# Stock Exchange Database

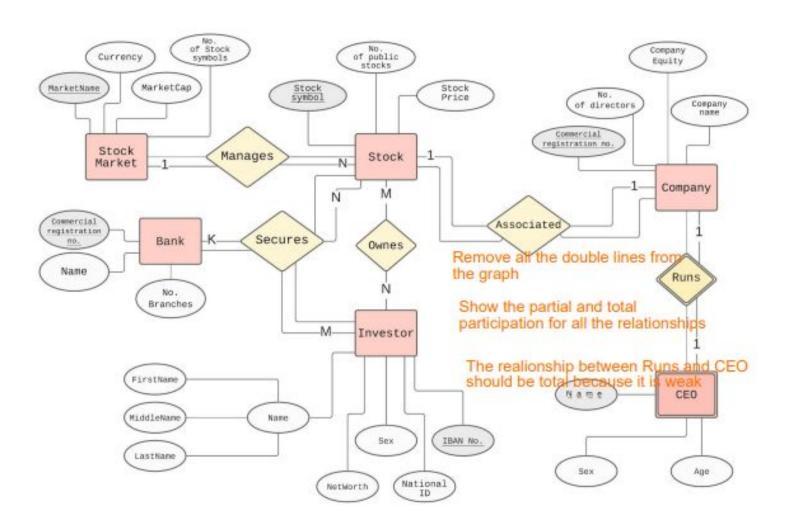
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### Old ERD

### Entity Relationship Diagram (ERD)



### Introduction

In simple terms, the **Stock Exchange Market** (or Stock Market for short) is a market in which companies sell stocks (i.e. shares) to investors.

Concretely, companies must acquire money to finance their expansion and growth, companies do that by selling what's called a *stock*, which is, stocks are traded to *Investors*.

Companies rely on a *Stock Market* to moderate and manage the transactions and security of their stocks. In Saudi Arabia, the only existing stock market is called *Tadawul* (בועל) and it moderates 202 different stocks identified by their *Stock Symbol* (e.g. *Othaim Markets* Stock symbol is *4001*).

A company may sell a number of stocks publicly through Tadawul, and a *Bank* which processes the money exchange from investors. The person in charge of deciding whether a company sells stocks or not is usually the *CEO* of the company.

So the database we're aiming to build should enable the management of the stock market via secure transactions between companies, investors, and banks.

### Objectives

- Manage company stocks by building a database to store stock data (Company associated with Stock, number of stocks, etc.)
- Accelerate the trade of stocks by systematizing the process online via a database (In the past trading was not done over the internet)
- Securely trade stocks between companies and investors

### Data requirements

- Stock Market's name, market cap, currency
- Info about a Company's name, commercial registration number (رقم السجل التجاري) is collected as well as info about the CEO of the company
- In each transaction, we should store the Investor info such as his name and IBAN, along with the Stock he bought (identified by its stock symbol) and the Bank that made this transaction. This is to ensure secure trade among parties

#### **Functions**

- Display a Stock's data (e.g. price, no. of available Stock)
- Display a Company's data to investors (e.g. Company Equity, CEO data, etc.)
- Process buy and sell transactions
- Add new Companies, Stocks, Investors, etc
- Delete Companies, Stocks, Investors, etc
- Keep track of each Stock's data and update it periodically

#### Entities and attributes

- Stock Market is identified by Name. Currency, market cap, and number of stock symbols are also recorded
- Stock is identified by Stock symbol. Number of public stocks, stock price are also recorded
- Investor is identified by IBAN No. Networth, ID, sex, age, name are also recorded.
- Company is identified by Commercial registration number. Company equity, company name, number of directors are also recorded
- Bank is identified by Commercial registration number.
   name, number of branches are also recorded
- The CEO is identified by Name. Sex, age are also recorded

Red	Primary Key
Green	Composite Attribute
Yellow	Partial Key

### Relationships

- Stock Market has a relationship Manage with Stock (1-m)
- Company has a relationship Run by with CEO (1-1)
- Company has a relationship Associated with Stock (1-1)
- Stock has a relationship Owned with Investor (n-m)
- Stock has a relationship Secures with Bank (n-m)
- Investors has a relationship Secures with Bank (n-m)

### Business rules

#### Constraints

- The CEO can't run more than one Company
- Company can't be associated with more than one Stock
- Stock can only be managed by one Stock Market

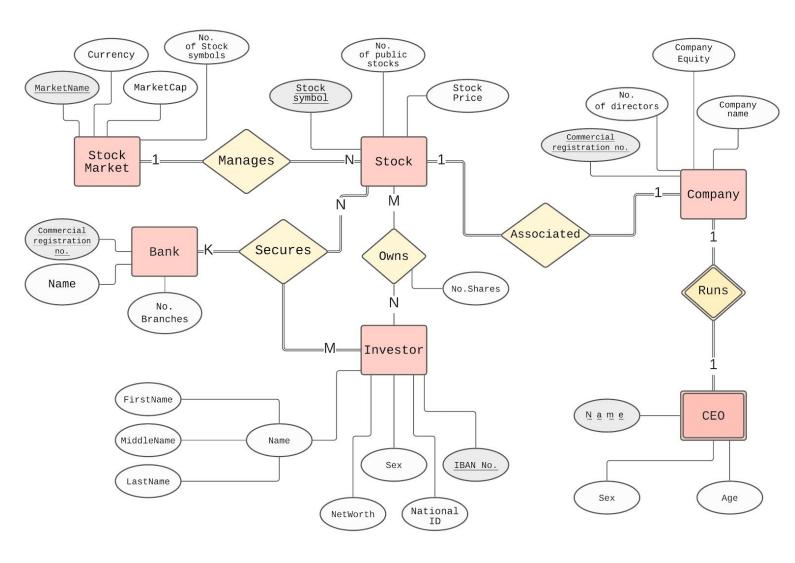
### Participation

- Stock Market totally participate in manage
- Stock totally participate in manage
- Stock totally participate in secures
- Stock totally participate in associate
- Stock partially participate in own
- Company totally participate in associate
- Company totally participate in run
- CEO totally participate in run
- Investors totally participate in secures
- Investors partially participate in own
- Bank totally participate in secures

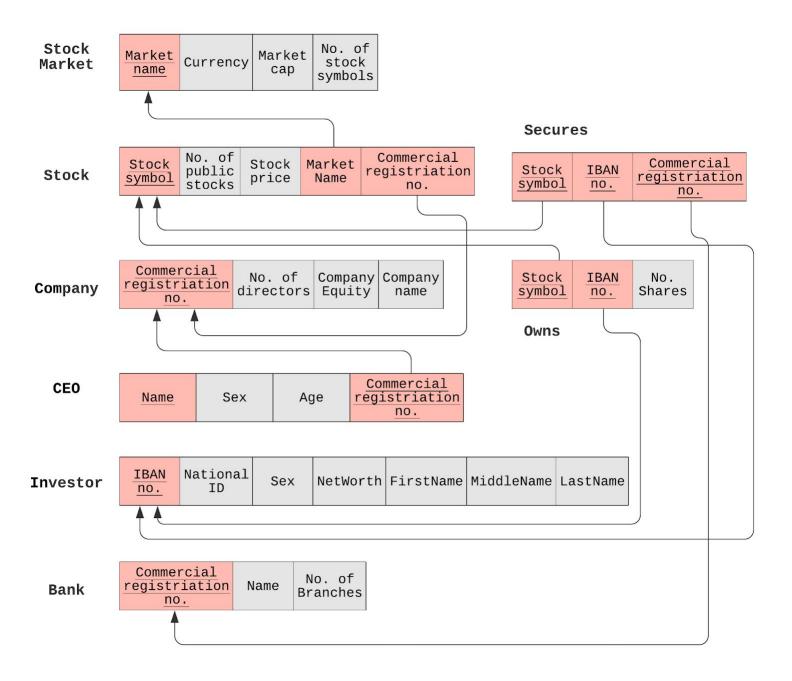
### Queries

1	SELECT ALL <b>INVESTORS</b> WITH NETWORTH > 420 MILLION RIYALS
2	SELECT ALL STOCKS WITH NO. PUBLIC STOCKS < 2000
3	DISPLAY LAST NAME OF <b>INVESTOR</b> WITH IBAN NO. NL12RAB08139718173
4	SELECT ALL INVESTORS WHO ARE SECURED BY BANKS WITH COMMERCIAL REGISTRATION NO. 1110001116
5	SELECT ALL INVESTORS WHO OWN STOCK WITH STOCK SYMBOL 4001
6	LIST ALL <b>COMPANIES</b> WITH <b>STOCK</b> WITH STOCK PRICE > 103.5
7	LIST ALL <b>STOCKS</b> ASSOCIATED WITH <b>COMPANIES</b> THAT HAS MINIMUM NO. OF DIRECTORS OF 3
8	LIST ALL BANKS WHO SECURE INVESTORS WITH OWNED STOCK WITH STOCK SYMBOL 4161
9	SELECT ALL CEOS WHO RUN COMPANIES WHICH ARE ASSOCIATED WITH STOCK WITH STOCK PRICE < 200
10	SELECT ALL MALE CEOS THAT RUN COMPANIES ASSOCIATED WITH STOCKS OWNED BY INVESTORS WHOSE NETWORTH IS OVER 50,000

## Entity Relationship Diagram (ERD)



### Relational Model Diagram



### Implementation Using SQL

#### Add:

We can see that the Stock\_Market table has the market *Tadawul*, let's try **Adding a an existing tuple** 

Market_Name	Currency	Market_Cap_in_trillion	Number_Of_Stock_Symbols
Euronext	EUR	4.52	1462
NASDAQ	USD	1.72	8100
Shanghai Stock Exchange	CNY	5.01	1041
Tadawul	SAR	2.19	202
Tokyo Stock Exchange	JPY	5.67	2292

The database returned an error, saying *Tadawul* already exists, we know addition is functioning properly

mysql> insert into stock\_market(Market\_Name ,Currency , Market\_Cap\_in\_trillion , Number\_Of\_Stock\_Symbols) values ("Tadawul" , "KUW" , 1.4 , 839); ERROR 1062 (23000): Duplicate entry 'Tadawul' for key 'stock\_market.PRIMARY'

#### Delete:

We can see that the tables <code>Stock\_Market</code>, <code>Stock</code> and <code>Owns</code> are displaying data, let's try to delete the stock market <code>Tadawul</code> and see if stocks related to it will <code>cascade delete</code>. For reference keep an eye for the first two stock in the <code>Stock</code> table, they should be deleted

Market_Name		Currency	Market_Cap_in_	trillion	Numl	ber_Of_Stock_Symbols	
Euronext NASDAQ Shanghai Stock Exchange Tadawul Tokyo Stock Exchange		EUR   USD   CNY   SAR   JPY		4.52   1.72   5.01   2.19   5.67		1462   8100   1041   202   2292	
rows in set (	0.00 sec)	++				+	
/sql> select *	from stock	;					
Stock_Symbol	Number_Of	_Public_Stoc	ks_in_thousand	Stock_Pr	ice	Market_Name	Commercial_Registration_Number
2010 2222 4001 4161 AMZN GOOGL HKG NOKIA			660000 940699 215350 297472 500890 28988 274500 988089	35 7250 7301 3185 1787 269	.90	Tokyo Stock Exchange Tokyo Stock Exchange NASDAQ NASDAQ Shanghai Stock Exchange	8857232768 5315073274 4001894494 6229087803 4457756495 8643657928 6713620014 1792169223
SPC VOW3			1501 295089	301	.00	Shanghai Stock Exchange	5098220895   9598342161
<pre>7 rows in set ( 7 ysql&gt; select * 7 Stock_Symbol</pre>	from owns;	er	Number	 _0f_Shares			
	+ CH4250514						
2010 2010 2222 2222 2222	CH75505153 CH75505153 DE16500103 SA21252676	162589388976 162589388976 517452954624 688145539388	886   886   5   743	39 504 48 91 1			
2010 2222 2222 2222 4001 4001 4001 4161 4161	CH7550515: CH7550515: DE16500109: SA21252676 JP82175696 NL12RAB08: US3419225: CH4250514: JP82175696	162589388976 162589388976 517452954624 688145539388 900409139544 13971873 53675553244 369317289437	886   886   5   743   63245     157   63245	504 48 91 1 73 163 16 1323 99			
2010 2222 2222 2222 4001 4001 4001 4161	CH7550515: CH7550515: DE1650010: SA2125267( JP8217569( NL12RAB08: US3419225: CH4250514: JP8217569( SA2125267( NL12RAB08: US3419225: NL12RAB08:	162589388976 162589388976 517452954624 688145539388 900409139544 13971873 53675553244 369317289437 900409139544 688145539388 13971873 41519999339 53675553244	886   886	504 48 91 1 73 163 16 1323			

mysql> delete from stock\_market where Market\_Name="Tadawul"; Query OK, 1 row affected (0.06 sec)

We can see that from the picture below, our cascade delete was successful in deleting all tuples that possess a foreign key of *Tadawul* 

Market_Name		Currency	Market	_Cap_in_t	trillion	Numb	ber_Of_Stock_Symbols	
Euronext		EUR	1		4.52	Ī	1462	
NASDAQ		USD			1.72	ļ	8100	
Shanghai Stock		CNY			5.01		1041	
Tokyo Stock E	xchange	JPY			5.67		2292	
rows in set (	0.00 sec)	•				, , , , , ,		
/sql> select *	from stock							
Stock_Symbol	+   Number_Of	_Public_Sto	cks_in_t	thousand	Stock_P	rice	Harket_Name	Commercial_Registration_Number
4001				215350	7250	0.00	+   Tokyo Stock Exchange	4001894494
4161				297472	7303	1.00	Tokyo Stock Exchange	6229087803
AMZN				500890	318	5.00	NASDAQ	4457756495
G00GL				289886		7.00	NASDAQ	8643657928
HKG				274500		9.00	Shanghai Stock Exchange	6713620014
NOKIA	ļ			988089		3.42	Euronext	1792169223
SPC	ļ			1501	30.	1.00	Shanghai Stock Exchange	5098220895
rows in set (				295089 	149	9.08	Euronext +	9598342161 +
VOW3  rows in set (( /sql> select *	from owns;				149		Euronext 	9598342161 +
rows in set (( /sql> select *	from owns;    IBAN_numb	er 	162215		of_Shares		Euronext	9598342161 +
rows in set (( /sql> select *	from owns;     IBAN_numb     JP8217569	er  00040913954	463245		 Of_Shares 73		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001	from owns;     IBAN_numb     JP8217569	 er  00040913954 13971873	į		of_Shares 73		Euronext	9598342161
rows in set (( /sql> select *	from owns;     IBAN_numb     JP8217569   NL12RAB08   US3419225	er  00040913954			 Of_Shares 73		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001	from owns;   IBAN_numb   JP8217569   NL12RAB08   US3419225   CH4250514	er  00040913954 13971873 53675553244	7157		73 163		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001 4001 4161	from owns;   IBAN_numb   JP8217569   NL12RAB08   US3419225   CH4250514   JP8217569		7157 463245		73 163 163		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001 4001 4161	from owns;   IBAN_numb   JP8217569   NL12RAB08   US3419225   CH4250514   JP8217569		7157 463245		0f_Shares 73 163 16 1323		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001 4161 4161 4161 4MZN AMZN	IBAN_numb   IBAN_numb   JP8217569   NL12RAB08   US3419225   CH4250514   JP8217569   SA2125267   NL12RAB08   US2812645		7157 463245 8743		0f_Shares 73 163 16 1323 99 2 40		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001 4001 4161 4161 4161 AMZN AMZN	from owns;   IBAN_numb   JP8217569    NL12RAB08   US3419225    CH4250514   JP8217569    SA2125267    NL12RAB08   US3812645    US3419225	er 	7157 463245 8743		73 163 166 1323 99 2 400 420		Euronext	9598342161
rows in set (( /sql> select *	from owns;   IBAN_numb   JP8217569   NL12RAB08   US3419225   CH4250514   JP8217569   SA2125267   NL12RAB08   US3419225   NL12RAB08		7157 463245 18743		75 Shares 73 163 163 123 99 2 40 420 321 861		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001 4161 4161 4161 4MZN AMZN AMZN GOOGL GOOGL	From owns; IBAN_numb- NL12RAB08 US3419225 CH4250514 JP8217569 SA2125267 NL12RAB08 US2812645- US2812645- US3419225 NL12RAB08 SA4038369		7157 463245 18743		73 163 16 1323 99 2 40 420 321 861		Euronext	9598342161
rows in set (6/sql> select * Stock_Symbol 4001 4001 4001 4161 4161 4161 4161 AMZN AMZN 6006L 6006L 6006L	TBAN_numb   TBAN_numb   TBAN_17569   NL12RAB08   US3419225   CH4250514   JP8217569   SA2125267   NL12RAB08   US2812645   US3419225   NL12RAB08   US3419225   NL12RAB08   US3419225	er	7157 463245 8743 9462		73 163 16 1323 99 2 40 420 321 861 34		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001 4061 4161 4161 4161 AMZN AMZN AMZN GOOGL GOOGL GOOGL HKG	from owns;    IBAN_numb    IBAN_17569    NL12RAB08     US3419225    CH4250514     JP8217569    SA2125267    NL12RAB08     US3419225    NL12RAB08     SA4038369    US3419225    JP6010096	00040913954 13971873 53675553244 36931728943 00040913954 68814553938 13971873 4151999339 53675553244 13971873 11611343396 53675553244	9462 6457 <b>04</b>		73 163 16 1323 99 2 40 420 321 861 34 266 9		Euronext	9598342161
rows in set (( /sql> select *	IBAN_numb   IBAN_numb   NL12RAB08   US3419225   CH4250514   JP8217569   SA2125267   NL12RAB08   US2812645   US3419225   NL12RAB08   SA4038369   US3419225   JP6010096   JP8217569		7157 463245 8743 9462 645704 463245		73 163 16 123 99 2 40 420 321 861 34 26 9		Euronext	9598342161
rows in set (( /sql> select * Stock_Symbol 4001 4001 4061 4161 4161 4161 AMZN AMZN AMZN GOOGL GOOGL GOOGL HKG	IBAN_numb   IBAN_numb   NL12RAB08   US3419225   CH4250514   JP8217569   SA2125267   NL12RAB08   US2812645   US28	00040913954 13971873 53675553244 36931728943 00040913954 68814553938 13971873 4151999339 53675553244 13971873 11611343396 53675553244			73 163 16 1323 99 2 40 420 321 861 34 266 9		Euronext	9598342161
rows in set (( /sql> select *  Stock_Symbol  4001 4001 4161 4161 4161 AMZN AMZN AMZN GOOGL GOOGL GOOGL HKG HKG HKG	IBAN_numb   IBAN				73 163 16 1323 99 2 40 420 321 861 34 26 9 1942 32		Euronext	9598342161
rows in set (6 /sql> select * Stock_Symbol 4001 4001 4001 4161 4161 4161 AMZN AMZN GOOGL GOOGL GOOGL HKG HKG HKG NOKIA	from owns;    IBAN_numb    IBAN_17569    NL12RAB08     US3419225    CH4250514     JP8217569    SA2125267     NL12RAB08     US3419225     NL12RAB08     US3419225     NL12RAB08     US3419225     JP6010096     JP8217569     SA4038369     US4038369     US403	00040913954 13971873 36931728943 36931728943 360040913954 68814553938 13971873 41519999339 53675553244 13971873 11611343396 53675553244 00050571982 00050571982			73 163 16 1323 99 2 40 321 861 34 26 9 1942		Euronext	9598342161

### Update:

Let's try and update a foreignkey and see if our database will cascade update. Let's update *Tadawul* to *Saudi\_Tadawul* and update the stock symbol "2222" to "1111"

Market_Name		Currency	Market_Ca	p_in_t	trillion   N	Numbe	er_Of_Stock_Symbols	
Euronext		EUR			4.52		1462	
NASDAQ		USD			1.72		8100	
Shanghai Stock	k Exchange	CNY	Ĭ.		5.01		1041	
Tadawul		SAR	Ĭ		2.19		202	
Tokyo Stock Ex	xchange	JPY	<u>l</u>		5.67		2292	
rows in set (0	0.00 sec)		+				+	
/sql> select *	from stock;							
Stock_Symbol	Number_Of_	_Public_Sto	cks_in_thou	sand	Stock_Pric	ce	Market_Name	Commercial_Registration_Number
2010			66	0000	96.6	00	Tadawul	8857232768
2222	l e		94	0699	35.9	90	Tadawul	5315073274
4001			21	5350	7250.0		Tokyo Stock Exchange	4001894494
4161			29	7472	7301.6	00	Tokyo Stock Exchange	6229087803
AMZN			50	0890	3185.6		NASDAQ	4457756495
GOOGL	l .		28	9886	1787.6		NASDAQ	8643657928
HKG	l		27	4500	269.6	00	Shanghai Stock Exchange	6713620014
NOKIA	l		98	8089	3.4	42	Euronext	1792169223
SPC	ľ			4504	301.0	aa I	Shanghai Stock Exchange	5098220895
3FC	l.			1501	301.6	00	Shanghai Stock Exchange	3096220693
VOW3	(0.00 sec)			1501 5089 	301.0   149.0		Euronext	9598342161
VOW3   	from owns;	 :r	29 	5089				
VOW3   ) rows in set ( /sql> select * Stock_Symbol	from owns; +   IBAN_numbe +		29    Nu	5089	149.0			
VOW3   ) rows in set ( /sql> select * Stock_Symbol   2010	from owns; +   IBAN_numbe +    CH42505143	86931728943	29    Nu 	5089	149.0			
VOW3   ) rows in set ( /sql> select * Stock_Symbol   2010   2010	from owns; +		29 	5089	149.0			
VOW3	from owns; +		29   Nu   Nu   7157     6886     5886	5089	149.6			
VOW3	from owns; 	36931728943 36931728943 36258938897 36258938897 31745295462	29   Nu   Nu   No   Nu   No   No   No   No   No   No   No   No	5089	149.6 			
VOW3   ) rows in set ( /sql> select *  Stock_Symbol   2010   2010   2222   2222   2222	from owns;   IBAN_numbe 	6931728943 6258938897 6258938897 61745295462 68814553938	29   Nu   Nu   7157     5886     5886     45     8743	5089	149.6 Of_Shares   39   504   48   91   1			
VOW3	from owns; 	6931728943; 6931728943; 62589388976 62589388976 617452954624 688145539388	29   Nu   Nu   7157     5886     5886     45     8743	5089	149.6 			
VOW3	from owns; 	6931728943; 6931728943; 62589388976 62589388976 617452954624 688145539388	29   Nu   Nu   7157     5886     5886     45     8743	5089	149.6 Df_Shares   39   504   48   91   1   73			
VOW3	IBAN_numbe 	6931728943; 62589388976 62589388976 617452954624 688145539386 600409139544	29   Nu   Nu   7157     5886     5886     45     8743     463245	5089	149.6 			
VOW3	IBAN_numbe   IBAN_numbe   CH42505143   CH75505151   DE16500105   SA21252676   JP82175690   NL12RAB081   US34192255   CH42505143	6931728943; 62589388976 62589388976 617452954624 688145539388 600409139544 63675553244	29   Nu   Nu   Ni   Ni   Ni   Ni   Ni   Ni	5089	149.6  Of_Shares    39   504   48   91   1   73   163   16			
VOW3	from owns; 	36931728943 362589388976 31745295462 36814553938 30040913954 3971873 3675553244 36931728943	29   Nu   Nu   Nu   Nu   Nu   Nu   Nu   Nu	5089	39   504   48   91   1   73   163   16   1323			
VOW3	from owns; 	16931728943: 162589388976 162589388976 17452954624 1688145539388 1690409139544 13971873 13675553244 16931728943: 160409139544 1688145539388	29   Nu   Nu   Nu   Nu   Nu   Nu   Nu   Nu	5089	39   504   48   91   1   73   163   163   1323   99			
VOW3	IBAN_numbe 	16931728943: 162589388976 162589388976 17452954624 1688145539388 1690409139544 13971873 13675553244 16931728943: 160409139544 1688145539388	29   Nu   Nu   Nu   Nu   Nu   Nu   Nu   Nu	5089	149.6  Of_Shares   39   504   48   91   1   73   163   16   1323   99   2			
VOW3	IBAN_numbe   IBAN_numbe   CH42505143   CH75505151   DE16500105   SA21252676   JP82175690   NL12RAB081   US34192255   CH42505143   JP82175690   SA21252676   NL12RAB081   US28126454	16931728943; 162589388976; 162589388976; 17452954624; 188145539384; 1690469139544; 16931728943; 16931728943; 16931728943; 188145539384; 18971873	29   Nu   Nu   Nu   Nu   Nu   Nu   Nu   Nu	5089	149.6 Df_Shares   39   564   48   91   1   73   163   16   1323   99   2   40			
VOW3	IBAN_numbe   IBAN_numbe   CH42505143   CH75505151   DE16500105   SA21252676   JP82175690   NL12RAB081   US34192255   CH42505143   JP82175690   SA21252676   NL12RAB081   US28126454	16931728943 16258938897( 16258938897( 17452954624 188145539381 1890409139544 18931728943 180409139544 188145539381 13971873 11519999339 13675553244	29   Nu   Nu   Nu   Nu   Nu   Nu   Nu   Nu	5089	149.6 Of_Shares   39   504   48   91   1   73   163   16   1323   99   2   40   420			
VOW3	IBAN_numbe CH42505143 CH75505151 CH75505151 DE16500105 SA21252676 NL12RAB081 US34192255 CH42505143 JP82175690 SA21252676 NL12RAB081 US28126454 US34192255 NL12RAB081	16931728943 16258938897( 16258938897( 17452954624 188145539381 1890409139544 18931728943 180409139544 188145539381 13971873 11519999339 13675553244	29	5089	149.6  Of_Shares    504    48    91    1    73    163    16    1323    99    2    40    420    321			

```
mysql> update stock_market set Market_Name="Saudi_Tadawul" where Market_Name="Tadawul";
Query OK, 1 row affected (0.01 sec)
Rows matched: 1 Changed: 1 Warnings: 0

mysql> update stock set Stock_Symbol="1111" where Stock_Symbol="2222";
Query OK, 1 row affected (0.01 sec)
Rows matched: 1 Changed: 1 Warnings: 0
```

We can see that the database preformed cascade update successfully

Market Name		Currency	Market	Can in t	trillion	Numb	per Of Stock Symbols	
			nai kcc	_cap_in_i			+	
Euronext		EUR			4.52		1462	
NASDAQ	1	USD			1.72		8100	
Saudi_Tadawul		SAR			2.19		202	
Shanghai Stock		CNY			5.01		1041	
Tokyo Stock Ex	kchange	JPY			5.67		2292	
rows in set (0	0.00 sec)							
ysql> select *	from stock;							
Stock_Symbol	Number_Of_	_Public_Stoc	ks_in_tl	housand	Stock_Pr	ice	Market_Name	Commercial_Registration_Number
1111	i			940699	3:	.90	Saudi_Tadawul	5315073274
2010				660000	96	5.00 j	Saudi_Tadawul	8857232768
4001				215350	7250	00.0	Tokyo Stock Exchange	4001894494
4161				297472	7303	1.00	Tokyo Stock Exchange	6229087803
AMZN				500890	3185	00	NASDAQ	4457756495
G00GL				289886	1787	7.00	NASDAQ	8643657928
						69.00   Shanghai Stock Exchange		
HKG	İ			274500	269	00.e	Shanghai Stock Exchange	6713620014
HKG   NOKIA				274500 988089		0.00   3.42	Shanghai Stock Exchange   Euronext	6713620014   1792169223
NOKIA				988089	301	3.42	Euronext	1792169223
NOKIA   SPC   VOW3	(0.00.500)			988089 1501	301	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC	(0.00 sec)			988089 1501	301	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   7 rows in set (				988089 1501	301	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   7 rows in set (	from owns;			988089 1501 295089	301	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   7 rows in set (	from owns;    IBAN_numbe		+    +	988089 1501 295089	30:   30:   14:	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA SPC VOW3 Frows in set ( ysql> select * Stock_Symbol	from owns;     IBAN_numbe      CH75505151			988089 1501 295089	30:   30:   14: 	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA SPC VOW3 Prows in set ( ysql> select * Stock_Symbol	from owns;      IBAN_numbe     CH75505151   DE16500105	 162589388976	15	988089 1501 295089	: 30:   30:   14! 	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA SPC VOW3 Prows in set ( ysql> select * Stock_Symbol   1111 1111	from owns; IBAN_numbe CH75505151 DE16500105		5 743	988089 1501 295089	:   30:   14! 	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA SPC VOW3 Prows in set ( /sql> select * Stock_Symbol   1111 1111 1111	from owns; IBAN_numbe CH75505151 DE16500105 SA21252676 CH42505143		5   3743   7157	988089 1501 295089		3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   Prows in set ( /sql> select * Stock_Symbol	from owns; IBAN_numbe  CH75505151 DE16500109 SA21252676 CH42505143 CH75505151		5   3743   7157   5886	988089 1501 295089		3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   Prows in set (	from owns; IBAN_numbe  CH75505151 DE16500109 SA21252676 CH42505143 CH75505151		5   3743   7157   5886	988089 1501 295089	30; 30; 149; 	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   3   3   7   7   7   7   7   7   7	from owns;  IBAN_numbe  CH75505151  DE16500105  SA21252676  CH42505143  JP82175696  NL12RAB081		5   3743   7157   5886	988089 1501 295089		3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   Prows in set ( /sql> select * Stock_Symbol   1111	IBAN_numbes IBAN_numbes CH75508151 DE16500109 SA21252676 CH42505143 CH75508151 JP82175696 N1.12RAB081 US34192259		3743   3743   7157   3886   463245	988089 1501 295089	505 505 505 505 505 505 506 506 506 506	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   Prows in set ( rsql> select * Stock_Symbol   1111   1111   1111   1111   12010   2010   4001	from owns; IBAN_numbe CH75505151 DE16500103 SA21252676 CH42505143 CH75505151 JP82175696 NL12RAB081 US34192255 CH42505143	262589388976 2617452954624 2688145539388 269317289437 262589388976 200409139544 23971873 23675553244	25   2743   2157   2886   263245   1	988089 1501 295089	20f_Shares 	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   Prows in set ( /sql> select *	from owns;  IBAN_numbe  CH75505151  DE16500105  SA21252676  CH4250514:  CH75505151  JP82175696  NL12RAB081  US34192255  CH4250514:  JP82175696	162589388976 17452954624 188145539388 16931728938 16938976 160589388976 160409139544 13971873 13675553244 1369317289437	55   6743   7157   6886   63245   7157   63245	988089 1501 295089	30, 149, 149, 149, 149, 163, 163, 164, 1323	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA SPC VOW3 Prows in set ( /sql> select * Stock_Symbol    1111 1111 1111 1111 12010 2010 4001 4001	from owns;  IBAN_numbe  CH75505151  DE16500105  SA21252676  CH4250514:  CH75505151  JP82175696  NL12RAB081  US34192255  CH4250514:  JP82175696	.62589388976 17452954624 588145539388 569317289437 162589388976 100409139544 13971873 13675553244 169317289437 100409139546 588145539388	55   6743   7157   6886   63245   7157   63245	988089 1501 295089	1 30: 14: 14: 1	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA SPC VOW3	from owns; IBAN_numbe CH75506151 DE16500103 SA21252676 CH42505143 CH75505151 JP82175690 NL12RAB081 JS82175690 SA21252676 NL12RAB081 US28126454		55   6743   7157   6886   63245   7157   63245	988089 1501 295089	1 30 149 	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA SPC VOW3 0 rows in set ( ysql> select * Stock_Symbol   1111 1111 1111 12010 2010 4001 4001 400	From owns;  IBAN_numbe  CH75505151 DE16500108 SA21252676 CH42505143 CH75505151 JB82175696 NL12RAB081 JP82175696 SA21252676 NL12RAB081 US28126454 US34192255		55   6743   7157   6886   63245   7157   63245	988089 1501 295089	1 30: 14: 14: 10: 10: 15: 16: 16: 16: 16: 16: 13: 16: 16: 13: 16: 16: 13: 16: 16: 16: 16: 16: 16: 16: 16: 16: 16	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895
NOKIA   SPC   VOW3   0 rows in set ( ysql> select * Stock_Symbol   1111	From owns;  IBAN_numbe  CH75505151 DE16500105 SA21252676 CH42505143 CH75505151 JP82175609 NL12RAB081 US34192255 NL12RAB081 US34192255 NL12RAB081		15   16743   1743   1757   1886   163245   1757   163245   1743   1744   1757	988089 1501 295089	1 30 149 	3.42   1.00	Euronext Shanghai Stock Exchange	1792169223 5098220895

## Queries Implementation in SQL

1	mysql> select * from Investor where NetWorth > 420000000;
上	IBAN_number   National_ID   Sex   NetWorth   First_Name   Middle_Name   Last_Name
	JP601009600050571982645704   4142356652   M   1009860022   Hideki   Matsumoto   Kamiya     JP821756900040913954463245   8409156649   M   962214000   Masahiro   Michiko   Sakurai
	2 rows in set (0.00 sec)
2	mysql> select * from Stock where Number_Of_Public_Stocks_in_thousand < 2000;
_	++   Stock_Symbol   Number_Of_Public_Stocks_in_thousand   Stock_Price   Market_Name   Commercial_Registration_Number   +
	SPC
3	<pre>mysql&gt; select Last_Name from Investor where IBAN_number = "NL12RAB0813971873"; ++       Last_Name   ++       Tyson</pre>
4	mysql> select Investor.* from Secures natural join Investor where Secures.Commercial_Registration_Number=1110001116 group by Investor.IBAN_number;   IBAN_number
5	mysql> select Investor.* from Owns natural join Investor where Owns.Stock_Symbol="4001";    IBAN_number
6	mysql> select Company.* from Company natural join Stock where Stock.Stock_Price > 103.5;    Commercial_Registration_Number   Number_Of_Directors   Company_Equity_in_thousand   Company_Name     3741894494

```
nysql> select Stock.* from Stock natural join Company where Number_Of_Directors >= 3;
              Stock_Symbol | Number_Of_Public_Stocks_in_thousand | Stock_Price | Market_Name
                                                                                                                   | Commercial_Registration_Number |
               NOKIA
                                                               988089
                                                                                3.42
                                                                                       Euronext
NASDAQ
                                                                                                                    1792169223
                                                                             3185.00
              2222
HKG
                                                                             35.90
269.00
                                                                                       Tadawul
Shanghai Stock Exchange
                                                                                                                    5315073274
6713620014
                                                               940699
                                                               289886
660000
                                                                             1787.00
96.00
                                                                                       NASDAQ
Tadawul
                                                                                                                    8643657928
8857232768
               VOW3
                                                               295089
                                                                              149.08
                                                                                       Euronext
             mysql> select Bank.* from Owns natural join Secures natural join Bank where Stock_Symbol="4161";
 8
              +----
               Commercial_Registration_Number | Name
                                                                                   | Number_Of_Branches
                                                               Riyadh Bank
                1010001054
                                                                                                          341
                                                               Bank of China
                1516125270
                                                                                                        23682
                5016604726
                                                              MUFG Bank
                                                                                                          398
             3 rows in set (0.00 sec)
             mysql> select CEO.* from Ceo natural join Company natural join Stock where Stock_Price < 200;
 9
               Name
                                                | Age | Commercial_Registration_Number
                Yousef Al-Benyan
                                                            8857232768
                Amin H. Nasser
                                                     60
                                                            5315073274
                Pekka Lundmark
                                                            1792169223
               Herbert Diess
                                                            9598342161
             4 rows in set (0.00 sec)
              ysql> select CEO.* from Ceo natural join Company natural join Stock natural join Investor where NetWorth > 50000 and CEO.Sex-"M" group by Name;
10
                                      Age | Commercial_Registration_Number
              Akio Toyoda
Amin H. Nasser
Daniel Zhang
Fu Chengyu
Herbert Diess
Jeff Bezos
Masayoshi Son
Pekka Lundmark
Sundar Pichai
Yousef Al-Benyan
                                           6229087803
5315073274
6713620014
5098220895
9598342161
4457764495
                                       64 |
60 |
48 |
69 |
62 |
56 |
63 |
56 |
48 |
57 |
                                           3741894494
1792169223
8643657928
8857232768
             10 rows in set (0.00 sec)
```

### SQL Code

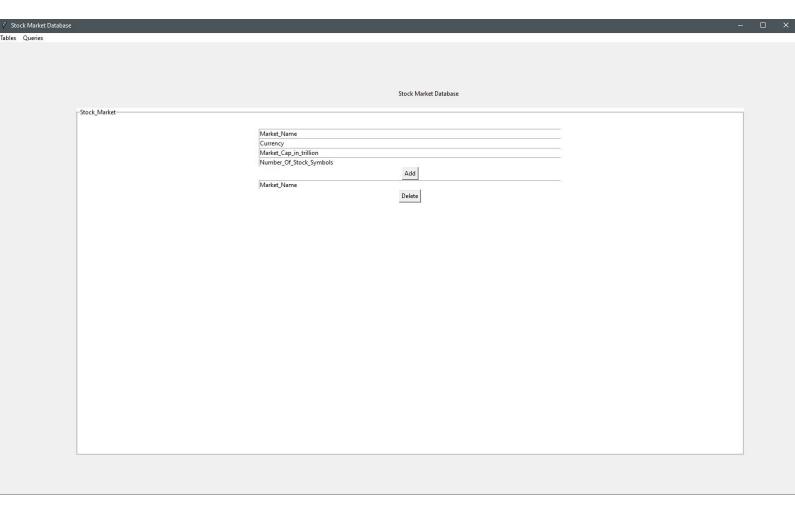
```
create database Stock Exchange;
           use Stock_Exchange;
                      Market_Name varchar(100),
Currency char(3) not null,
                      constraint Market_Name_PK primary key(Market_Name),
                     First_Name varchar(20) not null,
Middle_Name varchar(20) not null,
Last_Name varchar(20) not null,
                      Stock_Price decimal(8,2),
Market_Name varchar(100),
                      constraint Market_Name_FK foreign key(Market_Name) references Stock_Market(Market_Name) on
                      Commercial_Registration_Number varchar(100),
                      constraint Compound_PK primary key(Name , Commercial_Registration_Number),
                      constraint Commercial_Registration_Number_FK2 foreign key(Commercial_Registration_Number)
references Company(Commercial_Registration_Number) on update cascade on delete cascade,
```

```
create table Secures(
                                        Stock_Symbol varchar(10), IBAN_number varchar(100),
                                        Commercial_Registration_Number varchar(100),
Commercial_Registration_Number),
                                        constraint Stock Symbol FK foreign key(Stock Symbol) references Stock(Stock Symbol) on update
                                        constraint Commercial_Registration_Number_FK3 foreign key(Commercial_Registration_Number)
references Bank(Commercial_Registration_Number) on update cascade on delete cascade
                                        ("NASDAQ", "USD", 1.72, 8100),
("Tadawul", "SAR", 2.19, 202),
("Tokyo Stock Exchange", "JPY", 5.67, 2292),
("Euronext", "EUR", 4.52, 1462),
("Shanghai Stock Exchange", "CNY", 5.01, 1041);
                                        IBAN number,
                                        Last Name
                                        values
('US281264541519999339','9498117064','M',3590070,'Brent','Aahil','Chamberlain'),
('DE16500105174529546245','2126117000','M',99801000,'Andreas ','Sheikh ','Perez'),
('US341922553675553244','8277836920','M',191000050,'Macauley','Lugo','Nguyen'),
('JP821756900040913954463245','8409156649','M',962214000,'Masahiro ','Michiko ','Sakurai'),
('JP601009600050571982645704','4142356652','M',1009860022,'Hideki','Matsumoto','Kamiya'),
('CH4250514369317289437157','7734693388','M',5156,'Li','Dong','Brody'),
('CH2556515162589388976886','4092719807','M',39059,'Bo','Zhou','Galindo'),
                                        ('CH7550515162589388976886','4992719807','M',39059,'Bo','Zhou','Galindo'),
('SA2125267688145539388743','1304026480','M',358630,'Abdo','Saad','Husain'),
('SA4038369116113433969462','1011353190','M',459174,'Abdullah','Mohammed','Hamed'),
                    insert into Bank(
                                        Commercial_Registration_Number,
                                        Number_Of_Branches
                                        ('1010001054','Riyadh Bank',341),
('5016604726','MUFG Bank',398),
('2311911035','HSBC',4000),
('1516125270','Bank of China',23682);
```

```
Commercial_Registration_Number,
values
('4457756495',22,62060000,'Amazon'),
('5315073274',11,39800000,'Saudi Aramco'),
('6229087803',2,20480000,'Toyota Motor'),
('9598342161',20,131000000,'Volkswagen'),
('6713620014',11,43000000,'Alibaba Group'),
('8643657928',25,25003600,'Google'),
('8857232768',13,70000000,'SABIC'),
('1792169223',17,30310000,'Nokia'),
('5098220895',2,43000000,'Sinopec'),
('4001894494',2,89048000,'Softbank');
  Commercial_Registration_Number
) values
('Jeff Bezos','M',56,'4457756495'),
('Amin H. Nasser','M',60,'5315073274'),
('Akio Toyoda','M',64,'6229087803'),
('Herbert Diess','M',62,'9598342161'),
('Daniel Zhang','M',48,'6713620014'),
('Sundar Pichai','M',48,'8643657928'),
('Yousef Al-Benyan','M',57,'8857232768'),
('Pekka Lundmark','M',56,'1792169223'),
('Fu Chengyu','M',69,'5098220895'),
('Masayoshi Son','M',63,'4001894494');
) values
('AMZN',500890,3185,'NASDAQ','4457756495'),
('2222',940699,35.9,'Tadawul','5315073274'),
('4161',297472,7301,'Tokyo Stock Exchange','6229087803'),
('VOW3',295089,149.08,'Euronext','9598342161'),
('HKG',274500,269,'Shanghai Stock Exchange','6713620014'),
('GOOGL',289886,1787,'NASDAQ','8643657928'),
('2010',660000,96,'Tadawul','8857232768'),
('4001',215350,7250,'Tokyo Stock Exchange','4001894494'),
('NOKIA',988089,3.42,'Euronext','1792169223'),
('SPC',1501,301,'Shanghai Stock Exchange','5098220895');
) values
("AMZN", "US281264541519999339", 420),
("AMZN", "US341922553675553244", 321),
("AMZN", "NL12RAB0813971873", 40),
("2222", "SA2125267688145539388743", 1),
("2222", "DE16500105174529546245", 91),
("2222", "CH7550515162589388976886", 48),
("4161", "SA2125267688145539388743", 2),
("4161", "CH4250514369317289437157", 1323),
("4161", "JP821756900040913954463245", 99),
("VOW3", "CH7550515162589388976886", 123).
  ("VOW3", "CH7550515162589388976886", 123)
("VOW3", "US341922553675553244", 2311),
("VOW3", "DE16500105174529546245", 1053),
("HKG", "JP601009600050571982645704", 9),
```

```
("HKG", "SA4038369116113433969462", 32),
("HKG", "JP821756900040913954463245", 1942),
                                   ("GOOGL", "US341922553675553244", 26), ("GOOGL", "NL12RAB0813971873", 861), ("GOOGL", "SA4038369116113433969462", 34), ("2010", "CH4250514369317289437157", 39), ("2010", "CH7550515162589388976886", 504),
                                     ("4001", "JP821756900040913954463245", ("4001", "NL12RAB0813971873", 163), ("4001", "US341922553675553244", 16),
                                    ("NOKIA", "JP601009600050571982645704", 1
("NOKIA", "SA2125267688145539388743", 3),
("NOKIA", "DE16500105174529546245", 51),
                                     ("SPC", "CH7550515162589388976886", 342),
("SPC", "DE16500105174529546245", 4),
("SPC", "SA2125267688145539388743", 999);
                                     IBAN number,
                                     Commercial_Registration_Number
                                  values
("AMZN", "US281264541519999339", "1110001116"),
("AMZN", "US341922553675553244", "1110001116"),
("AMZN", "NL12RAB0813971873", "2311911035"),
("2222", "SA2125267688145539388743", "1010001054"),
("2222", "DE16500105174529546245", "2311911035"),
("2222", "CH7550515162589388976886", "1516125270"),
("4161", "SA2125267688145539388743", "1010001054"),
("4161", "CH4250514369317289437157", "1516125270"),
("4161", "JP821756900040913954463245", "5016604726"),
("VOW3", "CH7550515162589388976886", "1516125270"),
("VOW3", "US341922553675553244", "1110001116"),
("VOW3", "DE16500105174529546245", "2311911035"),
("HKG", "JP601009600050571982645704", "5016604726"),
("HKG", "JP821756900040913954463245", "5016604726"),
("HKG", "JP821756900040913954463245", "5016604726"),
("HKG", "JP821756900040913954463245", "5016604726"),
("GOOGL", "US341922553675553244", "1110001116"),
                                   ("HKG", "JP821756900040913954463245", "5016604726"), ("GOOGL", "US341922553675553244", "1110001116"), ("GOOGL", "NL12RAB0813971873", "1010001054"), ("GOOGL", "SA4038369116113433969462", "2311911035"), ("2010", "CH4250514369317289437157", "5016604726"), ("2010", "CH7550515162589388976886", "1516125270"), ("4001", "JP821756900040913954463245", "1010001054"), "4001", "JP821756900040913954463245", "1010001054"),
                                    ("4001", "JR821756900040913954465245", 1010001054"),
("4001", "NL12RAB0813971873", "2311911035"),
("4001", "US341922553675553244", "5016604726"),
("NOKIA", "JP601009600050571982645704", "2311911035"),
("NOKIA", "SA2125267688145539388743", "1010001054"),
("NOKIA", "DE16500105174529546245", "2311911035"),
("SPC", "CH7550515162589388976886", "1516125270"),
                                     ("SPC", "DE16500105174529546245", "1010001054"), ("SPC", "SA2125267688145539388743", "1010001054");
  select * from Investor where NetWorth > 420000000;
select Investor.* from Secures natural join Investor where Secures.Commercial_Registration_Number=1110001116 group by Investor.IBAN_number;
select Bank.* from Owns natural join Secures natural join Bank where Stock_Symbol="4161";
```

## Graphical User Interface (GUI)

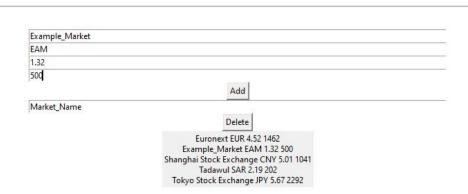


#### Addition And Deletion

We can add and delete using the GUI, for example we will be adding a new *Stock\_Market* tuple

ck_Market		
	Example_Market	
	EAM	
	1.32	
	50 <b>d</b>	

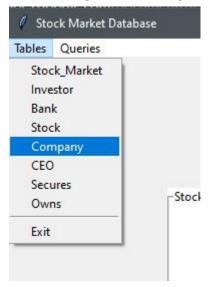
After pressing `Add` the GUI displays our results (our tuple is the second one)



We can also delete the tuple by entering the Primary key of the tuple (*Market\_Name*) and then clicking delete and seeing the results (The example market has been deleted!)



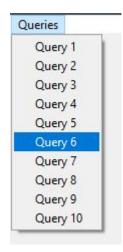
We can Add and delete for all tables, in the upper left corner we can change tables (Let's choose *Company*)



# We can see that the GUI has updated to *Company*'s attributes. From there we can also add and delete

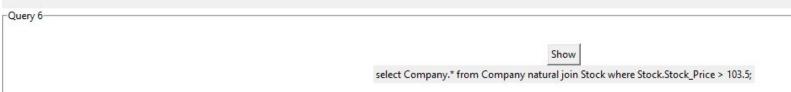
	Stock Market Database	
-Company-		
	Commercial_Registration_Number	
	Number_Of_Directors	
	Company_Equity_in_thousand	
	Company_Name Add	
	Commercial_Registration_Number  Delete	

#### **Preset Queries**



From the upper left corner we can choose preset queries (these ten are the ones we included above in the document). Let's click Query 6

We can see Query 6's command. Let's click show (which will fetch results from out DB)



We can see that the GUI shows the results of executing this command

Show
select Company.\* from Company natural join Stock where Stock.Stock\_Price > 103.5;
4001894494 2 89048000 Softbank
6229087803 2 20480000 Toyota Motor
6713620014 11 43000000 Alibaba Group
5098220895 2 43000000 Sinopec
9598342161 20 13100000 Volkswagen

#### Lets repeat the same thing for Query 10



#### And Query 8

Show

select Bank.\* from Owns natural join Secures natural join Bank where Stock\_Symbol="4161";

1010001054 Riyadh Bank 341
1516125270 Bank of China 23682
5016604726 MUFG Bank 398