders with a "0" offset are submitted as limit orders at the best bid/ask and will move up and down with the market to continue to match the inside quote.

View Supported Exchanges

Interactive Brokers

Pegged order example

- B2 is pegged 1 below the best bid

Buys				Sells			
ID	Time	Size	Price	Price	Size	Time	ID
B1	8:20:00	1,000	100	102	900	8:28:00	S1
B2	8:25:25	1,200	99	103	1,000	8:25:00	S2
B3	8:24:09	800	98	104	1,500	8:20:25	S3

- B4 sets a new best bid

Buys				Sells			
ID	Time	Size	Price	Price	Size	Time	ID
B4	8:27:00	500	101	102	900	8:28:00	S1
B1	8:20:00	1,000	100	103	1,000	8:25:00	S2
B2	8:25:25	1,200	99	104	1,500	8:20:25	S3
B3	8:24:09	800	98				

- B2 automatically moves up to 100

Buys				Sells			
ID	Time	Size	Price	Price	Size	Time	ID
B4	8:27:00	500	101	102	900	8:28:00	S1
B1	8:20:00	1,000	100	103	1,000	8:25:00	S2
B2	8:25:25	1,200	100	104	1,500	8:20:25	S3
B3	8:24:09	800	98				

Discretionary order

A Discretionary order is a limit order with a defined amount off the limit price (for example $.05) which may be used to increase the price range over which the limit order is eligible to execute.

Products		Availability		Routing		TWS	
Stocks	☑	US Products	☑	Smart	☑	Attribute	☐
		Non-US Products	☐	Directed	☐	Order Type	☐
						Time in Force	☐
						Price Attribute	☑

Available for Limit orders only.

Interactive Brokers

Discretionary order example

- B1 is a limit order at 100 with a discretionary amount of 1

Buys				Sells			
ID	Time	Size	Price	Price	Size	Time	ID
B1	8:25:01	1,000	100	102	1,000	8:25:00	S1
B2	8:20:05	800	99	103	2,000	8:20:25	S2
B3	8:24:00	1,200	98	104	900	8:24:09	S3

Buys				Sells			
ID	Time	Size	Price	Price	Size	Time	ID
~~B1~~	~~8:25:01~~	~~500~~	~~101~~	~~101~~	~~500~~	~~8:28:00~~	~~S4~~
B1	8:29:00	500	100	102	1,000	8:25:00	S1
B2	8:20:05	800	99	103	2,000	8:20:25	S2
B3	8:24:00	1,200	98	104	900	8:24:09	S3

- matches with S4

Outline

Hidden orders

Orders can be given a *hidden* or *non-display* attribute

- These orders will not be visible on any market center's order book
- Hidden orders are typically given a lower priority than visible orders

Initial orderbook:

BID SIZE	PRICE	ASK SIZE
	104	1500
	103	800
	102	1000
	101	500
1000	100	
900	99	
1400	98	

Final orderbook:

BID SIZE	PRICE	ASK SIZE
	104	1500
	103	800
	102	1000
1000	100	
900	99	
1400	98	

- time & sales record indicates that 1000 shares traded at 101
- based on how order book changed, the conclusion would be a hidden sell limit for 500 at 101 in addition to the visible orders on the book

Iceberg orders

Iceberg or *reserve* orders are large quantity hidden orders with a small visible order component

- Each time the visible portion of the order is filled, a new visible portion is split off from the hidden order until the order is fully executed

Iceberg example (sell 10,000 @ $101, display 1000)

- market order for 1500

Sells			
Price	Size	Time	ID
101	1000	8:20:00	S1
101	1000	8:21:25	S2
101	9000	8:10:00	H1
102	1500	8:24:09	S3

Sells			
Price	Size	Time	ID
~~101~~	~~1000~~	~~8:20:00~~	~~S1~~
~~101~~	~~500~~	~~8:21:25~~	~~S2~~
101	500	8:21:25	S2
101	1000	8:10:00	S4
101	8000	8:10:00	H1
102	1500	8:24:09	S3

Sells			
Price	Size	Time	ID
101	500	8:21:25	S2
101	1000	8:10:00	S4
101	8000	8:10:00	H1
102	1500	8:24:09	S3

Iceberg orders

Iceberg example (sell 10,000 @ $101, display 1000)

- market order for 2200

Sells			
Price	Size	Time	ID
101	500	8:21:25	S2
101	1000	8:10:00	S4
101	8000	8:10:00	H1
102	1500	8:24:09	S3

Sells			
Price	Size	Time	ID
~~101~~	~~500~~	~~8:21:25~~	~~S2~~
~~101~~	~~1000~~	~~8:10:00~~	~~S4~~
~~101~~	~~700~~	~~8:10:00~~	~~S5~~
101	300	8:10:00	S5
101	7000	8:10:00	H1
102	1500	8:24:09	S3

Sells			
Price	Size	Time	ID
101	300	8:10:00	S5
101	7000	8:10:00	H1
102	1500	8:24:09	S3

Outline

Order Protection Rule

Reg NMS (Regulation National Market System) is a set of rules passed by the SEC that took effect in 2007

- fairly controversial regulation

A key component to Reg NMS is the *Order Protection Rule* (also known as the *Trade-through rule* or *Rule 611*):

- ensures that investors receive the best price (NBBO) when their order is executed
- if a better price is quoted elsewhere, the trade must be routed there for execution, and not *"traded through"* at its current venue
- only top-of-the-book quotes are protected

Exceptions to Order Protection Rule include:

- Intermarket Sweep Order (ISO)

Routing example

Market Order Examples

Book Bids		Book Offers		Away Market Bids		Away Market Offers	
$50.05	1000	$50.10	300	$50.04	500	$50.09	700
$50.04	500	$50.12	2000	$50.03	100	$50.10	500
$50.03	1500	$50.15	1000	$50.00	1000	$50.15	3000

Market Order: **Buy 500** shares
Result: NYSE Arca routes order to the away market with the best of $50.09.

Market Order: **Sell 2000** shares
Result: NYSE Arca matches 1000 shares at $50.05 and 500 shares at $50.04 with the Book and routes 500 shares to the away market with the next best price of $50.04.

NYSE Arca, `http://usequities.nyx.com/markets/nyse-arca-equities/order-types`

Routing example

Limit Order Examples

Book Bids		Book Offers		Away Market Bids		Away Market Offers	
$50.05	1000	$50.10	300	$50.04	500	$50.09	700
$50.04	500	$50.12	2000	$50.03	100	$50.10	500
$50.03	1500	$50.15	1000	$50.00	1000	$50.15	3000

Limit Order: **Buy 1000** shares at **$50.09**
Result: NYSE Arca routes 700 shares to the away market at $50.09. The balance of 300 shares is posted to the Book at $50.09.

Limit Order: **Sell 3500** shares at **$50.03**
Result: NYSE Arca matches 1000 shares at $50.05 and 500 shares at $50.04 against the Book. Routes 500 shares at $50.04 to the away market, then matches the balance of 1500 shares at $50.03 with the Book.

NYSE Arca, `http://usequities.nyx.com/markets/nyse-arca-equities/order-types`

Routing example

Immediate or Cancel Examples

Book Bids		Book Offers		Away Market Bids		Away Market Offers	
$50.05	1000	$50.10	300	$50.04	500	$50.09	700
$50.04	500	$50.12	2000	$50.03	100	$50.10	500
$50.03	1500	$50.15	1000	$50.00	1000	$50.15	3000

IOC Order: **Buy 500** shares at **$50.09**
Result: Order is canceled since it cannot be filled immediately on NYSE Arca and would need to be routed to the away market with the best of $50.09.

IOC Order: **Sell 500** shares at the **market**
Result: NYSE Arca matches 500 shares at $50.05, the current best bid.

NYSE Arca, `http://usequities.nyx.com/markets/nyse-arca-equities/order-types`

Intermarket Sweep order

An *Intermarket sweep order* (ISO) is a limit order that prohibits routing to another venue even if that other venue is quoting a better price

- ISOs are an allowed exception to the Order Protection Rule
- ISOs are controversial and have been blamed for *flash crashes* and *flash dashes*
- ISOs are described as being typically used by institutional algorithmic investors and not by individual investors[†]

[†] `http://blogs.wsj.com/marketbeat/2010/05/07/accentures-flash-crash-whats-an-intermarket-sweep-order`

Intermarket Sweep order example

Trader wants to purchase 3000 at a limit of 50.02

- Buy 2000 @ 50.02 to Exch-1
- Buy 1000 @ 50.02 to ECN-1

Buys			Sells		
Venue	Size	Price	Price	Size	Venue
ECN-1	800	50.00	50.01	1,500	Exch-1
Exch-1	1,500	50.00	50.01	500	ECN-1
ECN-1	1,000	49.99	50.02	1,200	Exch-1
Exch-1	700	49.99	50.02	800	ECN-1
ECN-1	1,200	49.98	50.03	2,200	Exch-1

Exch-1 Sells		
Price	Size	ID
50.01	500	S1
50.01	1,000	S2
50.02	500	S3
50.02	700	S4
initial		

Exch-1 Sells		
Price	Size	ID
~~50.01~~	~~500~~	~~S1~~
~~50.01~~	~~1,000~~	~~S2~~
50.02	500	S3
50.02	700	S4
exchange routing		

Exch-1 Sells		
Price	Size	ID
~~50.01~~	~~500~~	~~S1~~
~~50.01~~	~~1,000~~	~~S2~~
~~50.02~~	~~500~~	~~S3~~
50.02	700	S4
inter-market sweep		

Outline

CME supported orders

Order Types	Agriculture	Equities	FX	Interest Rates	Energy	Metals	Real Estate	Weather
Limit	F, O	F, O	F, O	F, O	F, O	F, O	F	F
Market with Protection	F, O	F, O	F, O	F, O	F, O	F, O	F	F
Market to Limit	F, O	F, O	F, O	F, O	F, O	F, O	F	F
Stop Limit	F	F	F	F	F	F	F	F
Stop with Protection	F	F	F	F	F	F	F	F
Minimum Quantity	F, O	F, O	F, O	F	F, O	F	F	F
Hidden Quantity	F, O	F, O	F, O	F	F, O	F, O	F	F

Duration Qualifier	Agriculture	Equities	FX	Interest Rates	Energy	Metals	Real Estate	Weather
Session/Day	F, O	F, O	F, O	F, O	F, O	F, O	F	F
Good 'Til Canceled (GTC)	F, O	F, O	F, O	F, O	F, O	F, O	F	F
Good 'Til Date (GTD)	F, O	F, O	F, O	F, O	F, O	F, O	F	F
Fill and Kill (FAK)	F, O	F, O	F, O	F, O	F, O	F, O	F	F
Fill or Kill (FOK)	F, O	F, O	F, O	F, O	F, O	F, O	F	F

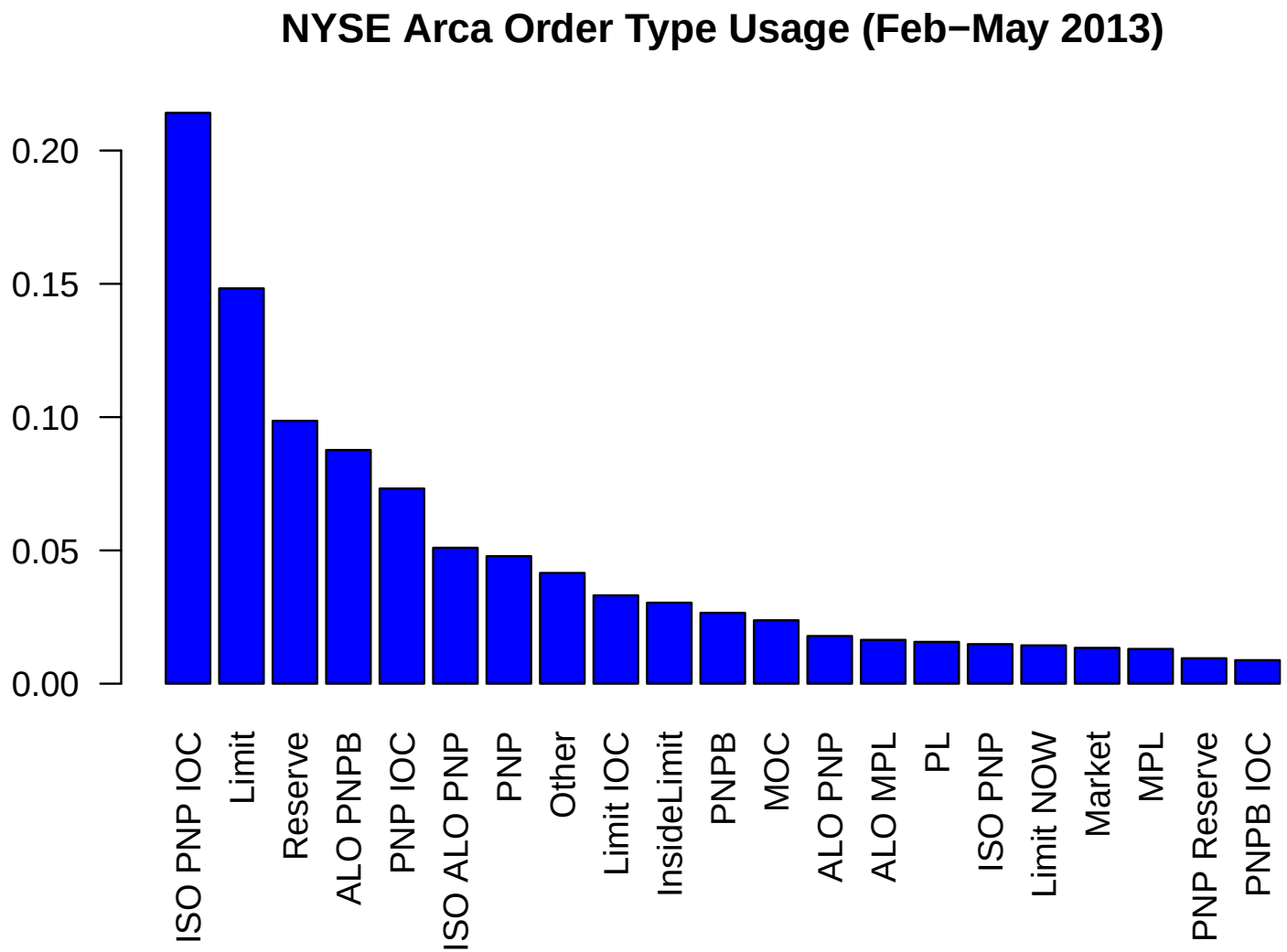
KEY: F = Available for futures
O = Available for options

NYSE Arca orders

Market Order	Post No Preference Blind (PNP B) Order	Pegged Order
Limit Order	Tracking Limit Order	NOW Order ®
Inside Limit Order℠	Passive Liquidity (PL) Order	Primary Until 9:45
Reserve Order	Mid-Point Passive Liquidity (MPL) Order	Primary After 3:55
Adding Liquidity Only (ALO) Order	Discretionary Order	Market-On- Close (MOC)
Good-Till-Cancel Order (GTC)	Discretion Limit Order ℠	Limit-On-Close Order (LOC)
Primary Only (PO) Order	Passive Discretionary Order	Self-Trade Prevention (STP) Modifier
PO+ Order	Cross Order	Intermarket Sweep Order(ISO) for IOC
Primary Sweep Order (PSO)	Midpoint Cross Order ℠	Intermarket Sweep Order(ISO) for PNP
Immediate-Or- Cancel (IOC) ℠	IOC Cross Order	Intermarket Sweep Order(ISO) for IOC Cross Orders
Fill or Kill Order (FOK)	Post No Preference (PNP) Cross and Post Order	Intermarket Sweep Order(ISO) for Post Cross Orders
Post No Preference (PNP) Order		

NYSE Arca, `http://usequities.nyx.com/markets/nyse-arca-equities/order-types`

NYSE Arca orders



NYSE Arca, `http://usequities.nyx.com/markets/nyse-arca-equities/order-types`

IB Order types and Algos

Order Type	Category	STK	OPT	FUT	FOP	FX	BND	FND	WAR	EFPs	CMB	CFDs
Basket	Advanced Trading	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐
Conditional	Advanced Trading	☑	☑	☑	☑	☑	☐	☐	☑	☐	☐	☐
One-Cancels-All (OCA)	Advanced Trading	☑	☑	☑	☑	☑	☑	☐	☑	☑	☐	☐
Spreads	Advanced Trading	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐
Volatility	Advanced Trading	☐	☑	☐	☑	☐	☐	☐	☐	☐	☑	☐
Accumulate/Distribute	Algorithmic Trading	☑	☑	☑	☑	☑	☑	☐	☑	☐	☐	☐
Arrival Price	Algorithmic Trading	☑	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
Balance Impact and Risk	Algorithmic Trading	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dark Ice	Algorithmic Trading	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Minimize Impact	Algorithmic Trading	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Percent of Volume	Algorithmic Trading	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Scale	Algorithmic Trading	☑	☑	☑	☑	☑	☑	☐	☑	☐	☐	☐
TWAP	Algorithmic Trading	☑	☑	☑	☐	☑	☐	☐	☐	☐	☐	☐
VWAP - Best Efforts	Algorithmic Trading	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Bracket	Limit Risk	☑	☑	☑	☑	☐	☐	☐	☑	☐	☐	☐
Market to Limit	Limit Risk	☑	☑	☑	☑	☐	☐	☐	☑	☑	☐	☑
Market with Protection	Limit Risk	☐	☐	☑	☑	☐	☐	☐	☐	☐	☐	☐
Request-for-Quote (RFQ)	Limit Risk	☐	☑	☑	☑	☐	☑	☐	☐	☐	☐	☐
Stop - Adjustable	Limit Risk	☑	☑	☑	☑	☑	☐	☐	☑	☑	☐	☐
Stop - Trailing Stop Limit	Limit Risk	☑	☑	☑	☑	☑	☑	☐	☑	☑	☐	☑
Stop - Trailing Stop	Limit Risk	☑	☑	☑	☑	☑	☐	☐	☑	☑	☐	☑
Stop Limit	Limit Risk	☑	☑	☑	☑	☑	☐	☐	☑	☑	☐	☑
Stop with Protection	Limit Risk	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Stop	Limit Risk	☑	☑	☑	☑	☑	☐	☐	☑	☑	☑	☑
Trailing Limit if Touched	Limit Risk	☑	☑	☑	☑	☑	☐	☑	☑	☑	☐	☑
Trailing Market if Touched	Limit Risk	☑	☑	☑	☑	☑	☐	☑	☑	☑	☐	☑
Auction	Price Improvement	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Block	Price Improvement	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Box Top	Price Improvement	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐

IB Order types and Algos

Order Type	Category	STK	OPT	FUT	FOP	FX	BND	FND	WAR	EFPs	CMB	CFDs
Limit if Touched	Price Improvement	☑	☑	☑	☑	☑	☑	☐	☑	☑	☐	☑
Limit-on-Close	Price Improvement	☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐
Limit-on-Open	Price Improvement	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Limit	Price Improvement	☑	☑	☑	☑	☑	☑	☐	☑	☑	☐	☑
NYSE Closing Auction D-Quote	Price Improvement	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Passive Relative	Price Improvement	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Pegged-to-Midpoint	Price Improvement	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Retail Price Improvement (RPI)	Price Improvement	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hidden	Privacy	☑	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐
IBDARK	Privacy	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Iceberg/Reserve	Privacy	☑	☑	☑	☐	☐	☐	☐	☑	☐	☐	☐
VWAP - Guaranteed	Privacy	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
At Auction	Speed of Execution	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Discretionary	Speed of Execution	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Market if Touched	Speed of Execution	☑	☑	☑	☑	☑	☑	☐	☑	☑	☐	☑
Market on Close	Speed of Execution	☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐
Market on Open	Speed of Execution	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Market	Speed of Execution	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐	☑
Midpoint Match (MPM)	Speed of Execution	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pegged-to-Market	Speed of Execution	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pegged-to-Stock	Speed of Execution	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Relative/Pegged-to-Primary	Speed of Execution	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sweep-to-Fill	Speed of Execution	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
All or None	Time to Market	☑	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐
Fill or Kill	Time to Market	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Good After Time/Date (GAT)	Time to Market	☑	☑	☑	☑	☑	☑	☐	☑	☐	☐	☐
Good-till-Canceled (GTC)	Time to Market	☑	☑	☑	☑	☑	☑	☐	☑	☑	☐	☐
Good-till-Date/Time (GTD)	Time to Market	☑	☑	☑	☑	☑	☑	☐	☑	☑	☐	☐
Immediate or Cancel (IOC)	Time to Market	☑	☑	☑	☑	☑	☐	☐	☑	☑	☐	☐

Common order types and attributes

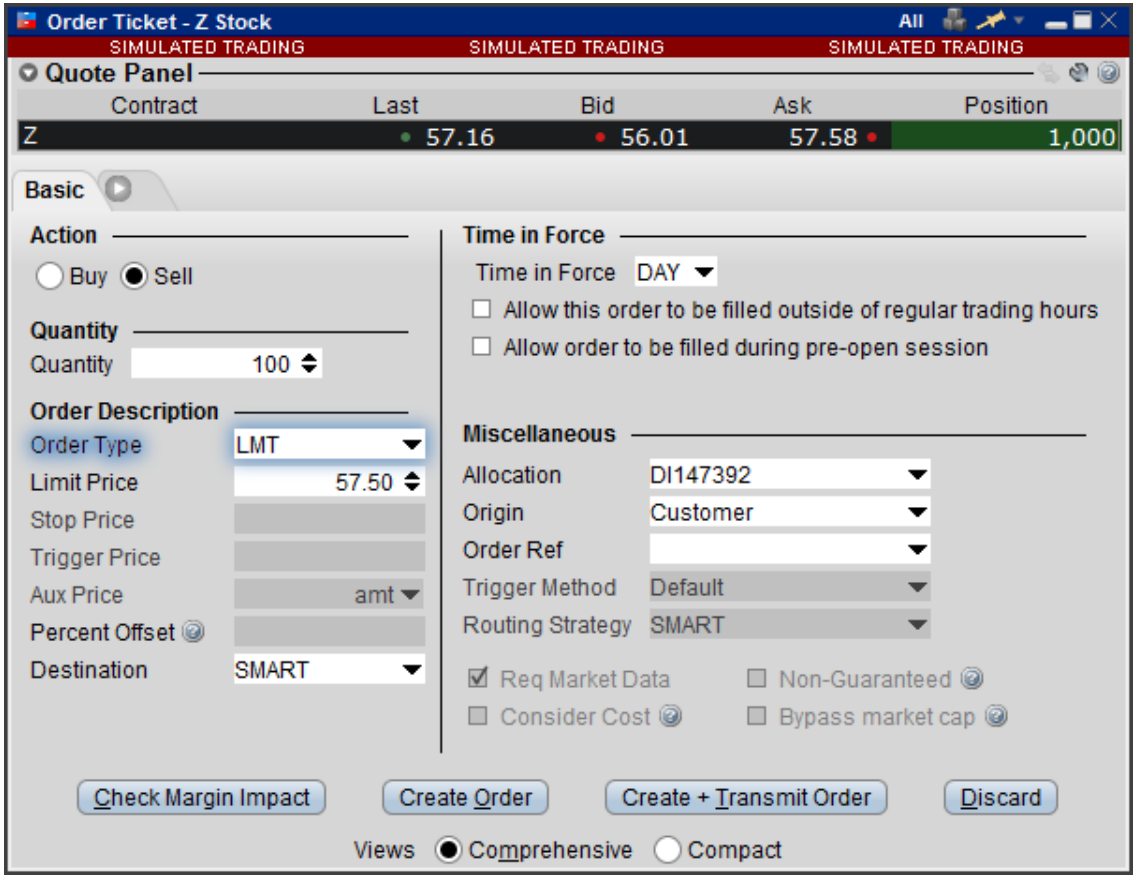
Class	Order types
Standard	Market, Limit
Conditional	Stop, Trailing Stop, Market-if-Touched
Hybrid	Market-to-limit, Market-with-protection
Hidden	Hidden, Iceberg
Discretional	Discretionary, Pegged

Attribute	Attribute Type
Duration	DAY, GTC, MOC, MOO
Fill	IOC, FOK, AON

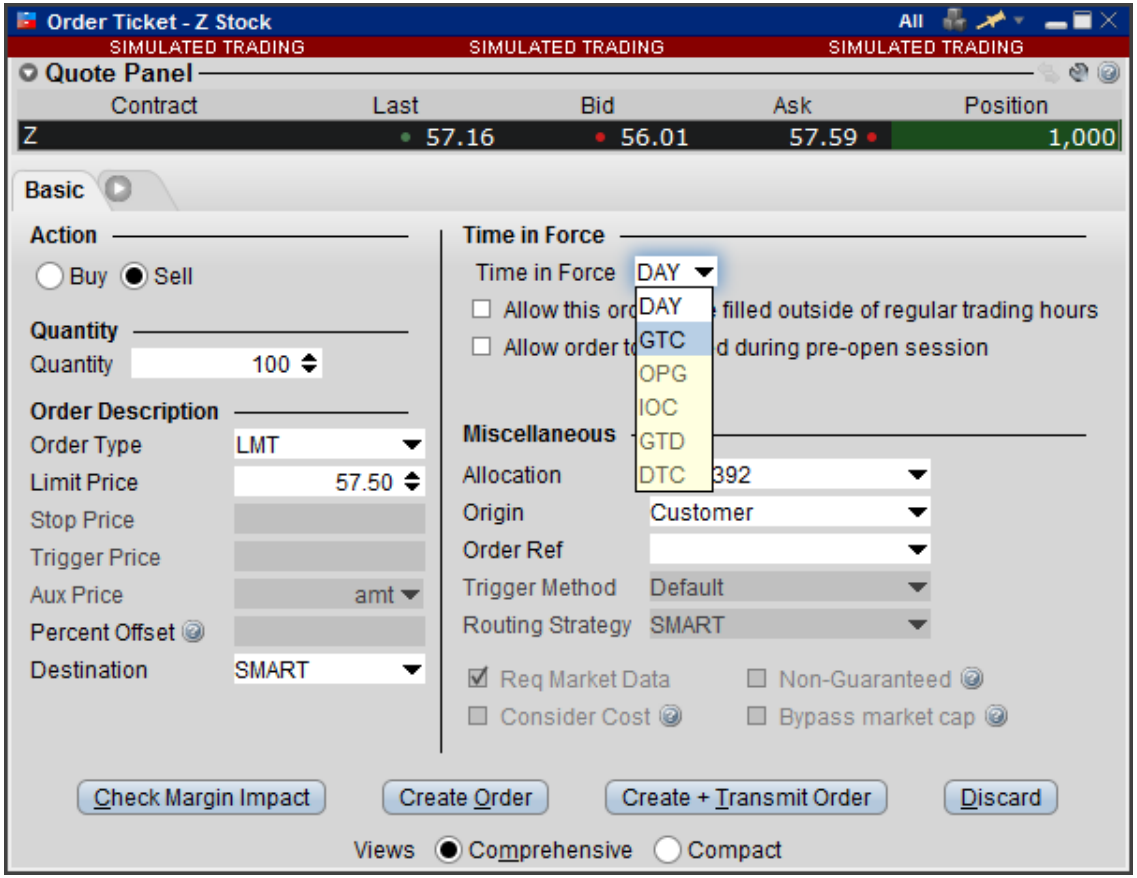
Outline

TraderWorkstation

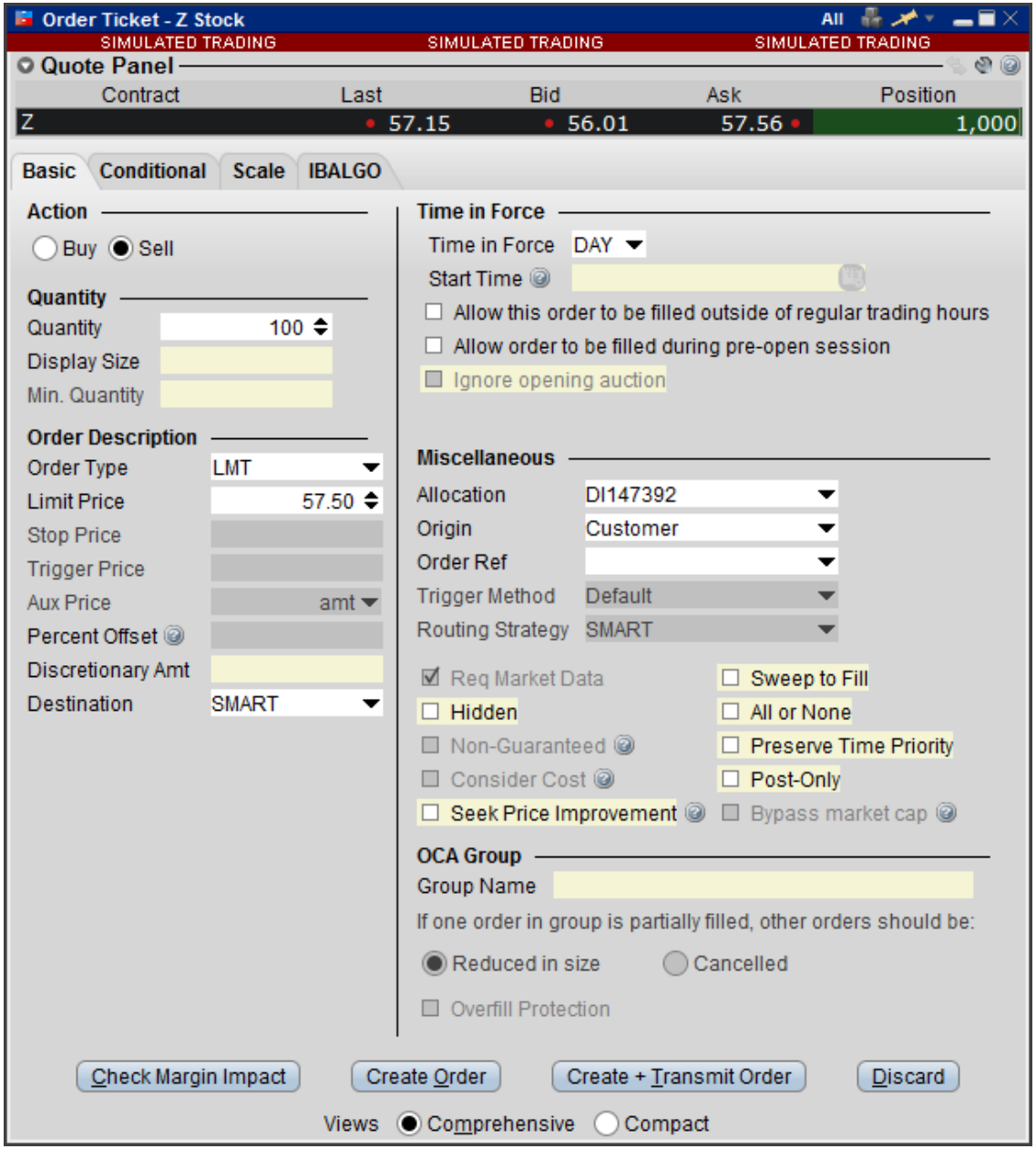
Order ticket: order type



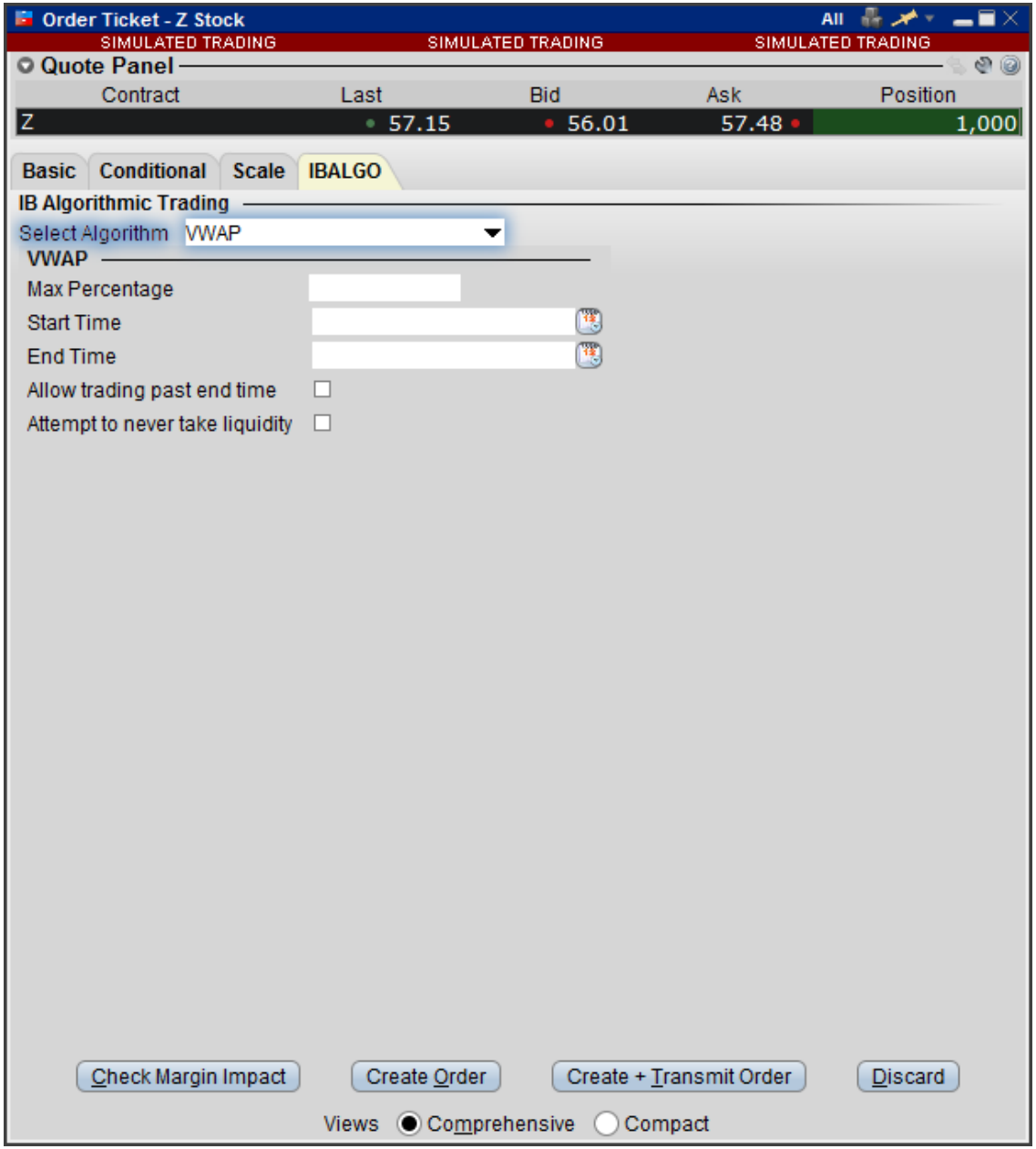
Order ticket: time in force



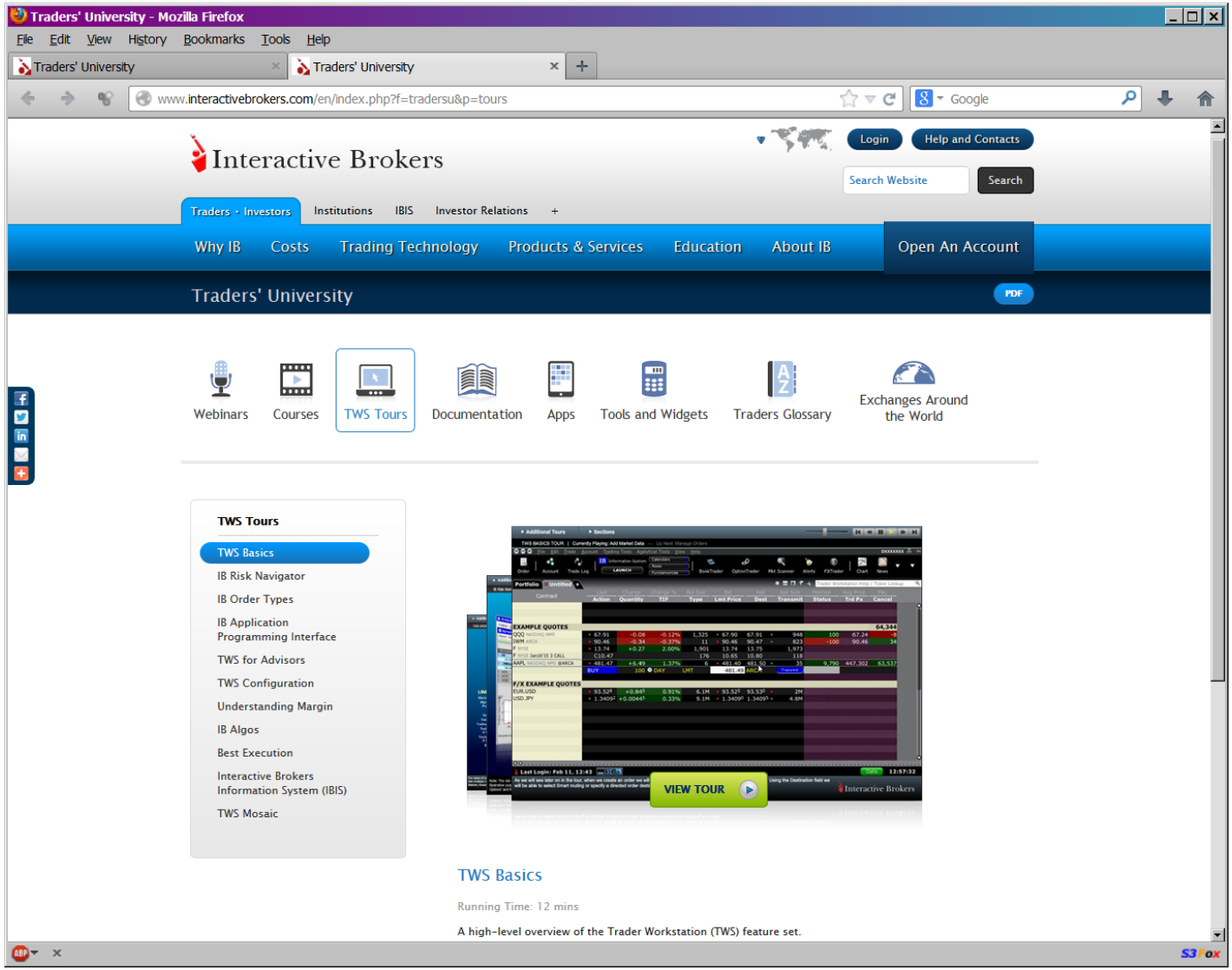
Order ticket: advanced settings



Order ticket: execution algorithms

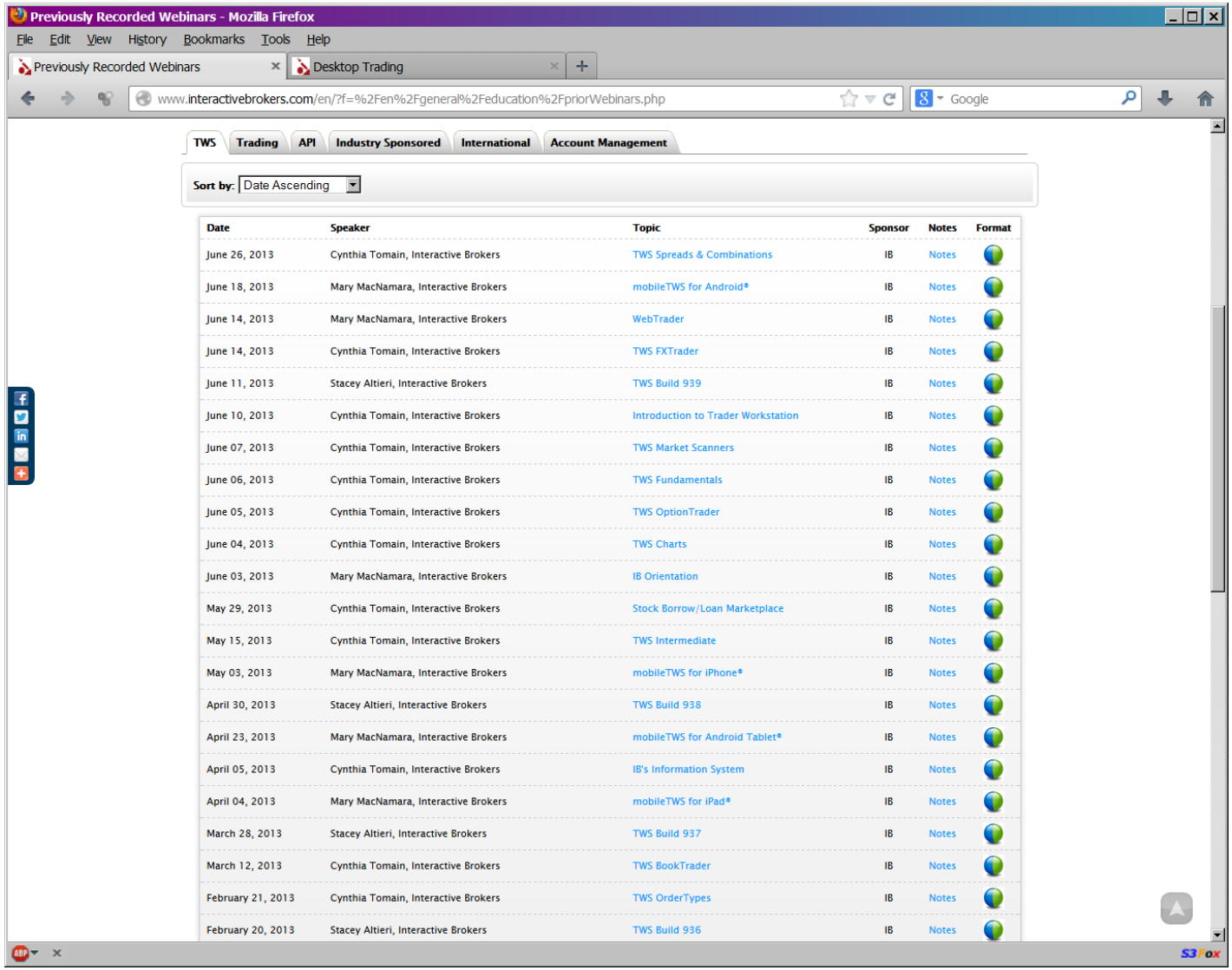


TraderWorkstation documentation



`http://www.interactivebrokers.com/en/index.php?f=tradersu&p=tours`

TraderWorkstation documentation



Date	Speaker	Topic	Sponsor	Notes	Format
June 26, 2013	Cynthia Tomain, Interactive Brokers	TWS Spreads & Combinations	IB	Notes	
June 18, 2013	Mary MacNamara, Interactive Brokers	mobileTWS for Android®	IB	Notes	
June 14, 2013	Mary MacNamara, Interactive Brokers	WebTrader	IB	Notes	
June 14, 2013	Cynthia Tomain, Interactive Brokers	TWS FXTrader	IB	Notes	
June 11, 2013	Stacey Altieri, Interactive Brokers	TWS Build 939	IB	Notes	
June 10, 2013	Cynthia Tomain, Interactive Brokers	Introduction to Trader Workstation	IB	Notes	
June 07, 2013	Cynthia Tomain, Interactive Brokers	TWS Market Scanners	IB	Notes	
June 06, 2013	Cynthia Tomain, Interactive Brokers	TWS Fundamentals	IB	Notes	
June 05, 2013	Cynthia Tomain, Interactive Brokers	TWS OptionTrader	IB	Notes	
June 04, 2013	Cynthia Tomain, Interactive Brokers	TWS Charts	IB	Notes	
June 03, 2013	Mary MacNamara, Interactive Brokers	IB Orientation	IB	Notes	
May 29, 2013	Cynthia Tomain, Interactive Brokers	Stock Borrow/Loan Marketplace	IB	Notes	
May 15, 2013	Cynthia Tomain, Interactive Brokers	TWS Intermediate	IB	Notes	
May 03, 2013	Mary MacNamara, Interactive Brokers	mobileTWS for iPhone®	IB	Notes	
April 30, 2013	Stacey Altieri, Interactive Brokers	TWS Build 938	IB	Notes	
April 23, 2013	Mary MacNamara, Interactive Brokers	mobileTWS for Android Tablet®	IB	Notes	
April 05, 2013	Cynthia Tomain, Interactive Brokers	IB's Information System	IB	Notes	
April 04, 2013	Mary MacNamara, Interactive Brokers	mobileTWS for iPad®	IB	Notes	
March 28, 2013	Stacey Altieri, Interactive Brokers	TWS Build 937	IB	Notes	
March 12, 2013	Cynthia Tomain, Interactive Brokers	TWS BookTrader	IB	Notes	
February 21, 2013	Cynthia Tomain, Interactive Brokers	TWS OrderTypes	IB	Notes	
February 20, 2013	Stacey Altieri, Interactive Brokers	TWS Build 936	IB	Notes	

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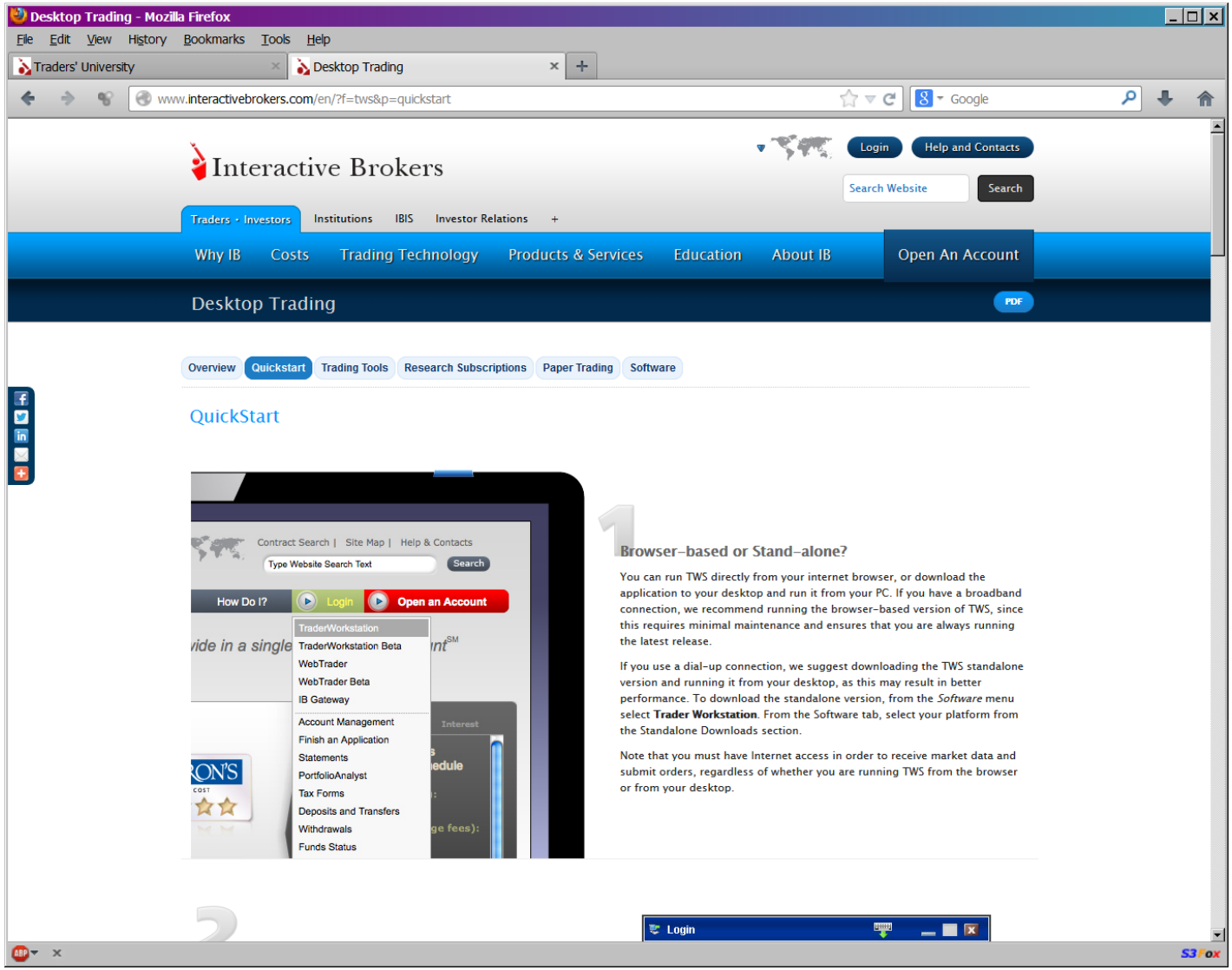
TraderWorkstation documentation



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