**University of Waterloo**

**CS 338**

**Final Project**

**Portfolio Database**

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**About the Database**

**Introduction:**

Having always been interested in trading and investing into the stock market, I have been following it for quite some time. Recently, due to the pandemic, the market crashed, and most companies shares reached their all-time or yearly lows on or around 23rd of March’ 2020. That was when I though that it was the perfect opportunity for me to start investing and to hopefully learn more about the market and how it works and hopefully making some financial gains out of it.

This database would be a great representation of the trades that I made, or I wished to make, but couldn’t due to financial constraints. This database has shares of companies that I follow and there are tables that contain values that would be used by analysts to make decisions on trades. Fundamental analysis and technical analysis are two of many analytical methods of deciding on why a company on this day would be a good buy or sell.

Finally, this database, once fully developed would be intended for use of any trader who would be looking for information about any stock in the market or who would like to create their own portfolio. This Database can be developed a lot further with the help of experienced traders and analysts to make as much information as possible available in it and to make it easy to use for beginner and advanced traders.

**Development of the Database:**

The development of this database was all manual input. All the information was taken from investing.com and input into this database. There were 4 main tables that I started off with; Stock summary, which contains information for a stock’s price during a day; the second one was Technical analysis which contained information about what technical analysis indicates in term of a particular stock; The third table consist of fundamental analysis which mainly consist of financial aspects of a company and what they indicate; lastly was a table which contained general information of a company. After completing these tables the database still looked incomplete and so I added a table which consisted of the users portfolio and another one that consisted of transactions that represents trades made by the user.

**Usage Documentation**

**Basic SQL:**

There are 3 main basic SQL statements that are most commonly used; Select, Insert and Delete statements. These can be used in the Portfolio database as follows:

1. **SELECT** \* from Company\_Information WHERE Industry = "Technology";
2. **INSERT** INTO Stock\_Summary VALUES ("ABC", 1, 2, 3, 4, 5, 12345678);
3. **DELETE** from Stock\_Summary where Tick\_Sym = "ABC";

The first statement is a Select statement which would produce a table that contains company information about all companies that are part of the technology industry.

The second statement is a normal insert statement where it inserts company ABCs stock summary into the stock\_summary table and the third statement deletes this entry from the table. This shows that all Basic SQL commands work perfectly with the database. A few more examples of basic SQL commands on the Portfolio Database as follows:

* SELECT **count**(\*) from Stock\_Summary;
* SELECT **avg**(Volume) from Stock\_Summary;
* SELECT \* from Company\_Financials **ORDER** by Beta DESC;
* SELECT Industry, count(\*) from Company\_Information **GROUP** by Industry;

**Views using Basic SQL:**

CREATE VIEW tech\_stocks as SELECT \* from Company\_Information WHERE Industry = "Technology";

This view would show company information for all stocks in the Technology industry and would be useful for someone looking to invest in the technology industry. Similarly we can create views which contain stocks from a particular industry or from a particular stock exchange.

**Advance SQL:**

There are two main types of advance SQL statements that are used in Databases which are subqueries and Joins and they can further be used to create new useful uses views in Databases. Following are two statement for the Portfolio Database that use joins and subqueries respectfully as follows:

1. SELECT Stock\_Summary.\* from Company\_Information **JOIN** Stock\_Summary WHERE Company\_Information.Tick\_Sym = Stock\_Summary.Tick\_Sym AND Industry = "Technology";
2. SELECT \* from Stock\_Summary where Tick\_Sym in (SELECT Tick\_Sym from Company\_Information WHERE Stock\_Exchange in (SELECT Stock\_exchange from country\_Stock\_exchange where country = "Canada"));

The first statement uses Joins to show the stock summary for all stocks in the Technology industry and the second statement uses subqueries to display stock\_summary for all stocks listed in Canadian stock exchanges. These statements can also be used in conjunction with Create Views in order to create useful views for the database as follows:

1. This view would contain stock summary for all technology stocks in the database:  
   CREATE **VIEW** Tech\_stock\_summary as SELECT Stock\_Summary.\* from Company\_Information JOIN Stock\_Summary WHERE Company\_Information.Tick\_Sym = Stock\_Summary.Tick\_Sym AND Industry = "Technology";
2. This contain stock summary for all Canadian stocks and we can use the same statement to create a view for stock summaries of stock from USA.  
   CREATE **VIEW** Canadian\_Stock\_summary as SELECT \* from Stock\_Summary where Tick\_Sym in (SELECT Tick\_Sym from Company\_Information WHERE Stock\_Exchange in (SELECT Stock\_exchange from country\_Stock\_exchange where country = "Canada"));
3. This view shows how much percent of your portfolios value is from a particular stock:  
   CREATE VIEW Stock\_percentage\_Of\_Portfolio as select Portfolio.Tick\_Sym, ((Portfolio.NumberOfShares\*Stock\_Summary.Last\_price)\*100/(SELECT sum(Portfolio.NumberOfShares\*Stock\_Summary.Last\_price) from Portfolio JOIN Stock\_Summary WHERE Portfolio.Tick\_Sym = Stock\_Summary.Tick\_Sym)) as PercentageOfPortfolio from Portfolio JOIN Stock\_Summary WHERE Portfolio.Tick\_Sym = Stock\_Summary.Tick\_Sym;
4. This view shows how much percent of your portfolios value is from a particular industry:  
   CREATE VIEW Stock\_percentage\_Of\_Portfolio\_by\_Industry as select Company\_Information.Industry,((Portfolio.NumberOfShares\*Stock\_Summary.Last\_price))\*100/(SELECT sum(Portfolio.NumberOfShares\*Stock\_Summary.Last\_price) from Portfolio JOIN Stock\_Summary WHERE Portfolio.Tick\_Sym = Stock\_Summary.Tick\_Sym)) as PercentagePortfolio from Portfolio JOIN Stock\_Summary JOIN Company\_Information WHERE Portfolio.Tick\_Sym = Stock\_Summary.Tick\_Sym and Stock\_Summary.Tick\_Sym = Company\_Information.Tick\_Sym GROUP by Company\_Information.Industry;
5. This view shows the total value of the portfolio:  
   CREATE VIEW Total\_portfolio\_value as SELECT sum(NumberOfShares\*Last\_price) as total\_value from Portfolio JOIN Stock\_Summary where Portfolio.Tick\_Sym = Stock\_Summary.Tick\_Sym;
6. This view shows the the general summary of gains and losses made on each stock in terms of present value of the stock in the market:  
   CREATE VIEW portfolio\_summary as SELECT Portfolio.Tick\_Sym, Portfolio.NumberOfShares, Portfolio.Avg\_Price, Portfolio.NumberOfShares\*Portfolio.Avg\_Price as bought\_for, Portfolio.NumberOfShares\*Stock\_Summary.Last\_price as present\_value, (Portfolio.NumberOfShares\*Stock\_Summary.Last\_price - Portfolio.NumberOfShares\*Portfolio.Avg\_Price) as Gain\_Loss from Portfolio JOIN Stock\_Summary WHERE Portfolio.Tick\_Sym = Stock\_Summary.Tick\_Sym;

More examples of different views in the database and advance SQL statements in the DB.

**Normalization**

**3rd Normal Form:**

The formal definition of a Database in 3rd Normal Form is if a database is in 2nd normal form and there exists no transitive dependencies between any non-key attributes in a table. Additionally, a database is in 2nd normal form if an attribute is not partially dependant on any non-key attributes.

The Portfolio Database contains 7 tables as follows with create table statements as follows.

* CREATE TABLE "**Company\_Financials**" ("Tick\_Sym" TEXT, "MarketCap\_InMillions" NUMERIC, "Revenue\_InMillions" NUMERIC, "EPS" NUMERIC, "PE\_Ratio" NUMERIC, "Beta" NUMERIC,"Dividend\_Yield" NUMERIC, "ETF"TEXT, PRIMARY KEY("Tick\_Sym"), FOREIGN KEY("Tick\_Sym") REFERENCES "Stock\_Summary"("Tick\_Sym"));
* CREATE TABLE "**Company\_Information**" ( "Tick\_Sym" TEXT, "Company\_Name" TEXT, "Industry" TEXT, "Stock\_Exchange" TEXT, "Company\_Description" TEXT, PRIMARY KEY("Tick\_Sym"), FOREIGN KEY("Tick\_Sym") REFERENCES "Stock\_Summary" ("Tick\_Sym"));
* CREATE TABLE "**Portfolio**" ("Tick\_Sym" TEXT, "NumberOfShares" REAL, "Avg\_Price" REAL, FOREIGN KEY("Tick\_Sym") REFERENCES "Stock\_Summary"("Tick\_Sym"), PRIMARY KEY("Tick\_Sym"));
* CREATE TABLE "**Stock\_Summary**" ("Tick\_Sym" TEXT, "Last\_price" REAL, "Open\_price" REAL, "High" REAL, "Low" REAL, "ChangeInPrice” REAL, "Volume" REAL, PRIMARY KEY("Tick\_Sym"));
* CREATE TABLE "**Technical\_Analysis**" ("Tick\_Sym" TEXT, "OneHour” TEXT, "FiveHour” TEXT, "Daily" TEXT, "Weekly" TEXT, "Monthly" TEXT, PRIMARY KEY("Tick\_Sym"), FOREIGN KEY("Tick\_Sym") REFERENCES "Stock\_Summary"("Tick\_Sym"));
* CREATE TABLE "**Transactions**" ("Tick\_Sym" TEXT, "TransactionID" INTEGER, "Shares” INTEGER, "Price" REAL,"Buy/Sell" TEXT, PRIMARY KEY("TransactionID" AUTOINCREMENT), FOREIGN KEY("Tick\_Sym") REFERENCES "Stock\_Summary" ("Tick\_Sym"));
* CREATE TABLE "**country\_Stock\_exchange**" ("Country" TEXT, "Stock\_Exchange" TEXT, PRIMARY KEY("Stock\_Exchange"));

All tables have Tick\_sym (ticker symbol of a stock) as their primary key for the table apart from the country\_Stock\_Exchange which has stock\_exchange as the ticker symbol. All tables have one primary key that is unique for each row in the table and all attributes of the table are functionally dependant on the primary key. Therefore, the Database is in 2nd normal form.

For 3rd normal form we need to check for transitive dependencies and in the company\_financials table we find that PE\_Ratio is dependant on Last\_price and EPS since it is the ratio of the two and since EPS and PE\_ratio is in the same table this causes a conflict for 3NF. But since both values are very important to Fundamental analysis and company financials they should be kept in the same table. Additionally, when EPS is negative PE ratio is NULL.

**References**

* All information for Database entries taken from ca.investing.com, retrieved on August 10th, 2020.