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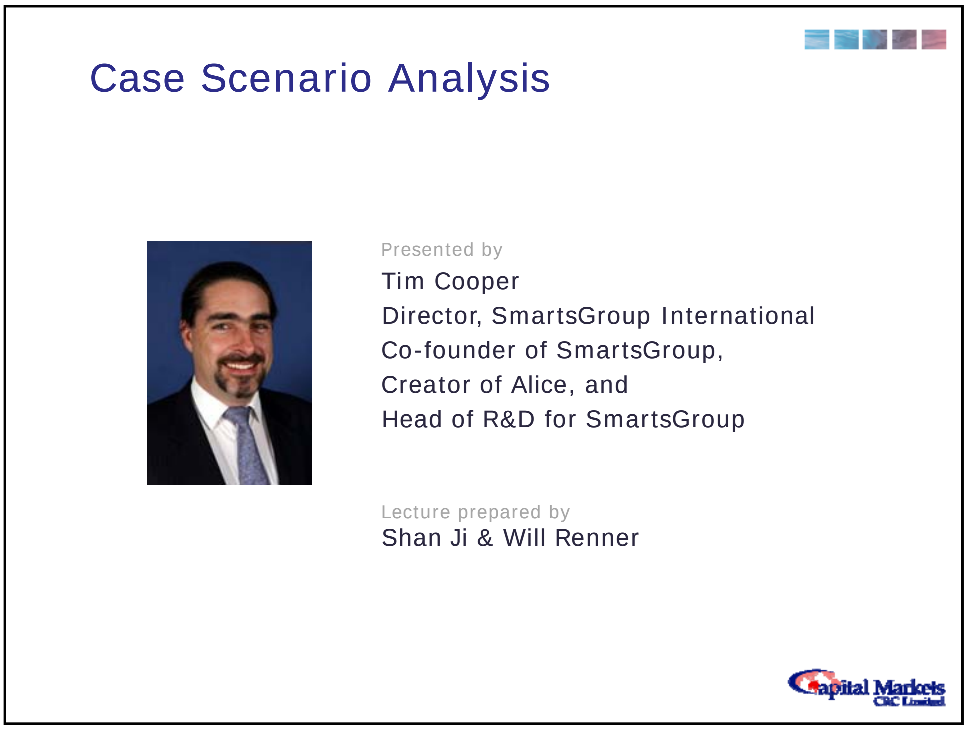
MARKET DATA ANALYSIS USING ALICE

Case Scenario Analysis

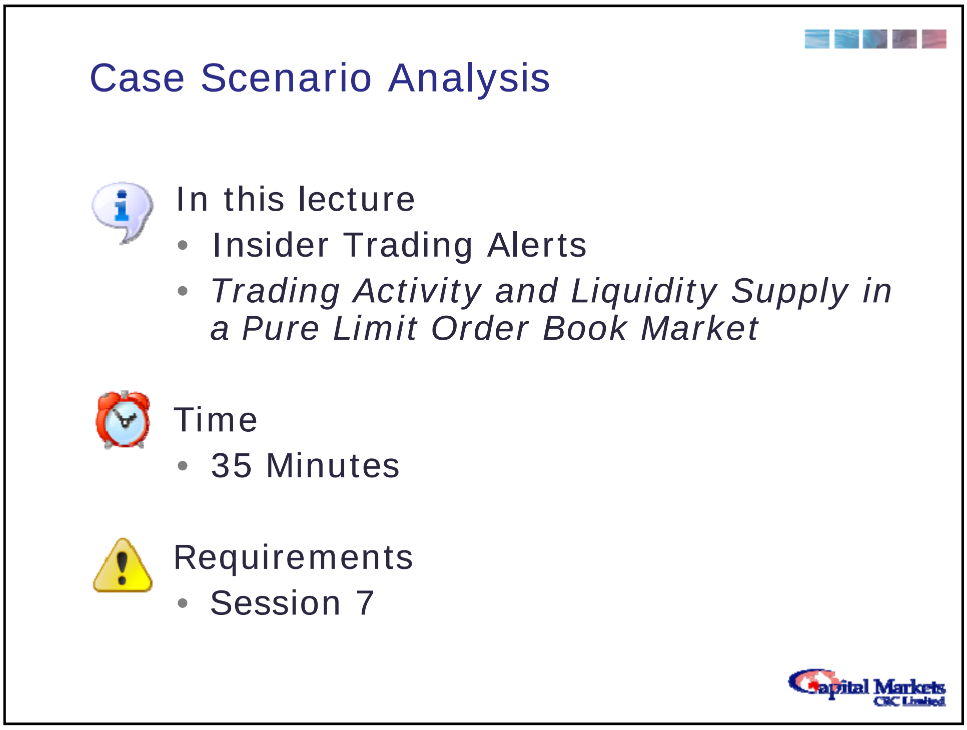


Case Scenario Analysis

Presented by

Tim Cooper
Director, SmartsGroup International
Co-founder of SmartsGroup,
Creator of Alice, and
Head of R&D for SmartsGroup

Lecture prepared by
Shan Ji & Will Renner

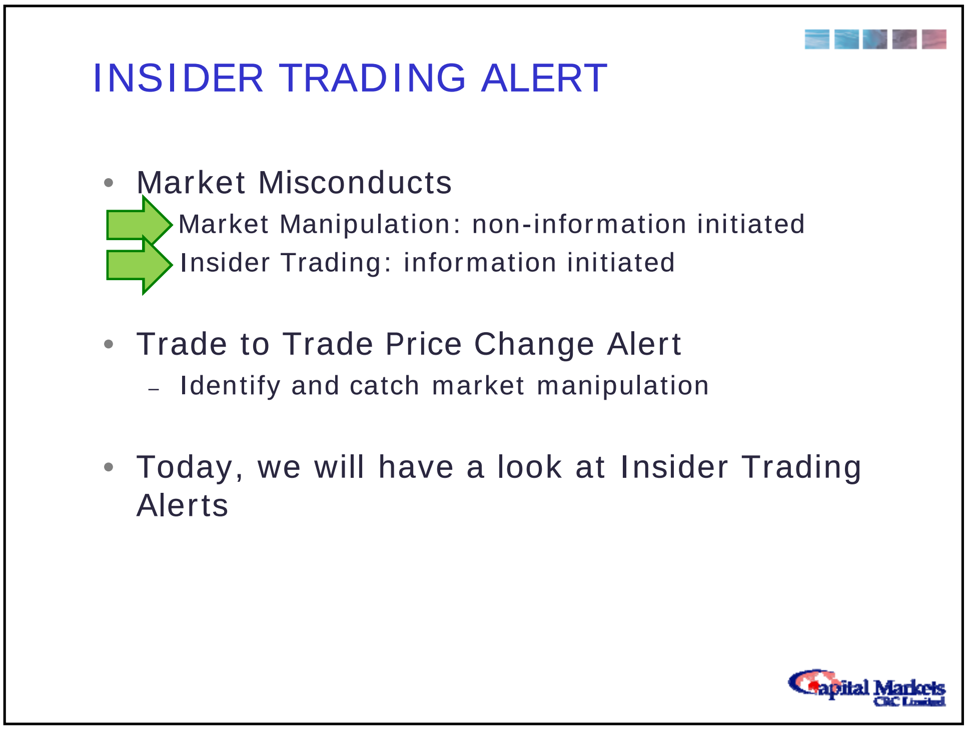


Case Scenario Analysis

In this lecture
- Insider Trading Alerts
- *Trading Activity and Liquidity Supply in a Pure Limit Order Book Market*

Time
- 35 Minutes

Requirements
- Session 7



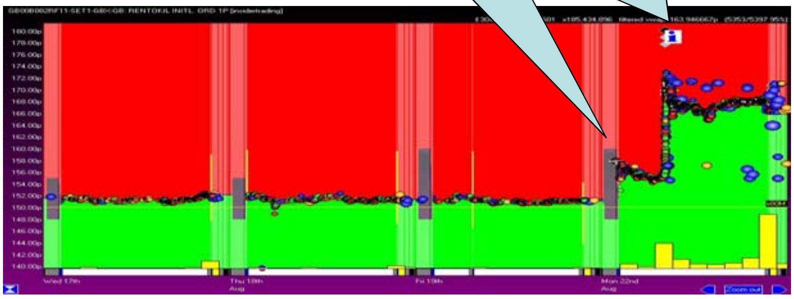
INSIDER TRADING ALERT

- Market Misconducts
  - ➡ Market Manipulation: non-information initiated
  - ➡ Insider Trading: information initiated
- Trade to Trade Price Change Alert
  - – Identify and catch market manipulation
- Today, we will have a look at Insider Trading Alerts

INSIDER TRADING ALERT

Example

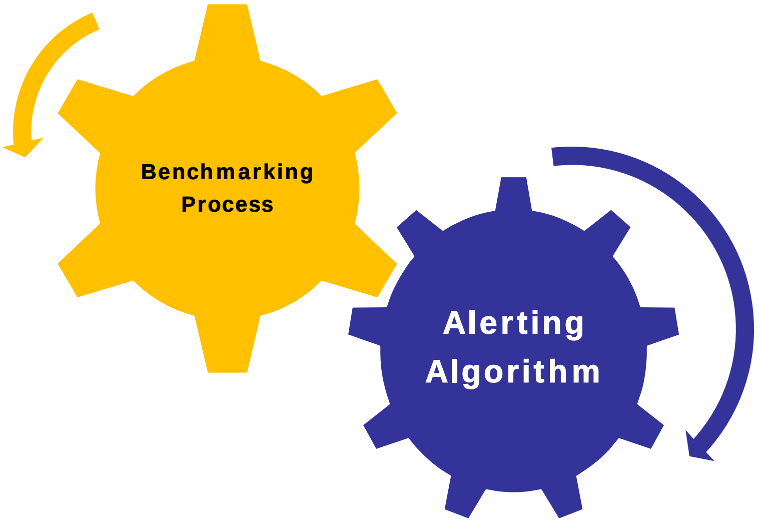
- Detects unusual price movements prior to information releases.
- Identify the participant that makes the most movement to the suspect security



Insider trading prior to announcement

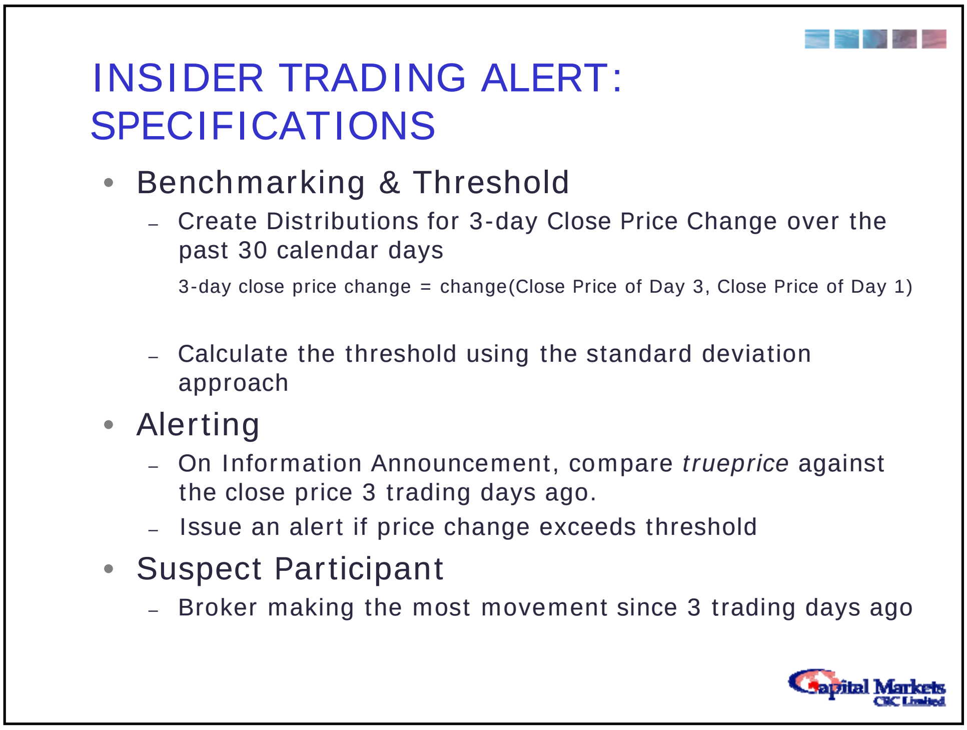
Information announcement

ALERT DESIGN



Benchmarking Process

Alerting Algorithm

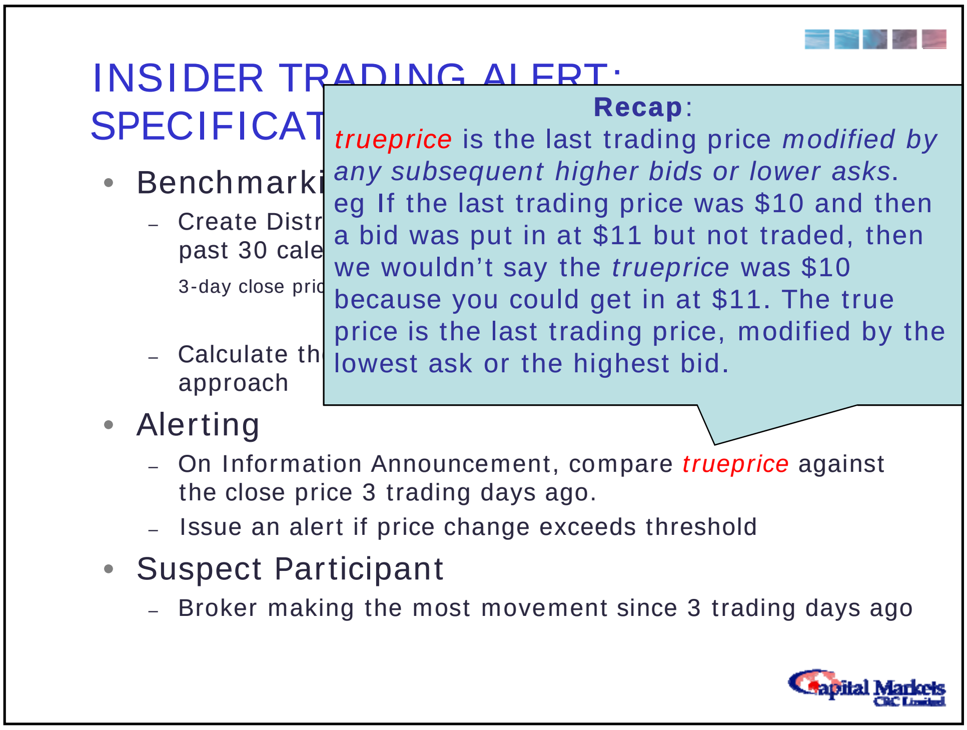


INSIDER TRADING ALERT: SPECIFICATIONS

- Benchmarking & Threshold
  - Create Distributions for 3-day Close Price Change over the past 30 calendar days

    3-day close price change = change(Close Price of Day 3, Close Price of Day 1)

  - Calculate the threshold using the standard deviation approach
- Alerting
  - On Information Announcement, compare *trueprice* against the close price 3 trading days ago.
  - Issue an alert if price change exceeds threshold
- Suspect Participant
  - Broker making the most movement since 3 trading days ago



INSIDER TRADING ALERT: SPECIFICAT

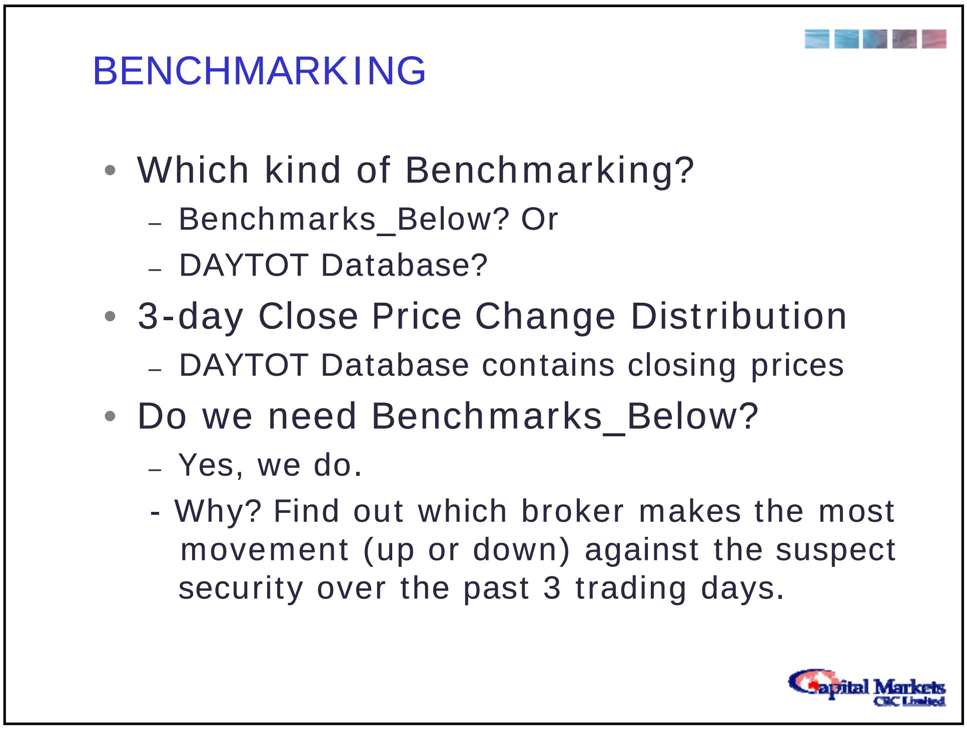
- Benchmarki
  - Create Distr past 30 cale

    3-day close pric

  - Calculate th approach

Recap:
trueprice is the last trading price *modified by any subsequent higher bids or lower asks.*
eg If the last trading price was $10 and then a bid was put in at $11 but not traded, then we wouldn't say the *trueprice* was $10 because you could get in at $11. The true price is the last trading price, modified by the lowest ask or the highest bid.

- Alerting
  - On Information Announcement, compare *trueprice* against the close price 3 trading days ago.
  - Issue an alert if price change exceeds threshold
- Suspect Participant
  - Broker making the most movement since 3 trading days ago



BENCHMARKING

- Which kind of Benchmarking?
  - Benchmarks_Below? Or
  - DAYTOT Database?
- 3-day Close Price Change Distribution
  - DAYTOT Database contains closing prices
- Do we need Benchmarks_Below?
  - Yes, we do.
  - Why? Find out which broker makes the most movement (up or down) against the suspect security over the past 3 trading days.

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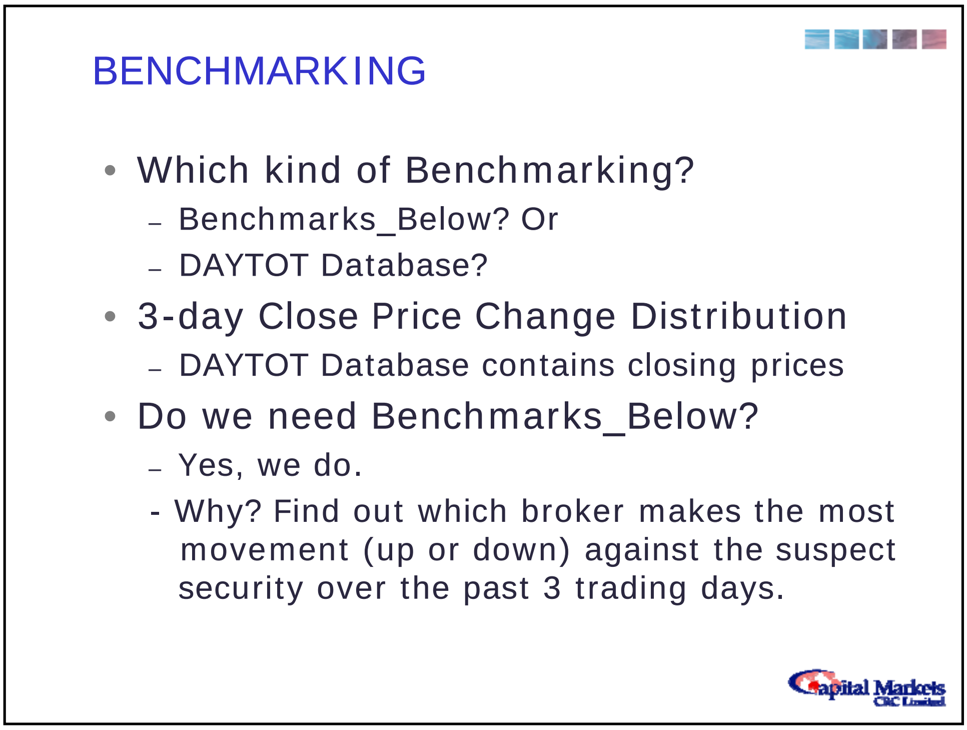

BENCHMARKING

- Which kind of Benchmarking?
  - Benchmarks_Below? Or
  - DAYTOT Database?
- 3-day Close Price Change Distribution
  - DAYTOT Database contains closing prices
- Do we need Benchmarks_Below?
  - Yes, we do.
  - Why? Find out which broker makes the most movement (up or down) against the suspect security over the past 3 trading days.

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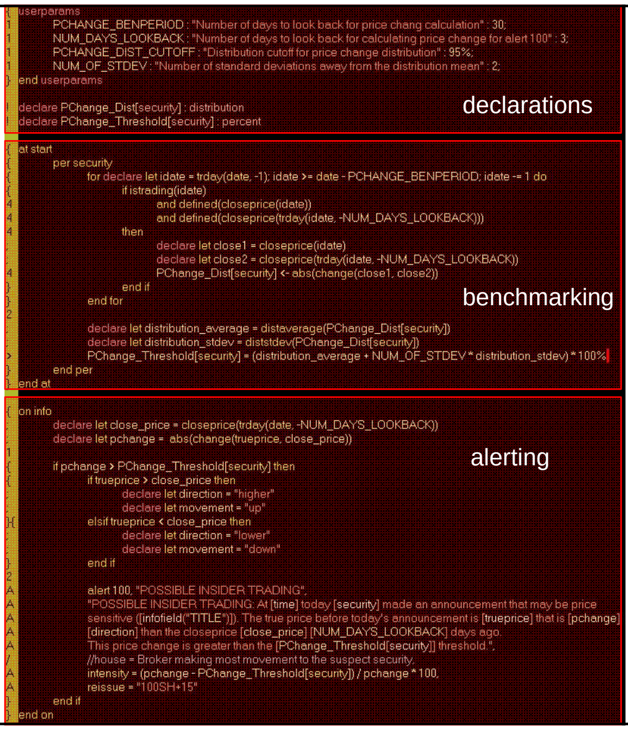
ALERTING ALGORITHMS

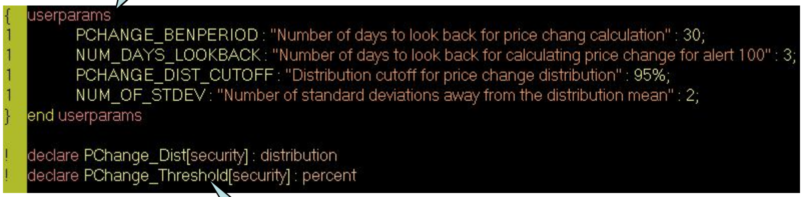
- **Trigger Alert On Which "When Clause"?**
  on info
- **Alert Code: 100**
- **Suspect Parameter**
  house=broker making most movement (up or down) since 3 trading days ago.
- **Intensity Parameter**
  *intensity=(Trueprice - Threshold) / Trueprice * 100*
- **Reissue Parameter**
  Reissue = "100SH+15"
  - Reissue once intensity increases by 15 for each suspect security/broker pair



```
userparams
        PCHANGE_BENPERIOD : "Number of days to look back for price chang calculation" : 30;
        NUM_DAYS_LOOKBACK : "Number of days to look back for calculating price change for alert 100" : 3;
        PCHANGE_DIST_CUTOFF : "Distribution cutoff for price change distribution" : 95%;
        NUM_OF_STDEV : "Number of standard deviations away from the distribution mean" : 2;
end userparams

declare PChange_Dist[security] : distribution
declare PChange_Threshold[security] : percent

at start
        per security
                for declare let idate = trday(date, -1); idate >= date - PCHANGE_BENPERIOD; idate -= 1 do
                        if istrading(idate)
                                and defined(closeprice(idate))
                                and defined(closeprice(trday(idate, -NUM_DAYS_LOOKBACK)))
                        then
                                declare let close1 = closeprice(idate)
                                declare let close2 = closeprice(trday(idate, -NUM_DAYS_LOOKBACK))
                                PChange_Dist[security] <- abs(change(close1, close2))
                        end if
                end for

                declare let distribution_average = distaverage(PChange_Dist[security])
                declare let distribution_stdev = diststdev(PChange_Dist[security])
                PChange_Threshold[security] = (distribution_average + NUM_OF_STDEV * distribution_stdev) * 100%
        end per
end at

on info
        declare let close_price = closeprice(trday(date, -NUM_DAYS_LOOKBACK))
        declare let pchange =  abs(change(trueprice, close_price))

        if pchange > PChange_Threshold[security] then
                if trueprice > close_price then
                        declare let direction = "higher"
                        declare let movement = "up"
                elsif trueprice < close_price then
                        declare let direction = "lower"
                        declare let movement = "down"
                end if

                alert 100, "POSSIBLE INSIDER TRADING",
                "POSSIBLE INSIDER TRADING: At [time] today [security] made an announcement that may be price
                sensitive ([infofield("TITLE")]). The true price before today's announcement is [trueprice] that is [pchange]
                [direction] than the closeprice [close_price] [NUM_DAYS_LOOKBACK] days ago.
                This price change is greater than the [PChange_Threshold[security]] threshold.",
                //house = Broker making most movement to the suspect security,
                intensity = (pchange - PChange_Threshold[security]) / pchange * 100,
                reissue = "100SH+15"
        end if
end on
```

DECLARATIONS

User Parameters



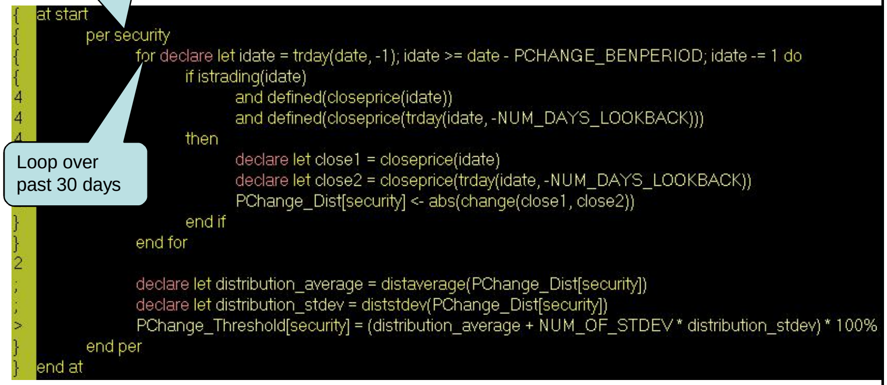
```
userparams
        PCHANGE_BENPERIOD : "Number of days to look back for price chang calculation" : 30;
        NUM_DAYS_LOOKBACK : "Number of days to look back for calculating price change for alert 100" : 3;
        PCHANGE_DIST_CUTOFF : "Distribution cutoff for price change distribution" : 95%;
        NUM_OF_STDEV : "Number of standard deviations away from the distribution mean" : 2;
end userparams

declare PChange_Dist[security] : distribution
declare PChange_Threshold[security] : percent
```

Global Variables

BENCHMARKING

- Looping DAYTOT Database At Start

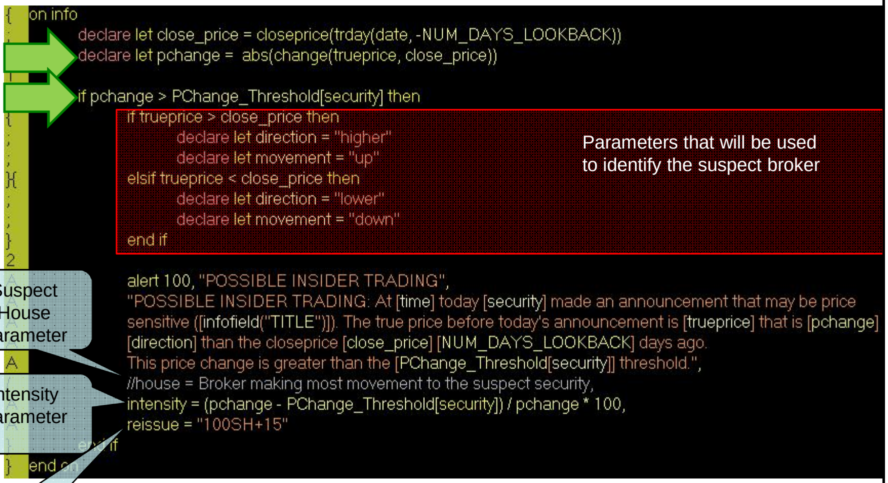
Loop over all securities



```
at start
        per security
                for declare let idate = trday(date, -1); idate >= date - PCHANGE_BENPERIOD; idate -= 1 do
                        if istrading(idate)
                                and defined(closeprice(idate))
                                and defined(closeprice(trday(idate, -NUM_DAYS_LOOKBACK)))
                        then
                                declare let close1 = closeprice(idate)
                                declare let close2 = closeprice(trday(idate, -NUM_DAYS_LOOKBACK))
                                PChange_Dist[security] <- abs(change(close1, close2))
                        end if
                end for

                declare let distribution_average = distaverage(PChange_Dist[security])
                declare let distribution_stdev = diststdev(PChange_Dist[security])
                PChange_Threshold[security] = (distribution_average + NUM_OF_STDEV * distribution_stdev) * 100%
        end per
end at
```

Loop over past 30 days

ALERTING



```
on info
        declare let close_price = closeprice(trday(date, -NUM_DAYS_LOOKBACK))
        declare let pchange =  abs(change(trueprice, close_price))

        if pchange > PChange_Threshold[security] then
                if trueprice > close_price then
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                elsif trueprice < close_price then
                        declare let direction = "lower"
                        declare let movement = "down"
                end if

                alert 100, "POSSIBLE INSIDER TRADING",
                "POSSIBLE INSIDER TRADING: At [time] today [security] made an announcement that may be price
                sensitive ([infofield("TITLE")]). The true price before today's announcement is [trueprice] that is [pchange]
                [direction] than the closeprice [close_price] [NUM_DAYS_LOOKBACK] days ago.
                This price change is greater than the [PChange_Threshold[security]] threshold.",
                //house = Broker making most movement to the suspect security,
                intensity = (pchange - PChange_Threshold[security]) / pchange * 100,
                reissue = "100SH+15"
        end if
end on
```

Parameters that will be used to identify the suspect broker

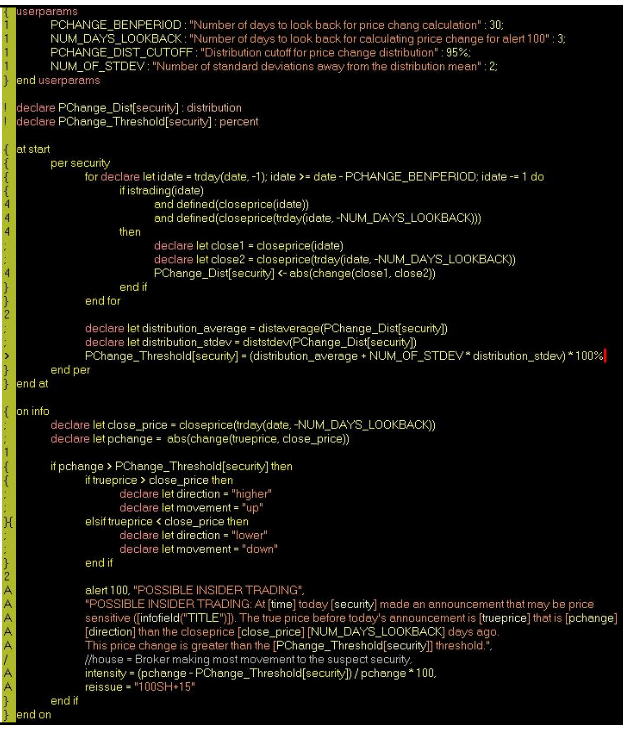
Suspect House Parameter

Intensity Parameter

Reissue Parameter

Exercise 1

Please run this Sample Code in ALDIT for 22/08/2008.



```
userparams
        PCHANGE_BENPERIOD : "Number of days to look back for price chang calculation" : 30;
        NUM_DAYS_LOOKBACK : "Number of days to look back for calculating price change for alert 100" : 3;
        PCHANGE_DIST_CUTOFF : "Distribution cutoff for price change distribution" : 95%;
        NUM_OF_STDEV : "Number of standard deviations away from the distribution mean" : 2;
end userparams

declare PChange_Dist[security] : distribution
declare PChange_Threshold[security] : percent

at start
        per security
                for declare let idate = trday(date, -1); idate >= date - PCHANGE_BENPERIOD; idate -= 1 do
                        if istrading(idate)
                                and defined(closeprice(idate))
                                and defined(closeprice(trday(idate, -NUM_DAYS_LOOKBACK)))
                        then
                                declare let close1 = closeprice(idate)
                                declare let close2 = closeprice(trday(idate, -NUM_DAYS_LOOKBACK))
                                PChange_Dist[security] <- abs(change(close1, close2))
                        end if
                end for

                declare let distribution_average = distaverage(PChange_Dist[security])
                declare let distribution_stdev = diststdev(PChange_Dist[security])
                PChange_Threshold[security] = (distribution_average + NUM_OF_STDEV * distribution_stdev) * 100%
        end per
end at

on info
        declare let close_price = closeprice(trday(date, -NUM_DAYS_LOOKBACK))
        declare let pchange =  abs(change(trueprice, close_price))

        if pchange > PChange_Threshold[security] then
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                        declare let movement = "up"
                elsif trueprice < close_price then
                        declare let direction = "lower"
                        declare let movement = "down"
                end if

                alert 100, "POSSIBLE INSIDER TRADING",
                "POSSIBLE INSIDER TRADING: At [time] today [security] made an announcement that may be price
                sensitive ([infofield("TITLE")]). The true price before today's announcement is [trueprice] that is [pchange]
                [direction] than the closeprice [close_price] [NUM_DAYS_LOOKBACK] days ago.
                This price change is greater than the [PChange_Threshold[security]] threshold.",
                //house = Broker making most movement to the suspect security,
                intensity = (pchange - PChange_Threshold[security]) / pchange * 100,
                reissue = "100SH+15"
        end if
end on
```
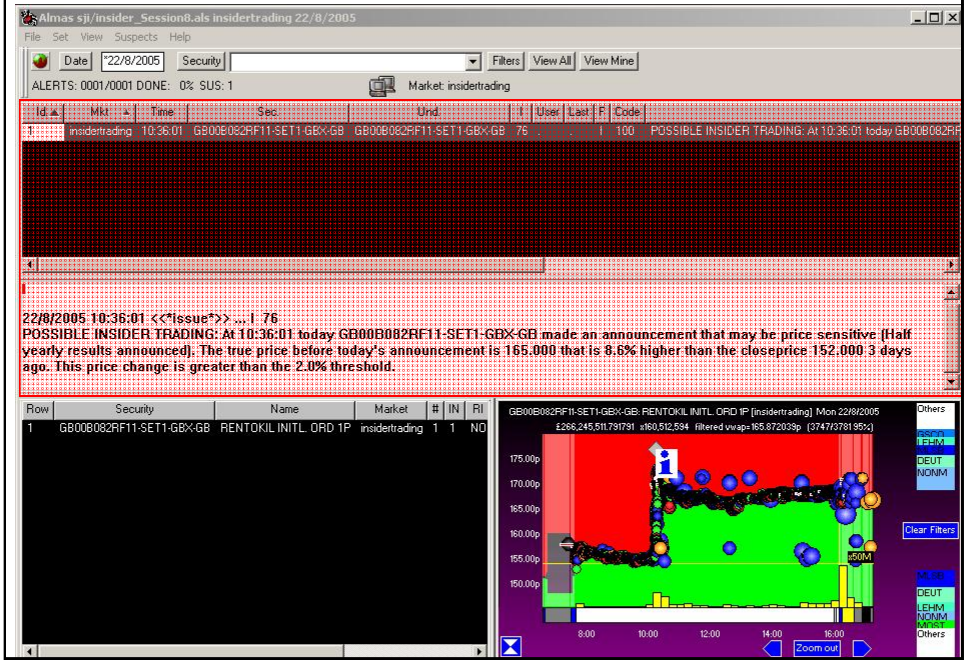

OUTPUT IN ALMAS



ALERTS: 0001/0001 DONE: 0% SUS: 1

Market: insidertrading

Id.	Mkt	Time	Sec.	Und.	I	User	Last	F	Code	
1	insidertrading	10:36:01	GB00B082RF11-SET1-GBX-GB	GB00B082RF11-SET1-GBX-GB	76	.	.	I	100	POSSIBLE INSIDER TRADING: At 10:36:01 today GB00B082RF

22/8/2005 10:36:01 <<*issue*>> ... I 76
POSSIBLE INSIDER TRADING: At 10:36:01 today GB00B082RF11-SET1-GBX-GB made an announcement that may be price sensitive (Half yearly results announced). The true price before today's announcement is 165.000 that is 8.6% higher than the closeprice 152.000 3 days ago. This price change is greater than the 2.0% threshold.

Row	Security	Name	Market	#	IN	RI
1	GB00B082RF11-SET1-GBX-GB	RENTOKIL INITL. ORD 1P	insidertrading	1	1	NO

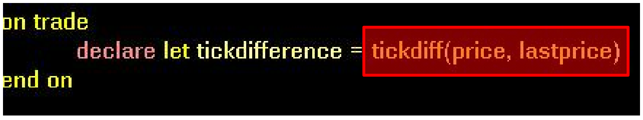
GB00B082RF11-SET1-GBX-GB: RENTOKIL INITL. ORD 1P [insidertrading] Mon 22/8/2005
£266,245,511.791791 x160,512,594 filtered vwap=165.872039p (3747/3781 95%)
175.00p
170.00p
165.00p
160.00p
155.00p
150.00p
8:00
10:00
12:00
14:00
16:00
x50M
Others
GSCO
LEHM
MLSB
DEUT
NONM
MLSB
DEUT
LEHM
NONM
MOST
Others

SUSPECT BROKER

- Find the broker that makes the most movements to the suspect security since 3 trading days ago
- Define Movements
  - **Tick: minimum price change value**
    - E.g., For BHP, every time its price changes, the minimum price change (up or down) will be $0.1.
    - Hence, for BHP, 1 tick = $0.1.
    - When BHP is previously traded at $35 and you want to sell BHP above the previous price, the minimum price you can offer is $35.10
  - **Tick value normally increases as price increases**
    - E.g. For BHP, when its price is between $20 - $30, 1 tick = $0.1
    - When its price is between $30 – $50, 1 tick = $0.2

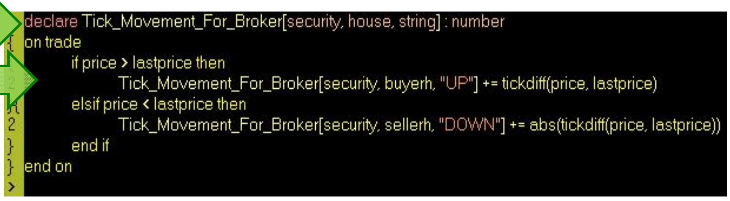
SUSPECT BROKER

- In ALICE, we use the following function to calculate tick differences between two prices:



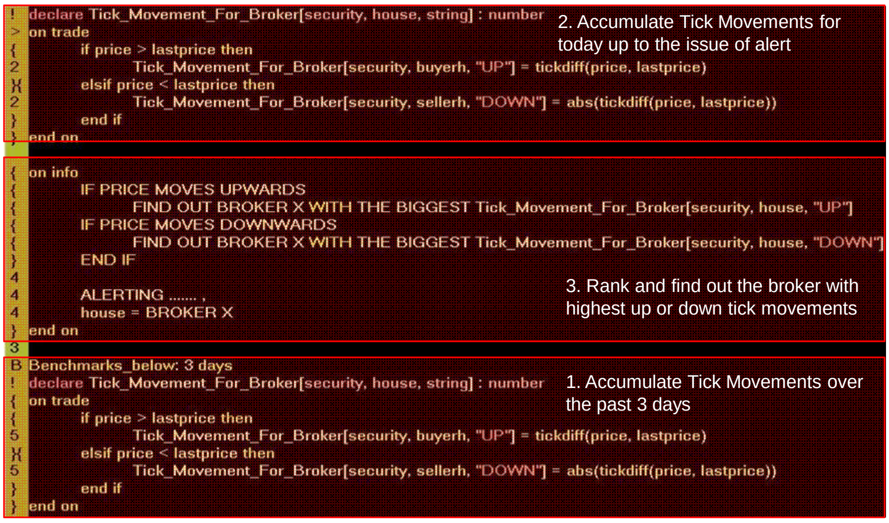
```
on trade
        declare let tickdifference = tickdiff(price, lastprice)
end on
```

To find the broker who makes the most tick movements, we need to accumulate up and down tick movements for each security/broker pair



```
declare Tick_Movement_For_Broker[security, house, string] : number
on trade
        if price > lastprice then
                Tick_Movement_For_Broker[security, buyerh, "UP"] += tickdiff(price, lastprice)
        elsif price < lastprice then
                Tick_Movement_For_Broker[security, sellerh, "DOWN"] += abs(tickdiff(price, lastprice))
        end if
end on
```

SUSPECT BROKER



```
declare Tick_Movement_For_Broker[security, house, string] : number
on trade
        if price > lastprice then
                Tick_Movement_For_Broker[security, buyerh, "UP"] = tickdiff(price, lastprice)
        elsif price < lastprice then
                Tick_Movement_For_Broker[security, sellerh, "DOWN"] = abs(tickdiff(price, lastprice))
        end if
end on
```

2. Accumulate Tick Movements for today up to the issue of alert

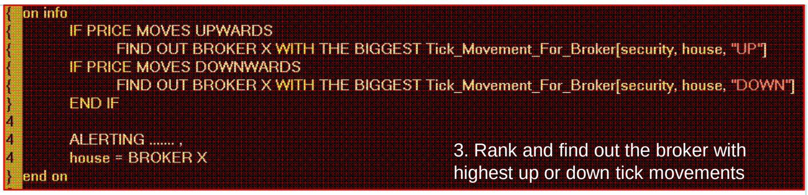
```
on info
        IF PRICE MOVES UPWARDS
                FIND OUT BROKER X WITH THE BIGGEST Tick_Movement_For_Broker[security, house, "UP"]
        IF PRICE MOVES DOWNWARDS
                FIND OUT BROKER X WITH THE BIGGEST Tick_Movement_For_Broker[security, house, "DOWN"]
        END IF

        ALERTING ....... ,
        house = BROKER X
end on
```

3. Rank and find out the broker with highest up or down tick movements

```
Benchmarks_below: 3 days
declare Tick_Movement_For_Broker[security, house, string] : number
on trade
        if price > lastprice then
                Tick_Movement_For_Broker[security, buyerh, "UP"] = tickdiff(price, lastprice)
        elsif price < lastprice then
                Tick_Movement_For_Broker[security, sellerh, "DOWN"] = abs(tickdiff(price, lastprice))
        end if
end on
```

1. Accumulate Tick Movements over the past 3 days

SUSPECT BROKER



```
on info
        IF PRICE MOVES UPWARDS
                FIND OUT BROKER X WITH THE BIGGEST Tick_Movement_For_Broker[security, house, "UP"]
        IF PRICE MOVES DOWNWARDS
                FIND OUT BROKER X WITH THE BIGGEST Tick_Movement_For_Broker[security, house, "DOWN"]
        END IF

        ALERTING ....... ,
        house = BROKER X
end on
```

3. Rank and find out the broker with highest up or down tick movements

- How to rank and find out the broker with the highest up or down tick movements?
  - Similar to Activity 2 from the Session 6 Task
  - Create arrays to hold any broker seen for each security traded
  - Use FOR loops to compare tick movements for each security/broker pair stored
  - Find out the broker with the highest tick movements
- Try to understand the above logics as this will be the Activity for this Session

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USING ALICE FOR RESEARCH

- We have demonstrated how to design and create an Insider Trading Alert
- Now let's have a look how ALICE can be helpful to create a database for your academic research
- *Trading Activity and Liquidity Supply in a Pure Limit Order Book Market by Grammig et.al 2004*

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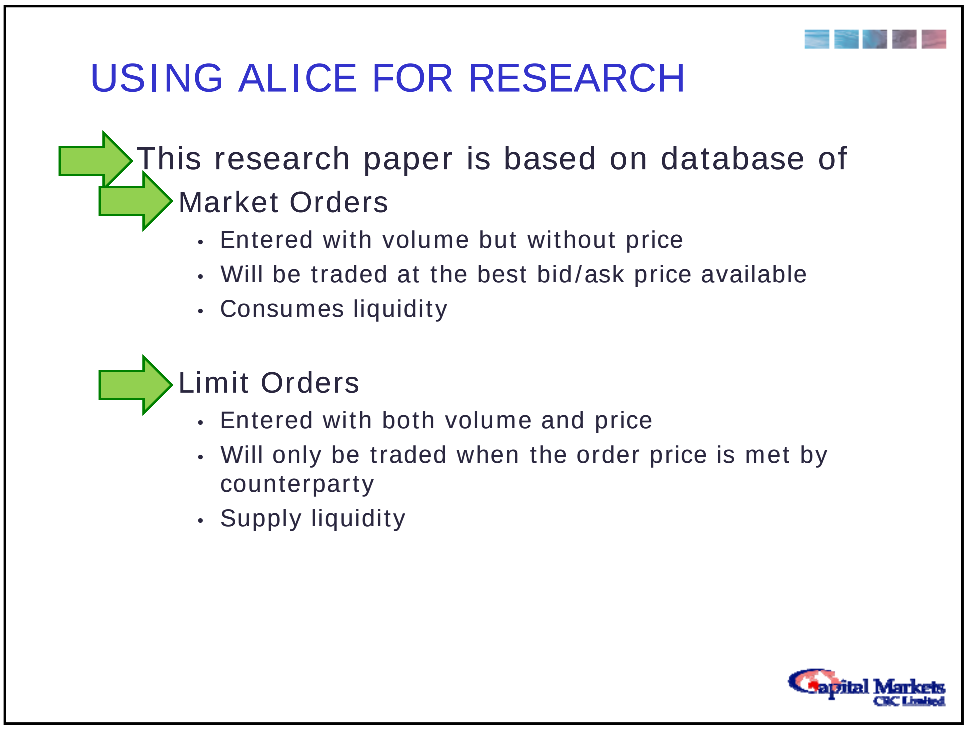


USING ALICE FOR RESEARCH

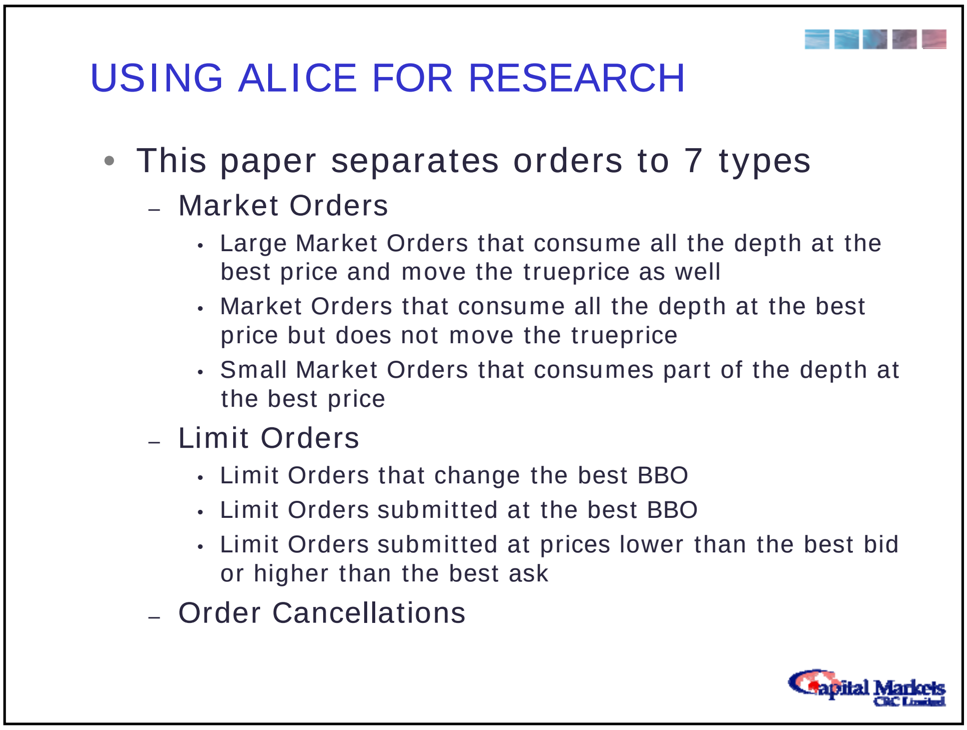
This research paper is based on database of

Market Orders

- Entered with volume but without price
- Will be traded at the best bid/ask price available
- Consumes liquidity

Limit Orders

- Entered with both volume and price
- Will only be traded when the order price is met by counterparty
- Supply liquidity



USING ALICE FOR RESEARCH

- This paper separates orders to 7 types
  - Market Orders
    - Large Market Orders that consume all the depth at the best price and move the trueprice as well
    - Market Orders that consume all the depth at the best price but does not move the trueprice
    - Small Market Orders that consumes part of the depth at the best price
  - Limit Orders
    - Limit Orders that change the best BBO
    - Limit Orders submitted at the best BBO
    - Limit Orders submitted at prices lower than the best bid or higher than the best ask
  - Order Cancellations

USING ALICE FOR RESEARCH

- We will learn

1) How to identify each of those 7 order types in ALICE
2) How to print details of orders from these 7 types into csv files
3) How to read in order detail csv files created in 2) and produce summary databases based on those csv files

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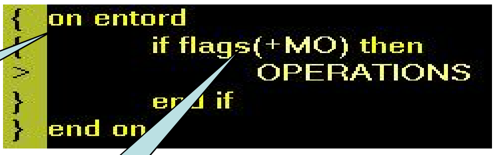
MARKET ORDERS

- In ALICE, we use flag MO to mark market orders
- The following function will return true if an order is a market order:

flags(+MO) = true for market order



```
on entord
        if flags(+MO) then
                OPERATIONS
        end if
end on
```

When Clause:
on entord

Check if it's a
market order

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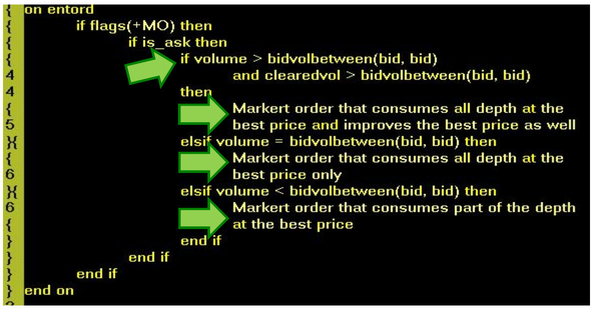
MARKET ORDERS

- How to check whether a market order will consume all the depth at the best price?
- ALICE function:
  - bidvolbetween(price, price)
  - askvolbetween(price, price)
  - clearedvol
- For market order that is an ask



```
on entord
        if flags(+MO) then
                if is_ask then
                        if volume > bidvolbetween(bid, bid)
                                and clearedvol > bidvolbetween(bid, bid)
                        then
                                Markert order that consumes all depth at the
                                best price and improves the best price as well
                        elsif volume = bidvolbetween(bid, bid) then
                                Markert order that consumes all depth at the
                                best price only
                        elsif volume < bidvolbetween(bid, bid) then
                                Markert order that consumes part of the depth
                                at the best price
                        end if
                end if
        end if
end on
```

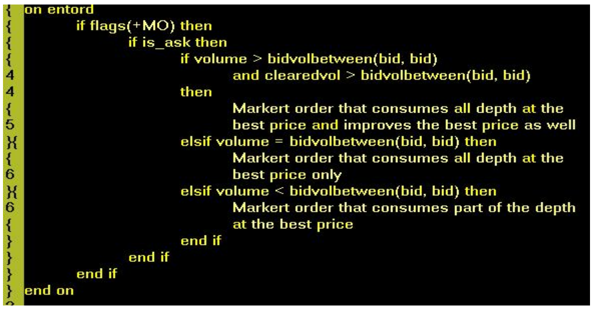
MARKET ORDERS

- How to check whether a market order will consume all the depth at the best price?
- ALICE function:
  - bidvolbetween(price, price)
  - askvolbetween(price, price)
  - clearedvol
- For market order that is an ask

Bid 1 $10 x500
Bid 2 $10 x300

Enter Market Order
Ask x 600

Clearedvol = x600



```
on entord
        if flags(+MO) then
                if is_ask then
                        if volume > bidvolbetween(bid, bid)
                                and clearedvol > bidvolbetween(bid, bid)
                        then
                                Markert order that consumes all depth at the
                                best price and improves the best price as well
                        elsif volume = bidvolbetween(bid, bid) then
                                Markert order that consumes all depth at the
                                best price only
                        elsif volume < bidvolbetween(bid, bid) then
                                Markert order that consumes part of the depth
                                at the best price
                        end if
                end if
        end if
end on
```

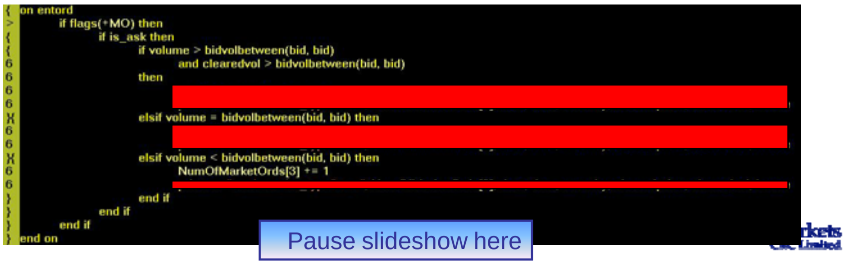
Exercise 2

- Now we need to print details of those market orders into csv files: number index, date, time, security, cleared price, cleared volume, broker
- Based on the following screenshot, fill in the parts highlighted in red with ALICE codes that will print the above market order details into three csv files with following names:

MarketOrder_Type1.csv
MarketOrder_Type2.csv
MarketOrder_Type3.csv

Assume we have declared the following variable

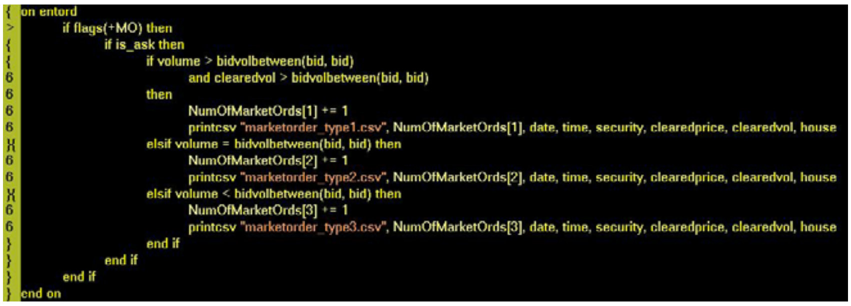
declare NumOfMarketOrds[number] : number



```
on entord
        if flags(+MO) then
                if is_ask then
                        if volume > bidvolbetween(bid, bid)
                                and clearedvol > bidvolbetween(bid, bid)
                        then


                        elsif volume = bidvolbetween(bid, bid) then


                        elsif volume < bidvolbetween(bid, bid) then
                                NumOfMarketOrds[3] += 1

                        end if
                end if
        end if
end on
```

Pause slideshow here

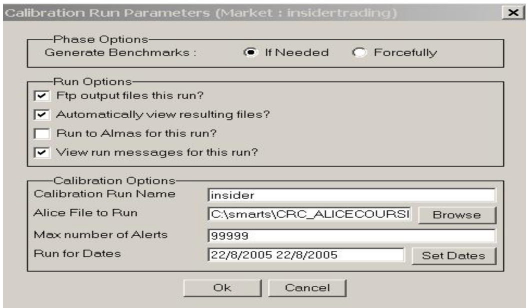
Exercise 2: Sample Solution



```
on entord
        if flags(+MO) then
                if is_ask then
                        if volume > bidvolbetween(bid, bid)
                                and clearedvol > bidvolbetween(bid, bid)
                        then
                                NumOfMarketOrds[1] += 1
                                printcsv "marketorder_type1.csv", NumOfMarketOrds[1], date, time, security, clearedprice, clearedvol, house
                        elsif volume = bidvolbetween(bid, bid) then
                                NumOfMarketOrds[2] += 1
                                printcsv "marketorder_type2.csv", NumOfMarketOrds[2], date, time, security, clearedprice, clearedvol, house
                        elsif volume < bidvolbetween(bid, bid) then
                                NumOfMarketOrds[3] += 1
                                printcsv "marketorder_type3.csv", NumOfMarketOrds[3], date, time, security, clearedprice, clearedvol, house
                        end if
                end if
        end if
end on
```

Exercise 2: Let run the solution

- Please make sure you select the following options from the Calibration Run Parameters Window:
  - Ftp Output files this Run
  - Automatically view resulting files



Calibration Run Parameters (Market : insidertrading)

Phase Options
Generate Benchmarks : ● If Needed ○ Forcefully

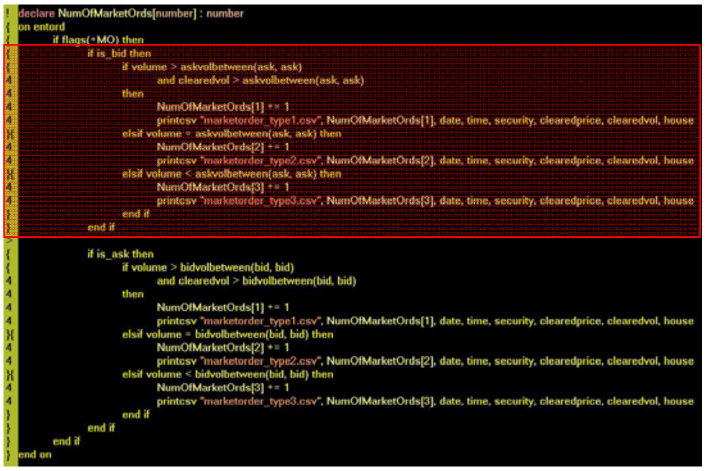
Run Options
☑ Ftp output files this run?
☑ Automatically view resulting files?
□ Run to Almas for this run?
☑ View run messages for this run?

Calibration Options
Calibration Run Name: insider
Alice File to Run: C:\smarts\CRC_ALICECOURSI
Max number of Alerts: 99999
Run for Dates: 22/8/2005 22/8/2005

- When the calibration run is finished, csv files will automatically open

MARKET ORDER

- Now let's apply the same logic to market orders that are bids

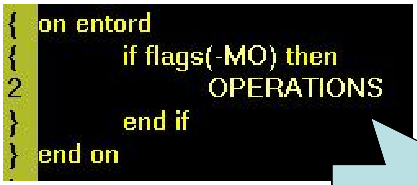


```
declare NumOfMarketOrds[number] : number
on entord
        if flags(+MO) then
                if is_bid then
                        if volume > askvolbetween(ask, ask)
                                and clearedvol > askvolbetween(ask, ask)
                        then
                                NumOfMarketOrds[1] += 1
                                printcsv "marketorder_type1.csv", NumOfMarketOrds[1], date, time, security, clearedprice, clearedvol, house
                        elsif volume = askvolbetween(ask, ask) then
                                NumOfMarketOrds[2] += 1
                                printcsv "marketorder_type2.csv", NumOfMarketOrds[2], date, time, security, clearedprice, clearedvol, house
                        elsif volume < askvolbetween(ask, ask) then
                                NumOfMarketOrds[3] += 1
                                printcsv "marketorder_type3.csv", NumOfMarketOrds[3], date, time, security, clearedprice, clearedvol, house
                        end if
                end if

                if is_ask then
                        if volume > bidvolbetween(bid, bid)
                                and clearedvol > bidvolbetween(bid, bid)
                        then
                                NumOfMarketOrds[1] += 1
                                printcsv "marketorder_type1.csv", NumOfMarketOrds[1], date, time, security, clearedprice, clearedvol, house
                        elsif volume = bidvolbetween(bid, bid) then
                                NumOfMarketOrds[2] += 1
                                printcsv "marketorder_type2.csv", NumOfMarketOrds[2], date, time, security, clearedprice, clearedvol, house
                        elsif volume < bidvolbetween(bid, bid) then
                                NumOfMarketOrds[3] += 1
                                printcsv "marketorder_type3.csv", NumOfMarketOrds[3], date, time, security, clearedprice, clearedvol, house
                        end if
                end if
        end if
end on
```

LIMIT ORDERS

- We use the MO flag to identify market orders, what about limit orders?
- Yes, orders without the MO flag are limit orders:

flags(-MO) = true for limit orders



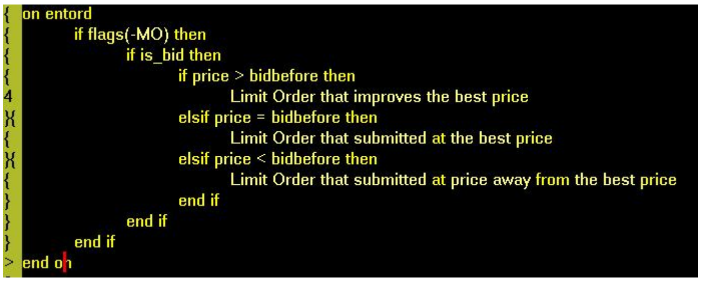
```
on entord
    if flags(-MO) then
        OPERATIONS
    end if
end on
```

You could also use:

If NOT flags(+MO)

LIMIT ORDERS

- How to check whether a limit order changes the best price?
- ALICE Function
  - Bidbefore
  - Askbefore
- For Limit Orders that are bids

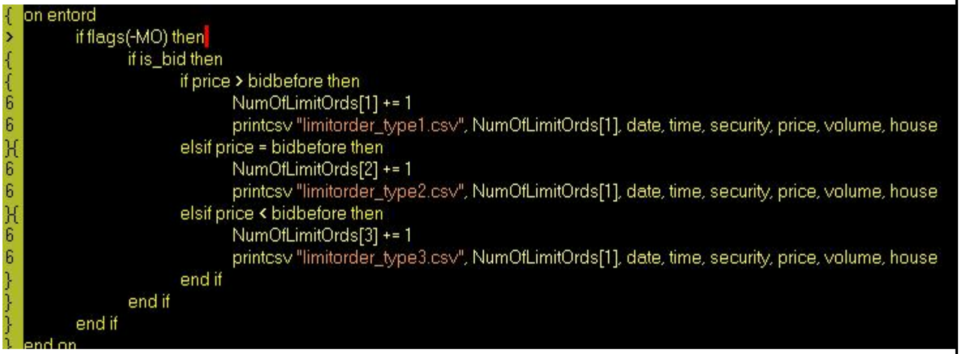


```
on entord
    if flags(-MO) then
        if is_bid then
            if price > bidbefore then
                Limit Order that improves the best price
            elsif price = bidbefore then
                Limit Order that submitted at the best price
            elsif price < bidbefore then
                Limit Order that submitted at price away from the best price
            end if
        end if
    end if
end on
```

LIMIT ORDERS

- Now let's print the following details of limit orders into csv files:

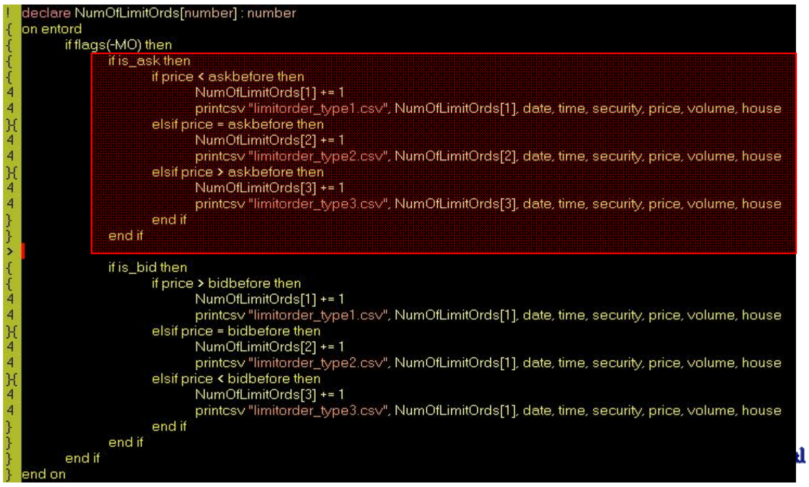
  number index, date, time, security, price, volume, broker



```
on entord
        if flags(-MO) then
                if is_bid then
                        if price > bidbefore then
                                NumOfLimitOrds[1] += 1
                                printcsv "limitorder_type1.csv", NumOfLimitOrds[1], date, time, security, price, volume, house
                        elsif price = bidbefore then
                                NumOfLimitOrds[2] += 1
                                printcsv "limitorder_type2.csv", NumOfLimitOrds[1], date, time, security, price, volume, house
                        elsif price < bidbefore then
                                NumOfLimitOrds[3] += 1
                                printcsv "limitorder_type3.csv", NumOfLimitOrds[1], date, time, security, price, volume, house
                        end if
                end if
        end if
end on
```

EXERCISE 3

- Now let's print the details of limit orders that are asks to csv files
- Here is the sample solution



```
declare NumOfLimitOrds[number] : number
on entord
        if flags(-MO) then
                if is_ask then
                        if price < askbefore then
                                NumOfLimitOrds[1] += 1
                                printcsv "limitorder_type1.csv", NumOfLimitOrds[1], date, time, security, price, volume, house
                        elsif price = askbefore then
                                NumOfLimitOrds[2] += 1
                                printcsv "limitorder_type2.csv", NumOfLimitOrds[2], date, time, security, price, volume, house
                        elsif price > askbefore then
                                NumOfLimitOrds[3] += 1
                                printcsv "limitorder_type3.csv", NumOfLimitOrds[3], date, time, security, price, volume, house
                        end if
                end if

                if is_bid then
                        if price > bidbefore then
                                NumOfLimitOrds[1] += 1
                                printcsv "limitorder_type1.csv", NumOfLimitOrds[1], date, time, security, price, volume, house
                        elsif price = bidbefore then
                                NumOfLimitOrds[2] += 1
                                printcsv "limitorder_type2.csv", NumOfLimitOrds[1], date, time, security, price, volume, house
                        elsif price < bidbefore then
                                NumOfLimitOrds[3] += 1
                                printcsv "limitorder_type3.csv", NumOfLimitOrds[1], date, time, security, price, volume, house
                        end if
                end if
        end if
end on
```

READ IN CSV FILES

- Finally, let's look at how to read in those csv files we just created for market orders and limit orders
- ALICE Function: read
  - Syntax: read "full file path", indx1, … indx t, array 1, … array N

E.g.,
declare Array1[number] : price
read "file.csv", number, Array1

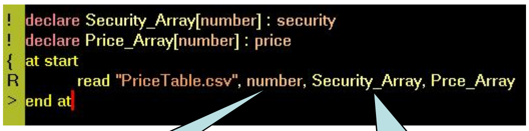
If you only specify the csv file name here, ALICE will use the default path

- Let see an example:

Suppose we have the following csv file

1	BHP	40.15
2	CVC	20.25
3	CIA	30.35
4	RIO	40.25
5	WES	12.35
6	VOD	40.95

To use ALICE to read in this table, we need to do:



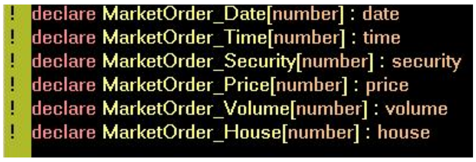
```
! declare Security_Array[number] : security
! declare Price_Array[number] : price
{ at start
R         read "PriceTable.csv", number, Security_Array, Prce_Array
> end at
```

In this case, we only have one index which is the first column from the csv and it's a number

The name of arrays are placed after the index. Remember, only the name of the array is needed

READ IN MarketOrder_Type3.csv

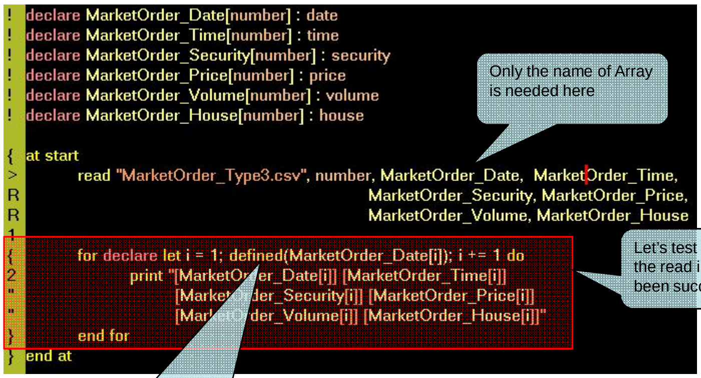
- Now let's try to read in MarketOrder_Type3.csv
- MarketOrder_Type3.csv contains
  - Column 1 Number Index
  - Column 2 Date
  - Column 3 Time
  - Column 4 Security
  - Column 5 Price
  - Column 6 Volume
  - Column 7 Broker
- Let's use column 1 as the index for arrays and declare 6 arrays for date, time, security, price, volume and broker



```
! declare MarketOrder_Date[number] : date
! declare MarketOrder_Time[number] : time
! declare MarketOrder_Security[number] : security
! declare MarketOrder_Price[number] : price
! declare MarketOrder_Volume[number] : volume
! declare MarketOrder_House[number] : house
```

READ IN MarketOrder_Type3.csv

- Csv file path: In this case, since LimitOrder_Type1.csv was stored at the default path, we only need to specify the file name for the read function.



```
declare MarketOrder_Date[number] : date
declare MarketOrder_Time[number] : time
declare MarketOrder_Security[number] : security
declare MarketOrder_Price[number] : price
declare MarketOrder_Volume[number] : volume
declare MarketOrder_House[number] : house

at start
        read "MarketOrder_Type3.csv", number, MarketOrder_Date,  MarketOrder_Time,
                                             MarketOrder_Security, MarketOrder_Price,
                                             MarketOrder_Volume, MarketOrder_House

        for declare let i = 1; defined(MarketOrder_Date[i]); i += 1 do
                print "[MarketOrder_Date[i]] [MarketOrder_Time[i]]
                       [MarketOrder_Security[i]] [MarketOrder_Price[i]]
                       [MarketOrder_Volume[i]] [MarketOrder_House[i]]"
        end for
end at
```

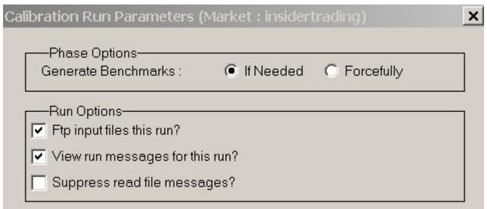
Only the name of Array is needed here

Let's test whether the read in has been successful

In this for loop, i is the row number from the csv file. The for loop will continue until it reaches the last row

READ IN MarketOrder_Type3.csv

- Now let's run this ALICE script
  - Make sure you select the Ftp Input Files this Run option

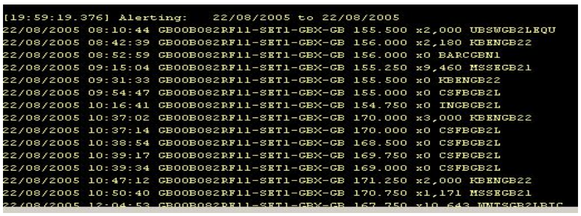


Calibration Run Parameters (Market : insidertrading)

Phase Options
Generate Benchmarks : ● If Needed ○ Forcefully

Run Options
☑ Ftp input files this run?
☑ View run messages for this run?
□ Suppress read file messages?

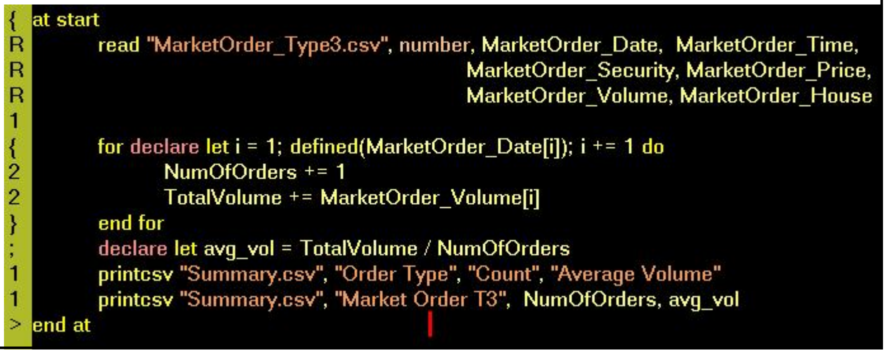
- You should observe the following outputs if you execute this previous ALICE Script



```
[19:59:19.376] Alerting:   22/08/2005 to 22/08/2005
22/08/2005 08:10:44 GB00B082RF11-SET1-GBX-GB 155.500 x2,000 UBSWGB2LEQU
22/08/2005 08:42:39 GB00B082RF11-SET1-GBX-GB 156.000 x2,180 KBENGB22
22/08/2005 08:52:59 GB00B082RF11-SET1-GBX-GB 156.000 x0 BARCGBN1
22/08/2005 09:15:04 GB00B082RF11-SET1-GBX-GB 155.250 x9,460 MSSEGB21
22/08/2005 09:31:33 GB00B082RF11-SET1-GBX-GB 155.500 x0 KBENGB22
22/08/2005 09:54:47 GB00B082RF11-SET1-GBX-GB 155.000 x0 CSFBGB2L
22/08/2005 10:16:41 GB00B082RF11-SET1-GBX-GB 154.750 x0 INGBGB2L
22/08/2005 10:37:02 GB00B082RF11-SET1-GBX-GB 170.000 x3,000 KBENGB22
22/08/2005 10:37:14 GB00B082RF11-SET1-GBX-GB 170.000 x0 CSFBGB2L
22/08/2005 10:38:54 GB00B082RF11-SET1-GBX-GB 168.500 x0 CSFBGB2L
22/08/2005 10:39:17 GB00B082RF11-SET1-GBX-GB 169.750 x0 CSFBGB2L
22/08/2005 10:39:34 GB00B082RF11-SET1-GBX-GB 169.000 x0 CSFBGB2L
22/08/2005 10:47:12 GB00B082RF11-SET1-GBX-GB 171.250 x2,000 KBENGB22
22/08/2005 10:50:40 GB00B082RF11-SET1-GBX-GB 170.750 x1,171 MSSEGB21
22/08/2005 12:04:53 GB00B082RF11-SET1-GBX-GB 167.750 x10,643 NWTSGB2LBIC
```

Exercise 4

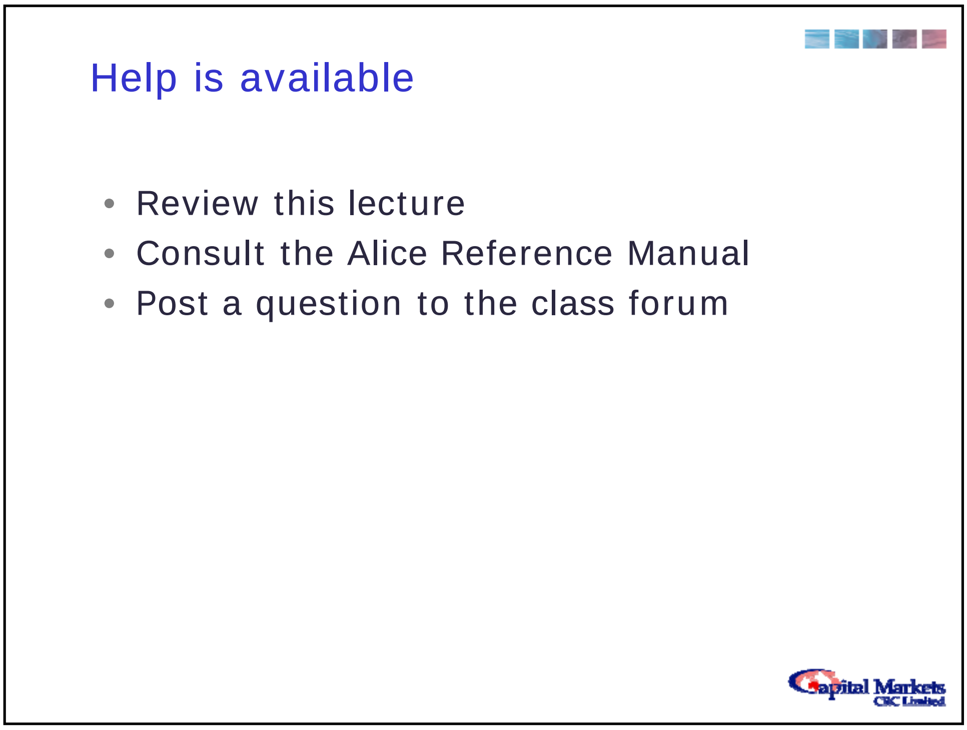
- Now, let create a new csv file that contains
  - The number of orders for each type
  - The average volume of orders for each order type
- You only need to print out the above statistics for Market Order Type 3 now
- Here is the sample solution



```
at start
        read "MarketOrder_Type3.csv", number, MarketOrder_Date,  MarketOrder_Time,
                                             MarketOrder_Security, MarketOrder_Price,
                                             MarketOrder_Volume, MarketOrder_House

        for declare let i = 1; defined(MarketOrder_Date[i]); i += 1 do
                NumOfOrders += 1
                TotalVolume += MarketOrder_Volume[i]
        end for
        declare let avg_vol = TotalVolume / NumOfOrders
        printcsv "Summary.csv", "Order Type", "Count", "Average Volume"
        printcsv "Summary.csv", "Market Order T3",  NumOfOrders, avg_vol
end at
```

Key terms and concepts

- Insider Trading Alert
- DAYTOT benchmarking
- On info
- Tick & tickdiff
- Suspect broker
- Market Order and Limit Order
- bidbefore & askbefore
- Cleared Volume



Help is available

- Review this lecture
- Consult the Alice Reference Manual
- Post a question to the class forum