Northeastern University
College of Professional Studies

Final Project – Analysis of Cryptocurrency

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ALY6030: Data Warehousing & SQL

Spring 2022

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May 17h, 2022

Introduction

The last 18 months have transformed cryptocurrency. Its growth has been faster than ever, yet its future has never been so unclear. Analysts estimate that the global cryptocurrency market will be more than triple by 2030, hitting a valuation of nearly $5 billion. Investors, businesses, and brands cannot ignore the rising tide of crypto for long.

A **Crypto or Cryptocurrency** is a digital or virtual currency that is secured by cryptography thereby making it nearly impossible to counterfeit or double-spend. Most cryptocurrencies are decentralized networks based on blockchain technology. A defining feature of cryptocurrencies is that they are generally not issued by any central authority, rendering them theoretically immune to government interference or manipulation.

Advantages of Cryptocurrencies include cheaper and faster money transfers and decentralized systems that do not collapse at a single point of failure. Disadvantages of cryptocurrencies include their price volatility, high energy consumption for mining activities, and use in criminal activities. There are close to 18000 cryptocurrencies of various types, prices and volumes.

The project was implemented using **Python, R Programming, Microsoft Excel, and SQL**. In this project we have **analyzed data** pertaining to the **top 5000 cryptocurrencies** available in the market. The goal of the project is to analyze the different attributes of cryptocurrency, and thereby compare the cryptocurrency to reveal insights about which cryptocurrency to invest-in, mine or use for payments and exchange.

Various other factors like Node Count, Cryptocurrency exchanges, Cost of production, Government Regulations, Scarcity and Market cap. Insights gained from this analysis can lay the foundations of understanding the cryptocurrency market and thereby help novice investors take their first step in joining the Crypto market.

Business Questions

The following business questions will be answered as part of our analysis:

- Most dominating coin w.r.t market capitalization.
- What is the Price Range of Currency?
- What are the currencies that would be suitable for mining?
- What currencies are good for exchange and payments?
- Which are the stable coins in a given price range?
- Which are the volatile coins in the price range?
- Which are the Top Drops in a given time period?
- Which are the Top Rises in a given time period?
- Which coins are almost completely mined?

Data Collection

Ideally web scraping is used to collect large amounts of data from websites. However, we made use of the API's provided by the Coin Market Cap website. While web scraping gives you the option to extract data from any website through web scraping tools, **APIs provide direct access to the type of data you would want**. In web scraping, the user can access the data only till it is available on a website.

Python scripts were used to collect and store the required data as a .csv file. Data was retrieved as JSON data streams. The data was then converted into the required data format and written into a csv file (data.csv).

```
# Exporting Cryptocurrency Info from CoinmarketCap to csv

## Importing Libraries
from requests import Request, Session
from requests.exceptions import ConnectionError, Timeout, TooManyRedirects
import json
import csv
import os

## Setting Coinbase Endpoint and Parameter
url = 'https://pro-api.coinmarketcap.com/v1/cryptocurrency/listings/latest'
parameters = {
  'start':'1',
  'limit':'5000',
  'convert':'USD'
}
headers = {
  'Accepts': 'application/json',
  'X-CMC_PRO_API_KEY': '1844530d-ca23-4fa9-b72d-43813b4881f2',
}


session = Session()
session.headers.update(headers)
csvPath = os.getcwd();
try:
  listResponse = session.get(url, params=parameters)

  # Converting response to JSON
  datastream = json.loads(listResponse.text)["data"]

  # Initializing header variable
  headers = list(datastream[0].keys())
  # Adding additional headers extracted from "quotes" column
  headers = headers + list(datastream[0]["quote"]["USD"].keys())
```

N. B: The complete python script can be viewed in the 'DataExtraction_CoinMarketCap.ipynb' file.

The csv file compiled is as shown below:

id	name	symbol	slug	num_market	date_added	tags	max_supply	circulating_s	total_supply	platform	cmc_rank	self_reporte	self_reporte	last_updatec	quote	price	volume_24h	vc
1	Bitcoin	BTC	bitcoin	9431	2013-04-28	['mineable', '	21000000	19041375	19041375		1			2022-05-16	{'USD': {'price	29758.355	3.305E+10	
1027	Ethereum	ETH	ethereum	5715	2015-08-07	['mineable', 'pow', 'smart-	120800743	120800743			2			2022-05-16	{'USD': {'price	2015.4027	2.001E+10	
825	Tether	USDT	tether	33404	2015-02-25	['payments', 'stablecoin', '	7.575E+10	7.971E+10	{'id': 1, 'name		3			2022-05-16	{'USD': {'price	0.9990728	6.282E+10	
3408	USD Coin	USDC	usd-coin	3978	2018-10-08	['medium-of-exchange', 'st	5.1E+10	5.1E+10	{'id': 1, 'name		4			2022-05-16	{'USD': {'price	0.9998124	6.456E+09	
1839	BNB	BNB	bnb	848	2017-07-25	['marketplac	165116760	163276975	163276975		5			2022-05-16	{'USD': {'price	297.01135	1.734E+09	
52	XRP	XRP	xrp	721	2013-08-04	['medium-of	1E+11	4.834E+10	9.999E+10		6			2022-05-16	{'USD': {'price	0.4164708	1.743E+09	
2010	Cardano	ADA	cardano	440	2017-10-01	['mineable', '	4.5E+10	3.382E+10	3.428E+10		7			2022-05-16	{'USD': {'price	0.562727	1.342E+09	
5426	Solana	SOL	solana	310	2020-04-10	['pos', 'platform', 'solana-e	337461239	511616946			8			2022-05-16	{'USD': {'price	53.965289	2.108E+09	
4687	Binance USD	BUSD	binance-usd	3699	2019-09-20	['stablecoin', 'asset-backec	1.774E+10	1.774E+10	{'id': 15, 'nan		9			2022-05-16	{'USD': {'price	1.000842	8.072E+09	
74	Dogecoin	DOGE	dogecoin	473	2013-12-15	['mineable', 'pow', 'scrypt'	1.327E+11	1.327E+11			10			2022-05-16	{'USD': {'price	0.0873643	633647798	
6636	Polkadot	DOT	polkadot-ne	342	2020-08-19	['substrate', 'polkadot', 'bi	987579315	1.103E+09			11	904869778	9.778E+09	2022-05-16	{'USD': {'price	10.805971	966594384	
5805	Avalanche	AVAX	avalanche	249	2020-07-13	['defi', 'smart-contracts', '	269110252	395891290			12			2022-05-16	{'USD': {'price	33.008762	893123586	
3717	Wrapped Bit	WBTC	wrapped-bit	431	2019-01-30	['medium-of-exchange', 'd	284603.93	284603.93	{'id': 1, 'name		13			2022-05-16	{'USD': {'price	29794.952	334244887	
1958	TRON	TRX	tron	601	2017-09-13	['media', 'payments', 'tron	9.797E+10	9.797E+10			14	7.166E+10	4.945E+09	2022-05-16	{'USD': {'price	0.0690121	926005390	
5994	Shiba Inu	SHIB	shiba-inu	347	2020-08-01	['memes', 'ethereum-ecosy	5.491E+14	5.897E+14	{'id': 1, 'name		15			2022-05-16	{'USD': {'price	1.21E-05	480712721	
4943	Dai	DAI	multi-collat	962	2019-11-22	['defi', 'stablecoin', 'ethere	6.431E+09	6.431E+09	{'id': 1, 'name		16			2022-05-16	{'USD': {'price	0.999789	583003079	
3890	Polygon	MATIC	polygon	385	2019-04-28	['platform', '	1E+10	7.949E+09	1E+10		17			2022-05-16	{'USD': {'price	0.6805556	667658161	
3635	Cronos	CRO	cronos	135	2018-12-14	['medium-of	3.026E+10	2.526E+10	3.026E+10	{'id': 1, 'name		18			2022-05-16	{'USD': {'price	0.1888379	43730625	
2	Litecoin	LTC	litecoin	771	2013-04-28	['mineable', '	84000000	70296519	84000000		19			2022-05-16	{'USD': {'price	67.08524	746951297	
3957	UNUS SED LE	LEO	unus-sed-leo	19	2019-05-21	['marketplace', 'centralize	953954130	985239504	{'id': 1, 'name		20			2022-05-16	{'USD': {'price	4.9406499	6705014.9	
6535	NEAR Protoc	NEAR	near-protoc	141	2020-08-11	['platform', '	1E+09	689284642	1E+09		21			2022-05-16	{'USD': {'price	6.6382201	635361866	
4195	FTX Token	FTT	ftx-token	123	2019-07-31	['marketplac	352170015	136538848	332408184	{'id': 15, 'nan	22			2022-05-16	{'USD': {'price	31.880329	77143899	

Data Cleaning

Next the data cleaning was performed on the compiled dataset using R Programming. The rows with NULL and Duplicate columns were accounted for and corrected. Columns without intelligible information were removed. Three new columns were added to depict the Mineable, Exchange or Payments tags and simplify further analysis. Finally, the records were checked for 'NA' values and written into a new csv file (cleanCryptoData.csv).

Exploratory Data Analysis

Overview of the Dataset Columns

The Final Dataset contains 5000 rows and 29 columns, with each record describing a unique Cryptocurrency. The following are the descriptions of each column in the dataset:

- *id*: The unique CoinMarketCap ID for this cryptocurrency.
- *name:* The name of this cryptocurrency.
- *symbol*: The ticker symbol for this cryptocurrency.
- *num_market*: The number of active trading pairs available for this cryptocurrency across supported exchanges. *"Trading pairs" or "cryptocurrency pairs" are assets that can be traded for each other on an exchange*
- *date_added*: Timestamp (ISO 8601) of when this cryptocurrency was added to CoinMarketCap.
- *max_supply*: The expected maximum limit of coins ever to be available for this cryptocurrency.
- *circulating_supply*: The approximate number of coins circulating for this cryptocurrency.
- *total_supply*: The approximate total amount of coins in existence right now (minus any coins that have been verifiably burned)
- *cmc_rank*: The cryptocurrency's CoinMarketCap rank by market cap.
- *price*: Price in the specified currency for this historical.
- *volume_24h*: Rolling 24 hour adjusted volume in the specified currency.
- *volume_change_24h*: 24-hour change in the specified currencies volume.
- *percent_change_1h*: 1 hour change in the specified currency.
- *percent_change_24h*: 24-hour change in the specified currency.

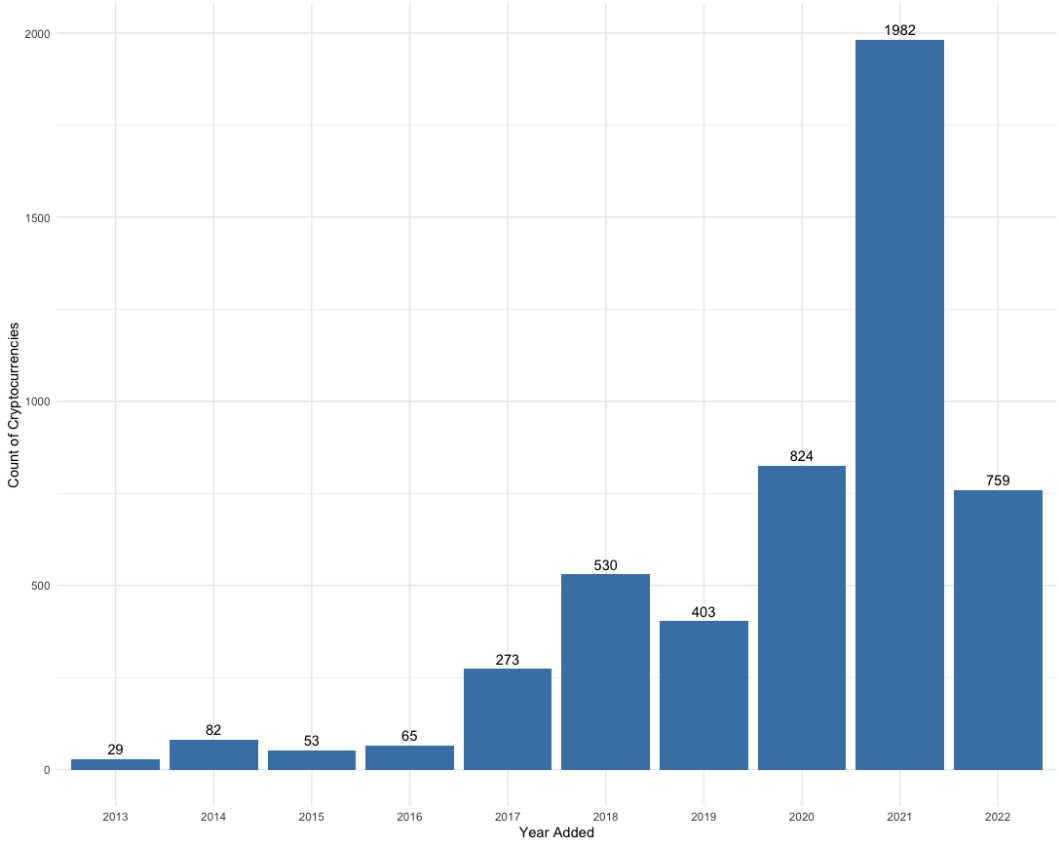
- *percent_change_7d*: 7 days change in the specified currency.
- *percent_change_30d*: 30 days change in the specified currency.
- *percent_change_60d*: 60 days change in the specified currency.
- *percent_change_90d*: 90 days change in the specified currency.
- *market_cap*: Market cap in the specified currency.
- *market_cap_dominance:* Market cap dominance in the specified currency. The ratio between the market capitalization of Bitcoin to the total market cap of the entire cryptocurrency market. Market cap is used as an indicator of the dominance and popularity of cryptocurrencies.
- *fully_diluted_market_cap*: Fully diluted market cap in the specified currency. A fully diluted market cap in crypto is the total value of crypto at today's token price if the total supply of cryptocurrency were in circulation. The fully diluted value market cap may be a good metric for long-term investors, as it allows them to better judge whether a project's value is reasonable.
- *Mineable_tag*: can be retrieved by mining
- *Exchange_tag:* used for trading exchanges
- *Payments_tag:* used for payments

Summary of the Dataset

```
> summary(df)
      id          name             symbol          num_market_pairs   date_added         max_supply        circulating_supply  total_supply         cmc_rank       price            volume_24h        volume_change_24h
 Min.   :    1  Length:5000        Length:5000        Min.   :   1.00  Length:5000        Min.   :-1.000e+05  Min.   :0.000e+00  Min.   :0.000e+00  Min.   :   1  Min.   :     0.00  Min.   :0.000e+00  Min.   :-1.000e+02
 1st Qu.: 4105  Class :character   Class :character   1st Qu.:   2.00  Class :character   1st Qu.:-1.000e+05  1st Qu.:0.000e+00  1st Qu.:9.841e+06  1st Qu.:1251  1st Qu.:     0.00  1st Qu.:1.412e+04  1st Qu.:-1.600e+01
 Median : 8770  Mode  :character   Mode  :character   Median :   5.00  Mode  :character   Median : 1.000e+08  Median :2.436e+06  Median :1.356e+08  Median :2500  Median :     0.02  Median :8.462e+04  Median : 0.000e+00
 Mean   : 9399                                       Mean   :  28.04                     Mean   : 1.267e+15  Mean   :3.122e+14  Mean   :1.458e+16  Mean   :2500  Mean   :   202.23  Mean   :3.846e+11  Mean   : 3.629e+08
 3rd Qu.:13904                                       3rd Qu.:  10.00                     3rd Qu.: 1.000e+09  3rd Qu.:1.225e+08  3rd Qu.:1.000e+09  3rd Qu.:3750  3rd Qu.:     0.27  3rd Qu.:4.978e+05  3rd Qu.: 2.400e+01
 Max.   :20141                                       Max.   :33404.00                    Max.   : 1.000e+18  Max.   :9.818e+17  Max.   :6.900e+19  Max.   :5000  Max.   :306897.46  Max.   :1.069e+15  Max.   : 6.136e+11
 percent_change_1h  percent_change_24h  percent_change_7d  percent_change_30d  percent_change_60d  percent_change_90d  market_cap          market_cap_dominance fully_diluted_market_cap  mineable          exchange
 Min.   :-85.5037   Min.   : -99.376   Min.   : -100.000  Min.   :    -100   Min.   :    -100   Min.   :    -100   Min.   :0.000e+00   Min.   : 0.00000     Min.   :0.000e+00       Length:5000       Length:5000
 1st Qu.: -1.3091   1st Qu.:  -3.599   1st Qu.:  -35.217  1st Qu.:     -60   1st Qu.:     -62   1st Qu.:     -73   1st Qu.:0.000e+00   1st Qu.: 0.00000     1st Qu.:5.840e+05       Class :character  Class :character
 Median : -0.5701   Median :  -1.371   Median :  -22.539  Median :     -45   Median :     -46   Median :     -57   Median :3.832e+04   Median : 0.00000     Median :5.692e+06       Mode  :character  Mode  :character
 Mean   : -0.3756   Mean   :   3.181   Mean   :  -15.129  Mean   :   62766   Mean   :    2578   Mean   :   12119   Mean   :2.707e+08   Mean   : 0.01999     Mean   :3.582e+12
 3rd Qu.:  0.0072   3rd Qu.:   1.590   3rd Qu.:   -9.631  3rd Qu.:     -26   3rd Qu.:     -26   3rd Qu.:     -33   3rd Qu.:2.179e+06   3rd Qu.: 0.00000     3rd Qu.:4.790e+07
 Max.   :563.9154   Max.   :10107.825   Max.   :20582.217  Max.   :255557041   Max.   :12994064   Max.   :46267834   Max.   :5.666e+11   Max.   :44.38700     Max.   :8.824e+15
   payments            year
 Length:5000        Length:5000
 Class :character   Class :character
 Mode  :character   Mode  :character
```

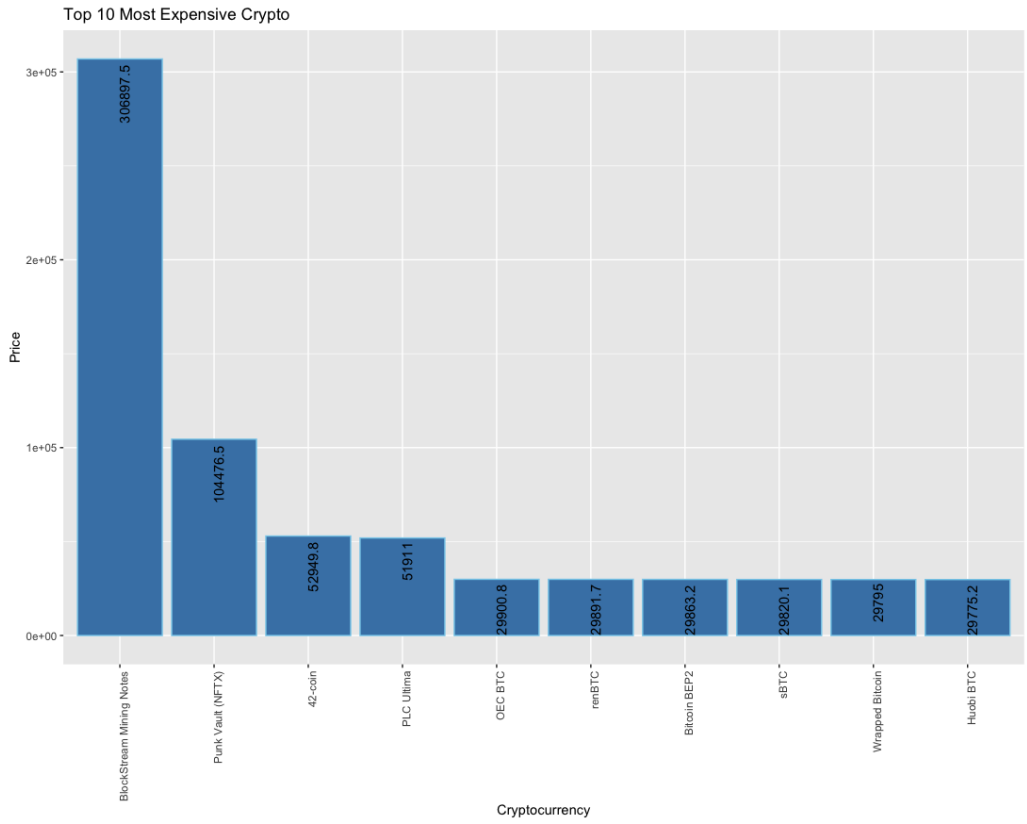
Data Visualizations from EDA

- ***Count of Cryptocurrencies added Yearly***



- The year **2021** had the highest addition of **1982** Cryptocurrencies.
- **759** new currencies have already been added this year (in a span of 5 months

- ***Top 10 Most Valued Cryptocurrencies***

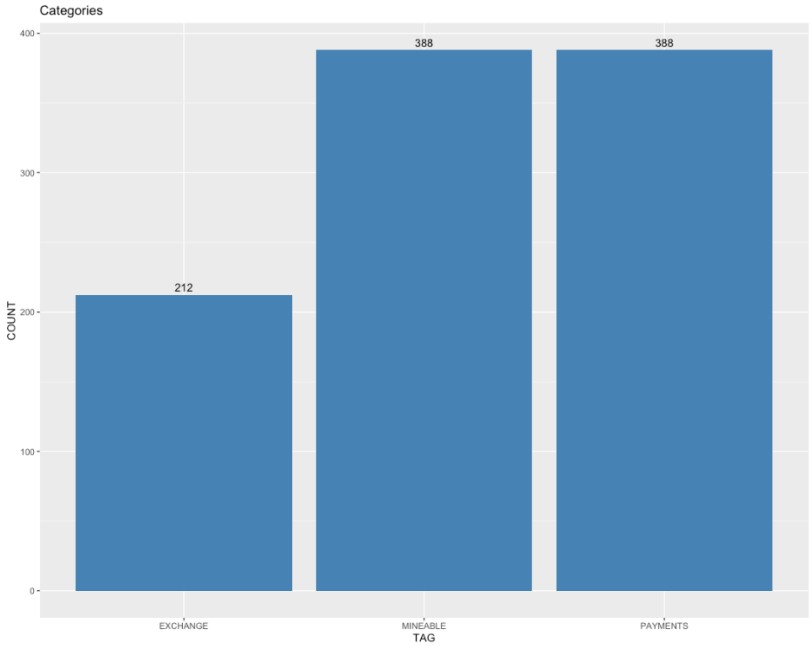


Block Stream Mining Notes (BMN) is the most valued at $306,897.5 followed by Punk Vault (NFTX) at $104,476.5

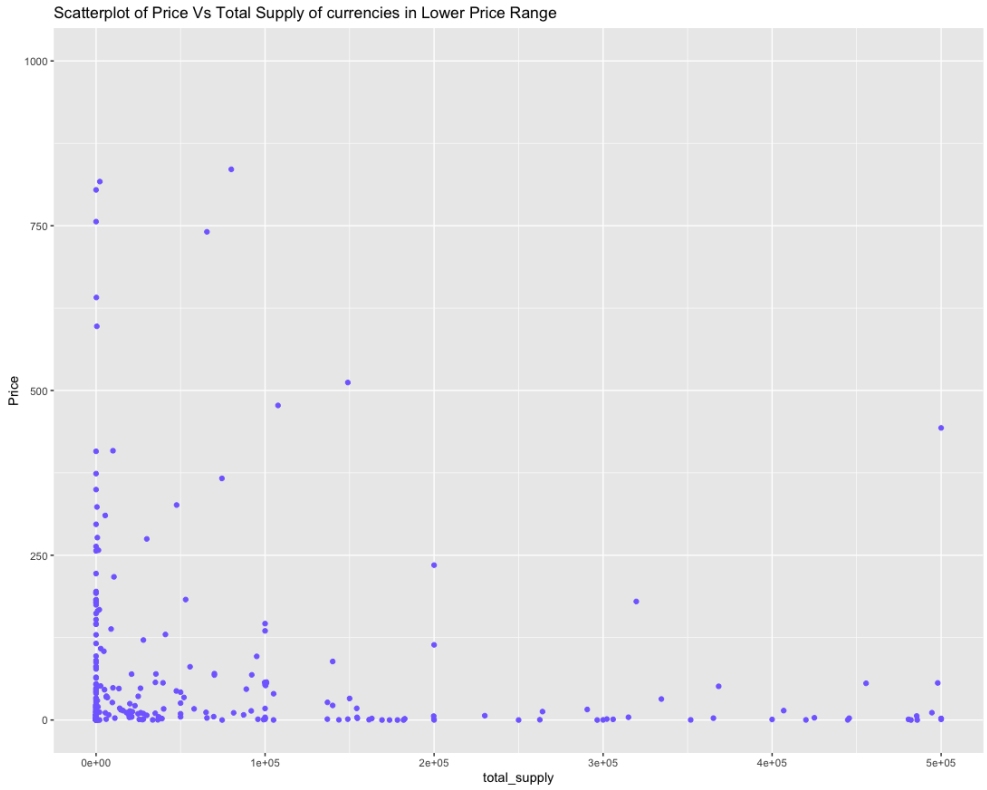
- ***Cryptocurrencies based on Tags***

From the below bar chart, we could observe that:

- Equal number (388) of Cryptocurrencies are categorized as MINEABLE and PAYMENTS
- 212 Cryptocurrencies are being used for exchanges



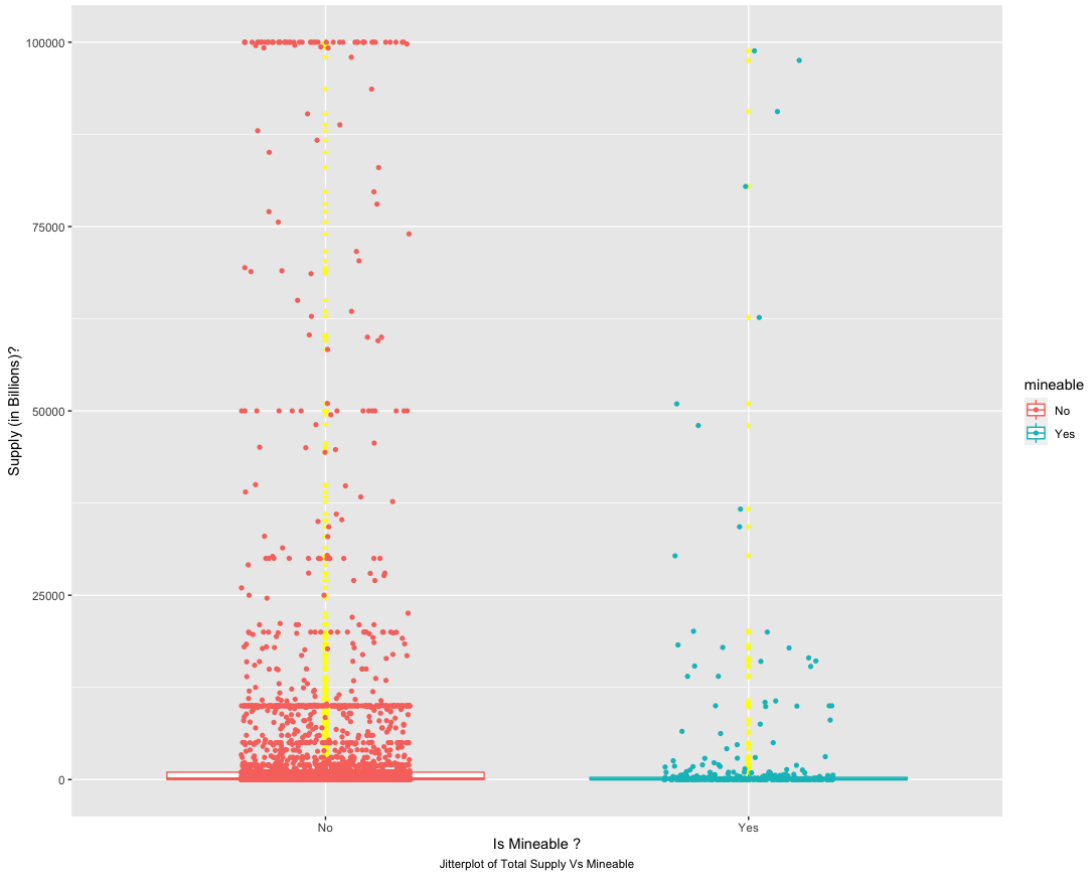
- ***Scatterplot of Price Vs Total Supply of currencies in Lower Price Range***



- The plot depicts the denser portion of the Crypto Currencies in the Low Value range

- It is not feasible to depict all the currencies in a single plot considering the immense variation in Price and Supply
- However, it is understood that Cryptocurrencies with Lower Supply have higher Prices and vice versa. The cluster in the Low Price- Low Supply region indicates the presence of other factors in determining the value of a cryptocurrency

- ***Jitter plot of Total Supply Vs Mineable***



- The Total Supply of Mineable Plot is less dense than the non-Mineable
- This shows the extent of growth for Mineable currencies
- The non-mineable on the other hand has very high supply, indicating high volume of cryptocurrency already in circulation.

- ***ANOVA Test to compare mean percent change over different time periods***

  The Analysis of Variance or ANOVA test is performed to analyze if the mean percent change of all cryptocurrencies over different time periods are equal.

  Hence, the NULL hypothesis states that the mean is equal.

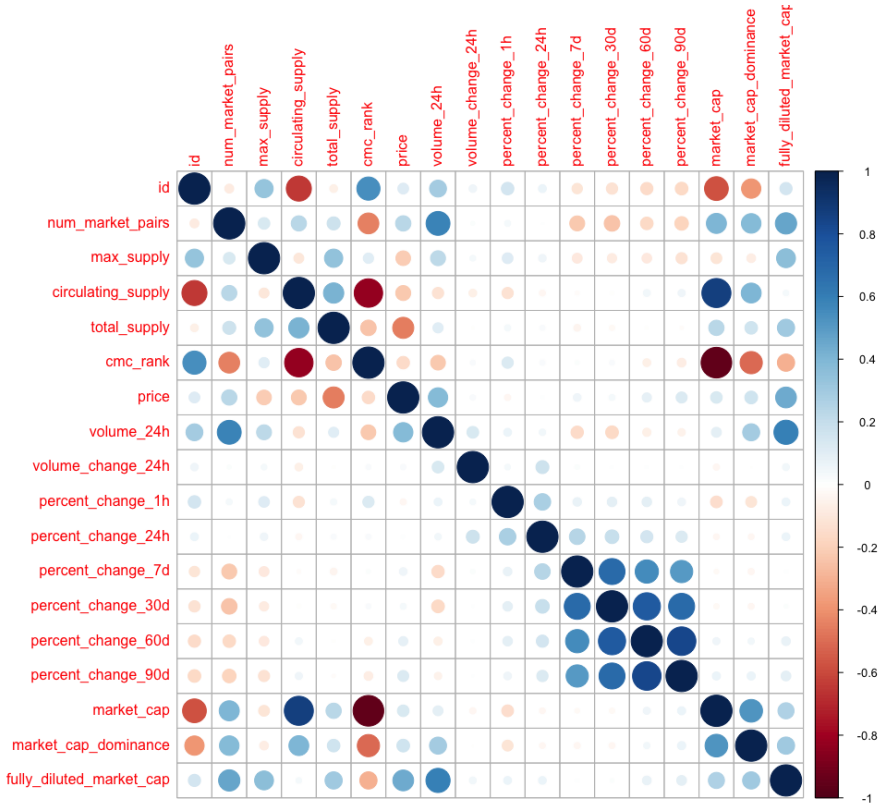
```
# One-way ANOVA Test

# Set significance level
alpha <- 0.05
# Dataframe for 30 Days
thirtyDays <- data.frame('variation' = df$percent_change_30d,
                         'timeperiod' = rep('thirtyDays',5000), stringsAsFactors = FALSE)
# Dataframe for 60 Days
sixtyDays <- data.frame('variation' = df$percent_change_60d,
                        'timeperiod' = rep('sixtyDays',5000), stringsAsFactors = FALSE)
# Dataframe for 90 Days
ninetyDays <- data.frame('variation' = df$percent_change_90d,
                         'timeperiod' = rep('ninetyDays',5000), stringsAsFactors = FALSE)
# Combine the Dataframe
variation <- rbind(thirtyDays,sixtyDays,ninetyDays)
variation$timeperiod <- as.factor(variation$timeperiod)

# Hypotheses
# H0: Mean Variation(30 Days) =  Mean Variation(60 Days) =  Mean Variation(90 Days)
# H1: Atleast one mean is different from others
```

```
> anova <- aov(variation ~ timeperiod, data = variation)
> a_summ <-summary(anova)
> # Critical Value
> qf(1-alpha,a_summ[[1]][1,1],a_summ[[1]][2,1])
[1] 2.996331
>
> # Test Value
> F.value <- a_summ[[1]][[1,"F value"]]
> F.value
[1] 1.101977
>
> # Compare p-value and alpha to make decision
> p.value <- a_summ[[1]][[1,"Pr(>F)"]]
> p.value
[1] 0.3322404
> ifelse(p.value > alpha,"Failed to reject Null Hypothesis","Reject Null Hypothesis")
[1] "Failed to reject Null Hypothesis"
>
```

The One-way ANOVA test failed to reject the Null hypothesis, hence proving that the mean of percent change over 30, 60 and 90 days are equal. This raises the question of whether prices of cryptocurrencies are dependent on each other.

- ***Correlation Analysis of Numeric values***

  The most effective way to understand correlation of the attributes is by plotting a correlation matric as shown below:



- Percent Changes shows high correlation between each other
- Total Supply has a negative correlation with Price
- Volume in 24 H has a positive correlation with the number of market pairs
- CMC Rank has a high correlation with market cap dominance

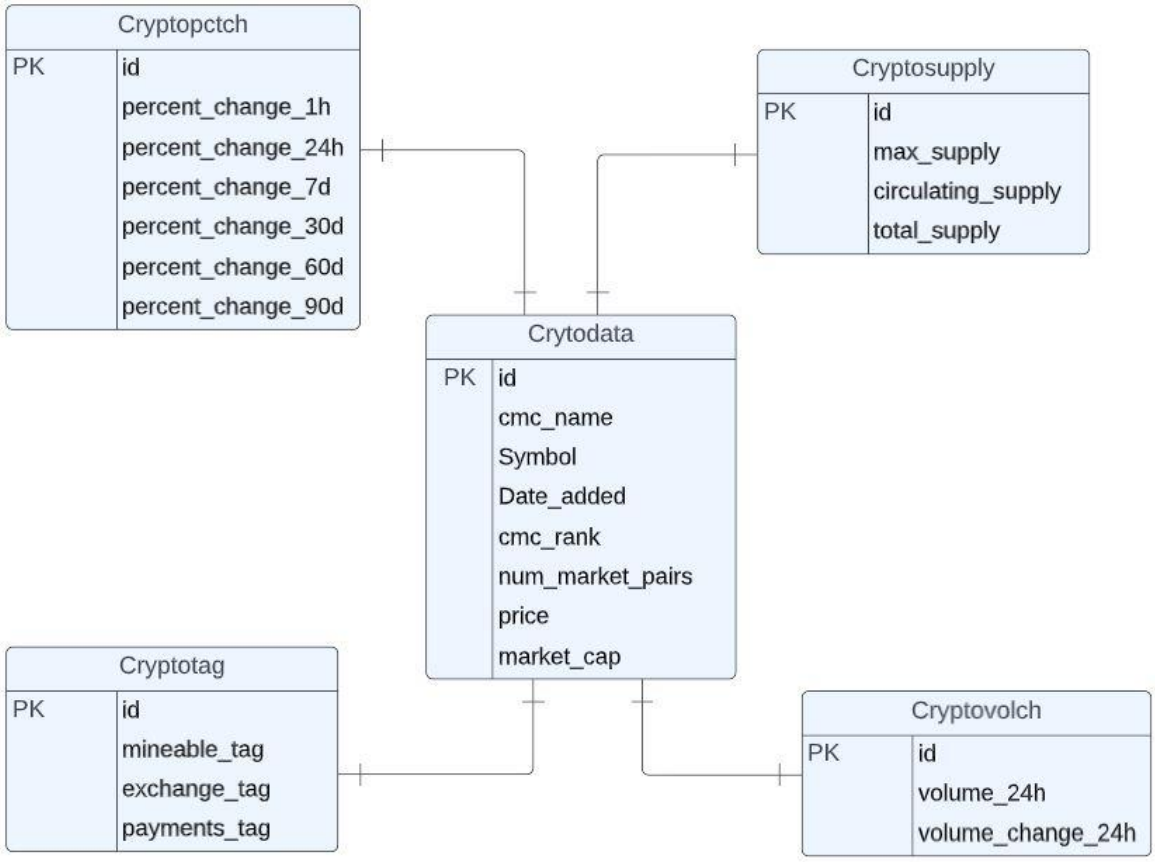
Database for Cryptocurrencies using SQL

The Analysis shows that cryptocurrencies are highly unpredictable, and price of a cryptocurrency are affected by many more unknown factors. Hence, it is more effective to have a database which stores data larger data pertaining to cryptocurrencies daily.

Querying this database would answer the questions (business questions) raised by new crypto investors. This database could further be used to create services (dashboards of insights, predictive models of prices and so on) to continuously analyze cryptocurrency.

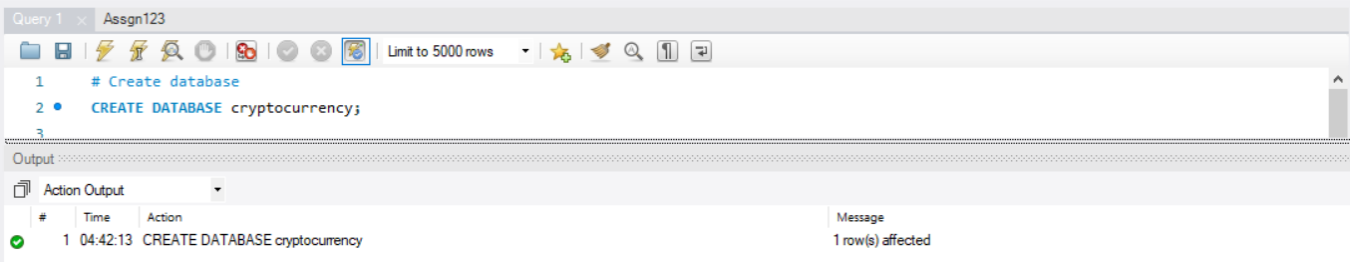
Entity Relationship Diagram

Normalization was performed and the main dataset was broken down into five tables. These tables contain information about cryptocurrencies, their supply, coin volume, tags and historical changes in prices.



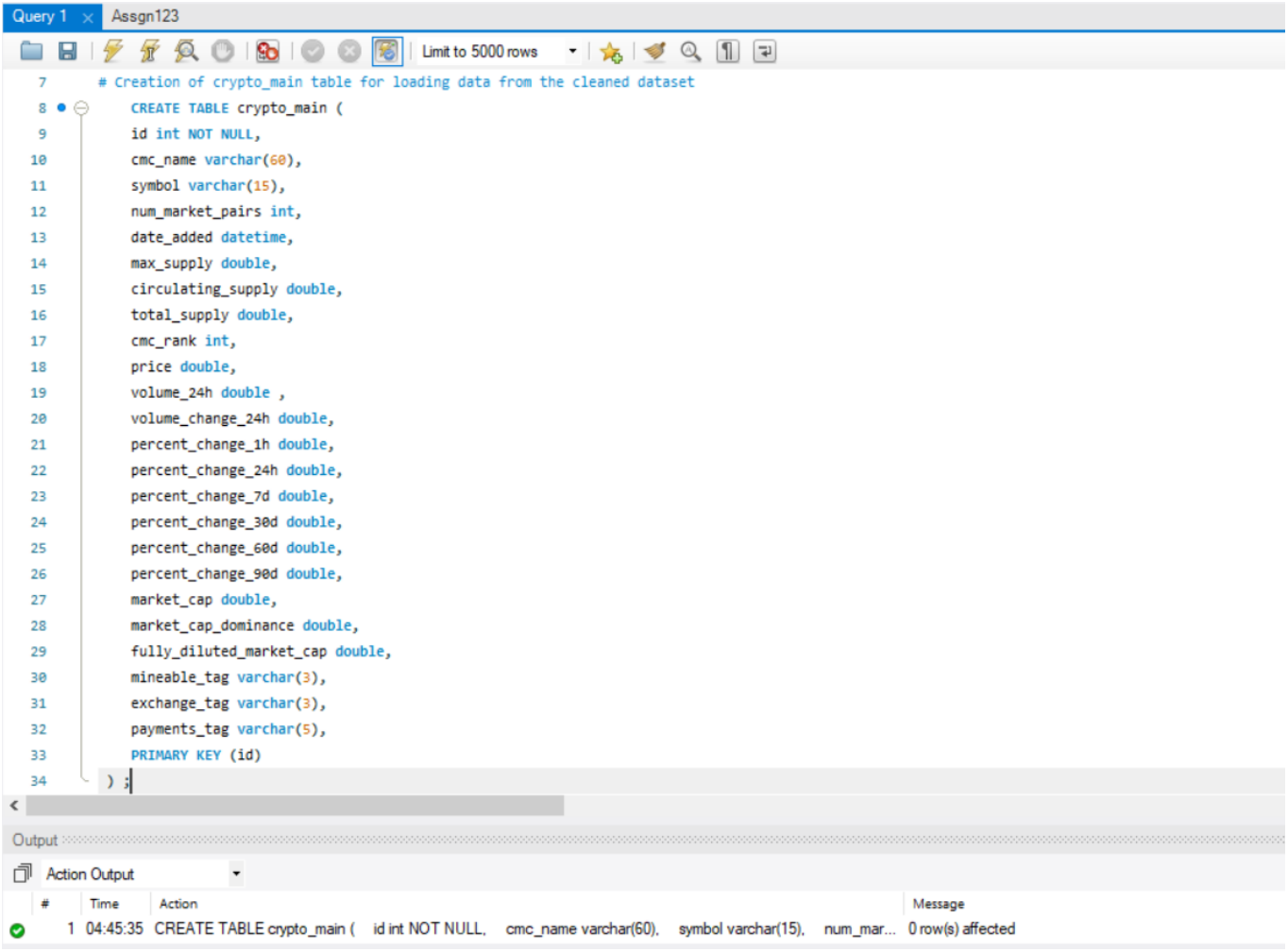
Data Preparation

- *Creation of Database*
  The schema cryptocurrency was created for storing the tables related to this project

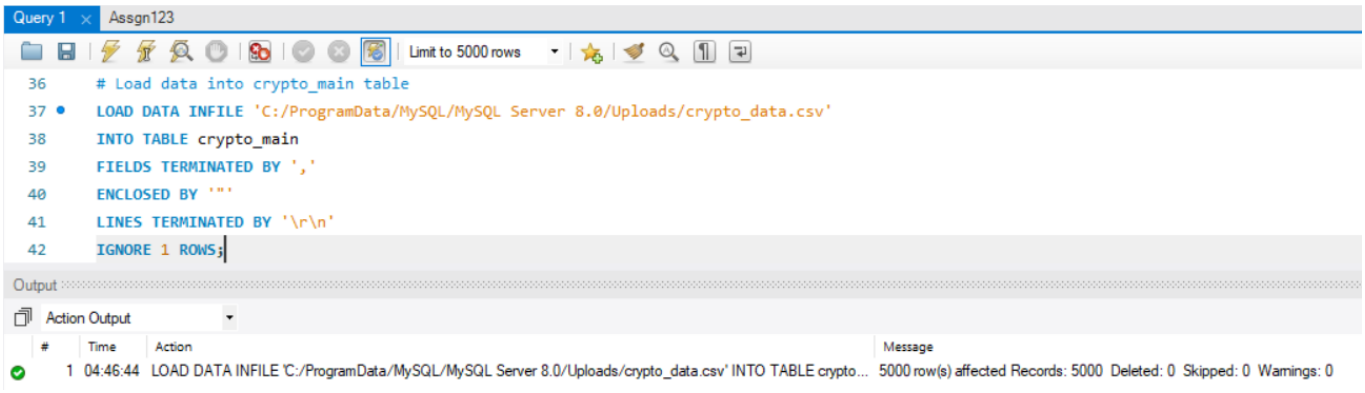


- *Creation of Tables*

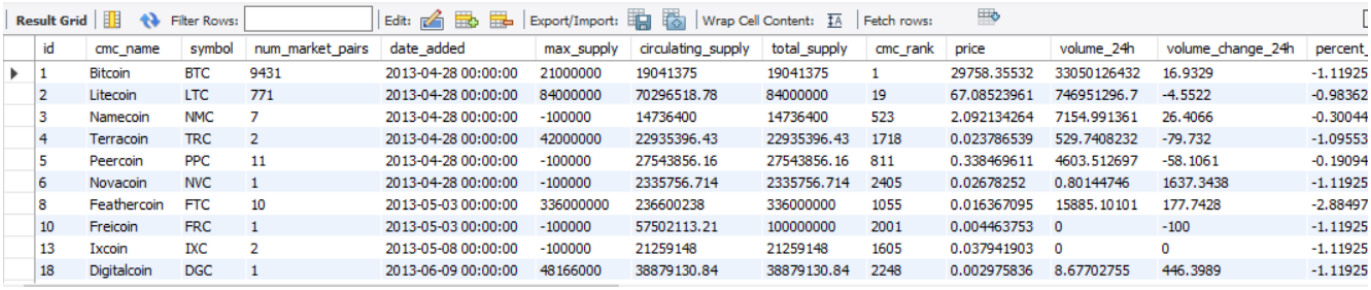
A new table structure was created using the CREATE TABLE() command for loading the dataset.



The cleaned dataset was loaded into the crypto_main table using the LOAD DATA command.



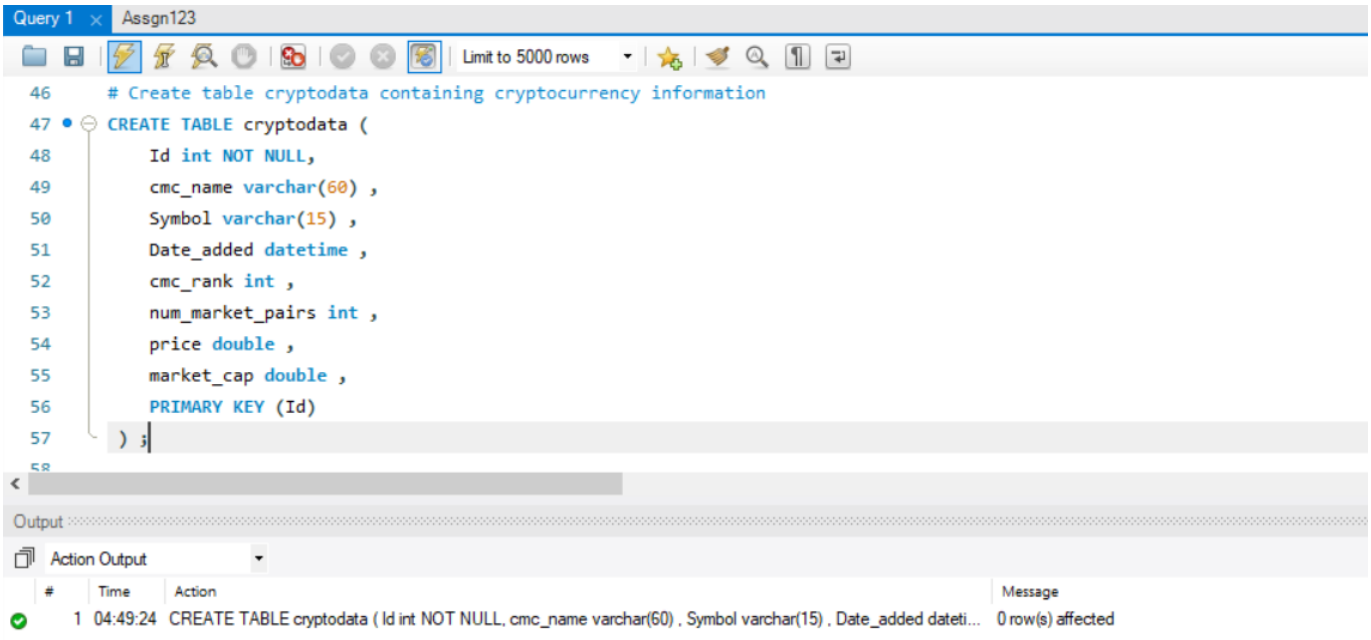
After loading data, the records got reflected in the crypt0_main table like below.



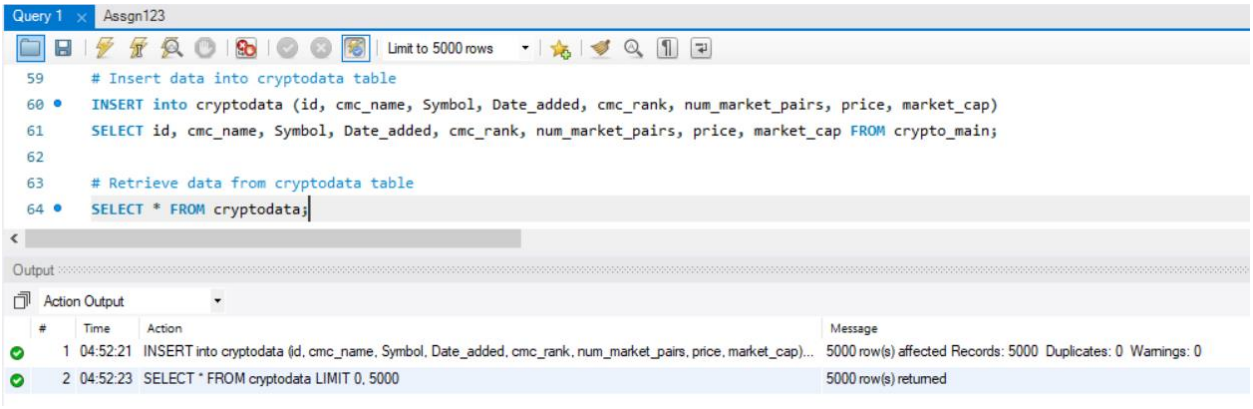
id	cmc_name	symbol	num_market_pairs	date_added	max_supply	circulating_supply	total_supply	cmc_rank	price	volume_24h	volume_change_24h	percent_
1	Bitcoin	BTC	9431	2013-04-28 00:00:00	21000000	19041375	19041375	1	29758.35532	33050126432	16.9329	-1.11925
2	Litecoin	LTC	771	2013-04-28 00:00:00	84000000	70296518.78	84000000	19	67.08523961	746951296.7	-4.5522	-0.98362
3	Namecoin	NMC	7	2013-04-28 00:00:00	-100000	14736400	14736400	523	2.092134264	7154.991361	26.4066	-0.30044
4	Terracoin	TRC	2	2013-04-28 00:00:00	42000000	22935396.43	22935396.43	1718	0.023786539	529.7408232	-79.732	-1.09553
5	Peercoin	PPC	11	2013-04-28 00:00:00	-100000	27543856.16	27543856.16	811	0.338469611	4603.512697	-58.1061	-0.19094
6	Novacoin	NVC	1	2013-04-28 00:00:00	-100000	2335756.714	2335756.714	2405	0.02678252	0.80144746	1637.3438	-1.11925
8	Feathercoin	FTC	10	2013-05-03 00:00:00	336000000	236600238	336000000	1055	0.016367095	15885.10101	177.7428	-2.88497
10	Freicoin	FRC	1	2013-05-03 00:00:00	-100000	57502113.21	100000000	2001	0.004463753	0	-100	-1.11925
13	Ixcoin	IXC	2	2013-05-08 00:00:00	-100000	21259148	21259148	1605	0.037941903	0	0	-1.11925
18	Digitalcoin	DGC	1	2013-06-09 00:00:00	48166000	38879130.84	38879130.84	2248	0.002975836	8.67702755	446.3989	-1.11925

Normalization was done and the below tables were created.

The cryptodata table contains information related to cryptocurrencies such as id, name, rank, active trading pairs, date added, price and its market capitalization.



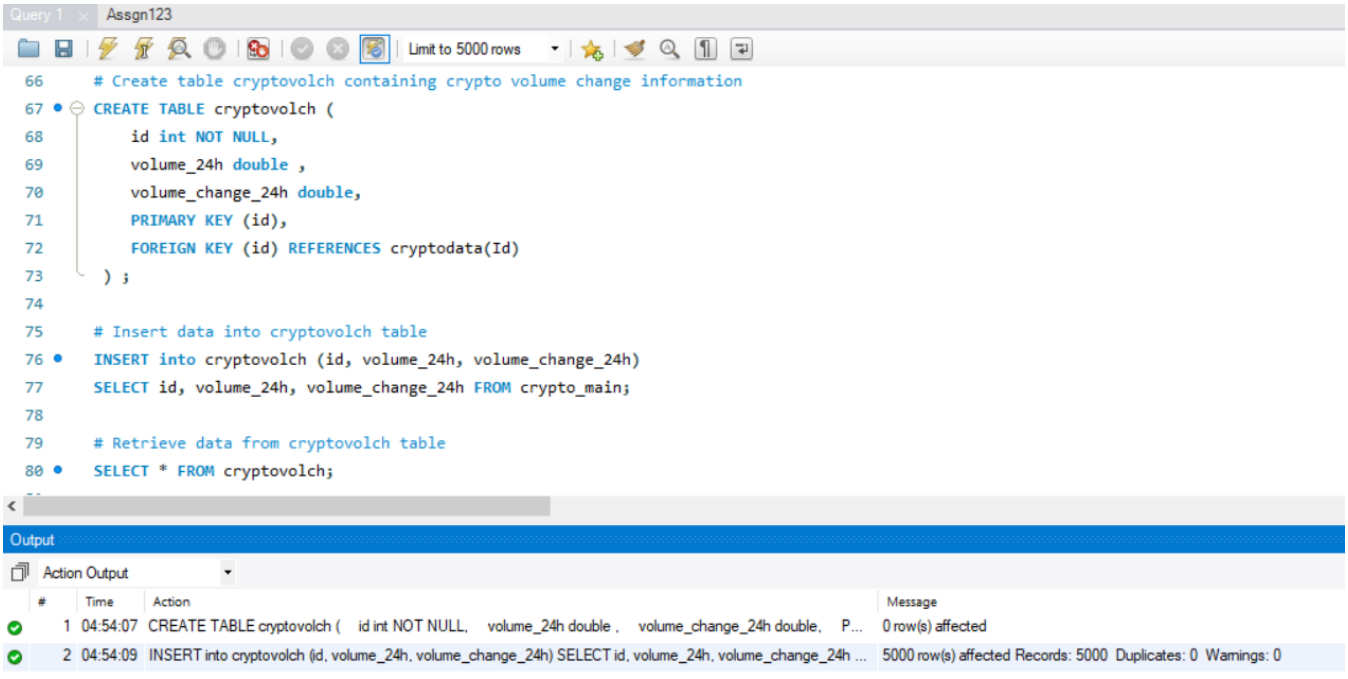
The data was inserted from the main table using the INSERT and SELECT command.



The records in the cryptodata table were retrieved and validated.

Id	cmc_name	Symbol	Date_added	cmc_rank	num_market_pairs	price	market_cap
1	Bitcoin	BTC	2013-04-28 00:00:00	1	9431	29758.35532	567000000000
2	Litecoin	LTC	2013-04-28 00:00:00	19	771	67.08523961	4715858806
3	Namecoin	NMC	2013-04-28 00:00:00	523	7	2.092134264	30830527.37
4	Terracoin	TRC	2013-04-28 00:00:00	1718	2	0.023786539	545553.7084
5	Peercoin	PPC	2013-04-28 00:00:00	811	11	0.338469611	9322758.292
6	Novacoin	NVC	2013-04-28 00:00:00	2405	1	0.02678252	62557.45041
8	Feathercoin	FTC	2013-05-03 00:00:00	1055	10	0.016367095	3872458.673
10	Freicoin	FRC	2013-05-03 00:00:00	2001	1	0.004463753	256675.2474
13	Ixcoin	IXC	2013-05-08 00:00:00	1605	2	0.037941903	806612.5319
18	Digitalcoin	DGC	2013-06-09 00:00:00	2248	1	0.002975836	115697.899
25	Goldcoin	GLC	2013-06-14 00:00:00	1479	8	0.028247396	1233886.411
35	Phoenixcoin	PXC	2013-07-04 00:00:00	1746	2	0.005956532	514245.3504

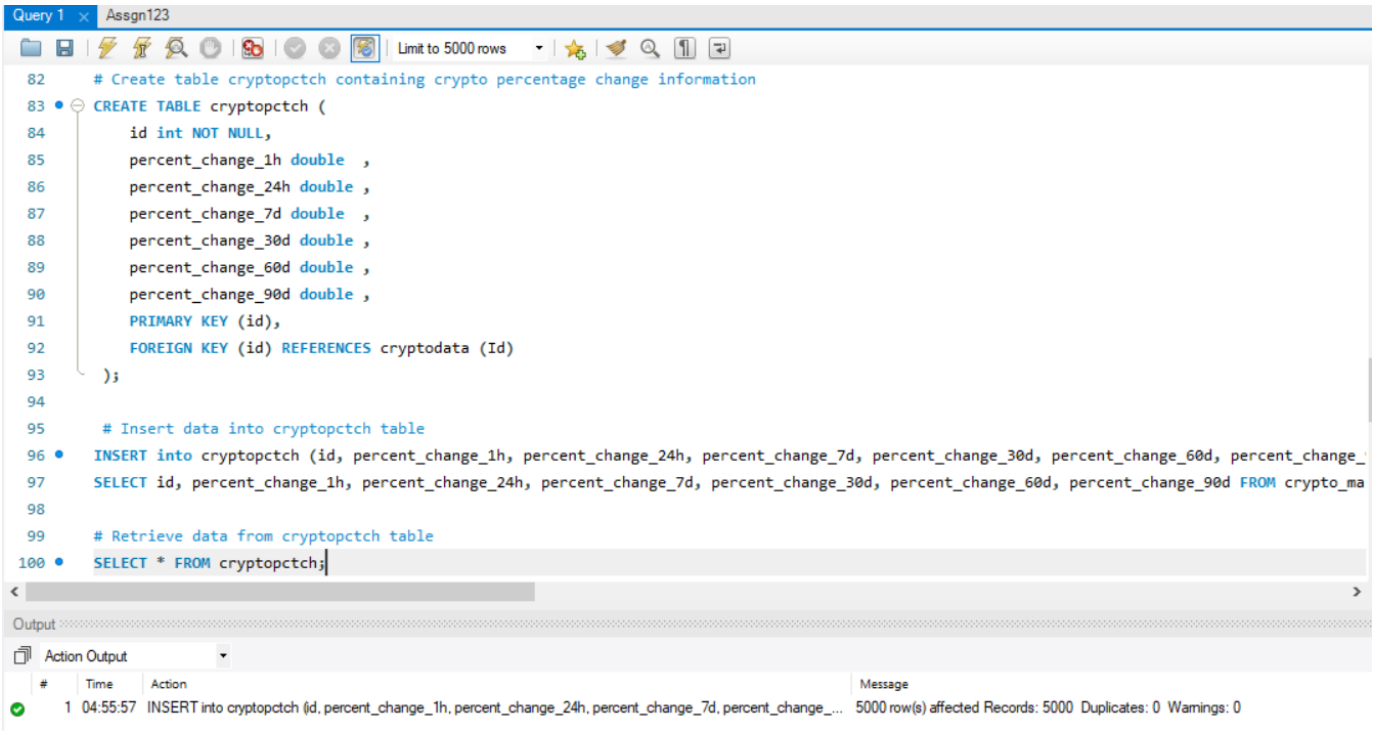
The cryptovolch table contains information about volume change in 24 hours for each coin.



The volume change in coins currently and in the last 24 hours were retrieved.

id	volume_24h	volume_change_24h
1	33050126432	16.9329
2	746951296.7	-4.5522
3	7154.991361	26.4066
4	529.7408232	-79.732
5	4603.512697	-58.1061
6	0.80144746	1637.3438
8	15885.10101	177.7428
10	0	-100

The cryptopctch table contains information about percentage change in prices for hourly and daily basis.

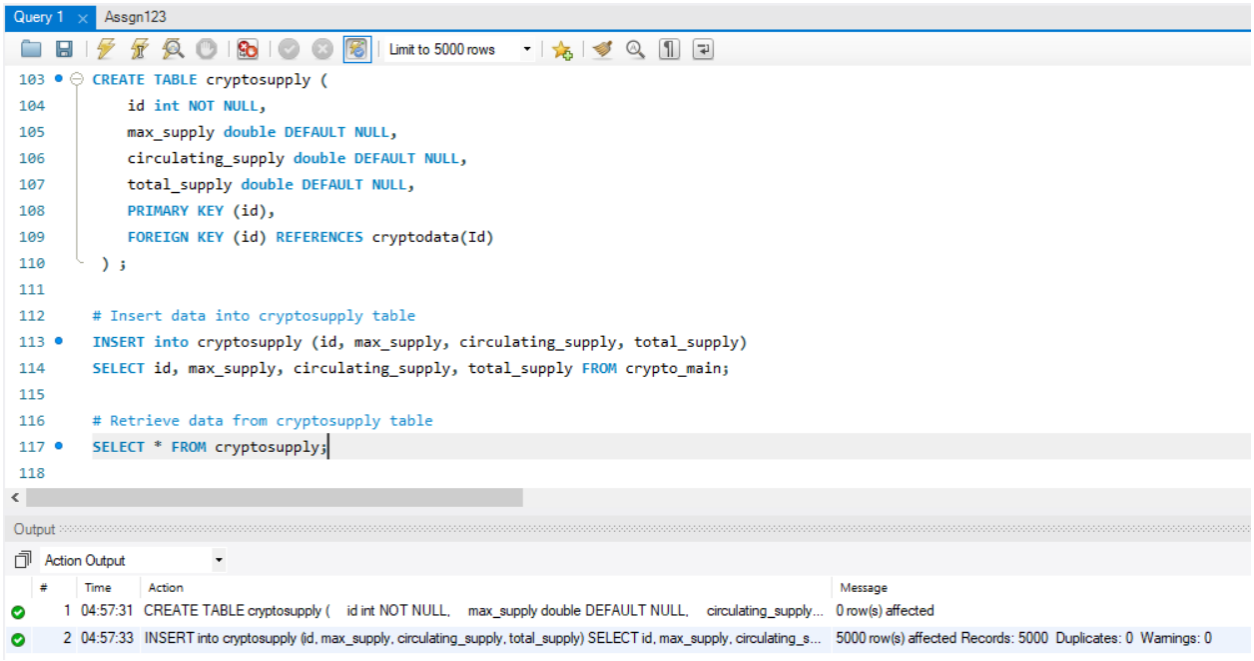


The records in the cryptodata table were retrieved and validated.

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content: | Fetch rows:

id	percent_change_1h	percent_change_24h	percent_change_7d	percent_change_30d	percent_change_60d	percent_change_90d
1	-1.11925016	-1.33688771	-9.71992518	-26.39118788	-27.35857161	-32.66720536
2	-0.98362841	-2.03487363	-23.57067068	-40.45819195	-39.16182741	-48.84897351
3	-0.30044638	-1.39874635	4.84635153	-17.28065872	-8.00217501	1.59000145
4	-1.09553445	-7.17802648	27.7220259	9.76665217	23.74685638	-30.1112353
5	-0.19094253	-5.82596008	-16.49625215	-37.81917739	-36.90878206	-48.48489825
6	-1.11925016	-1.33688771	-42.78023427	-65.31521942	-76.3125777	-83.57736716
8	-2.88497784	-4.7987513	27.31805424	84.0220303	135.1675571	61.0290101
10	-1.11925016	-1.33688771	-9.71992518	-26.39118788	-31.89866088	-22.30831387
13	-1.11925016	-1.33688771	-14.09918254	-51.30171162	-23.13873759	-53.34276458
18	-1.11925016	-1.33688771	-17.92720471	-26.39118788	-9.19821451	-48.20554258

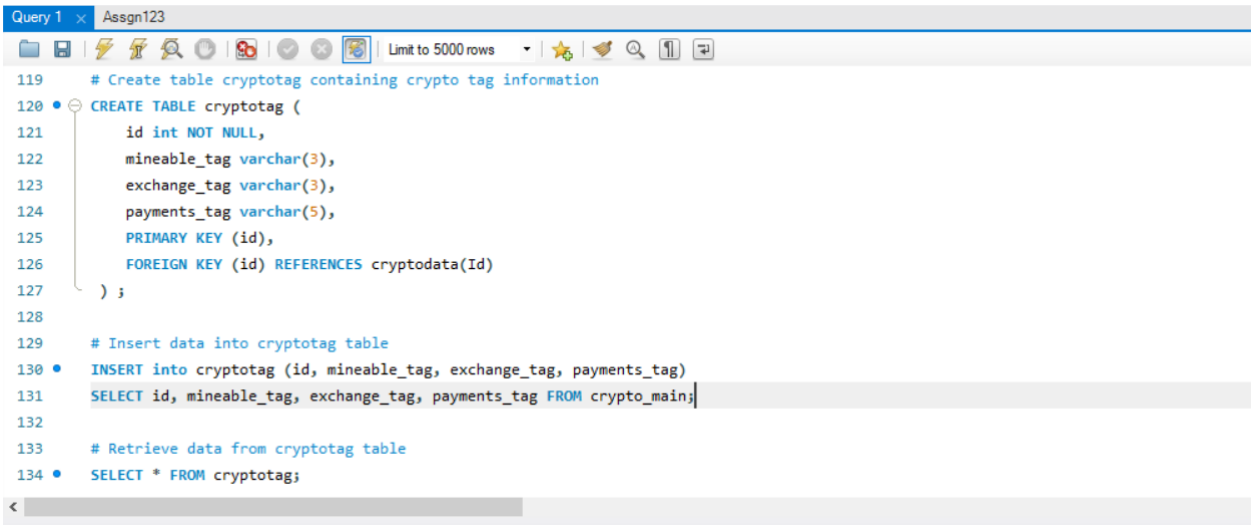
The cryptosupply table contains information about number of coins in existence, circulating and total supply.



The records in the cryptosupply table were retrieved and validated.

id	max_supply	circulating_supply	total_supply
1	21000000	19041375	19041375
2	84000000	70296518.78	84000000
3	-100000	14736400	14736400
4	42000000	22935396.43	22935396.43
5	-100000	27543856.16	27543856.16
6	-100000	2335756.714	2335756.714
8	336000000	236600238	336000000

The cryptotag contains tags indicates coins that can be mined, exchanged and paid for.



The records in the cryptotag table were retrieved and validated.

id	mineable_tag	exchange_tag	payments_tag
1	Yes	No	No
2	Yes	Yes	No
3	Yes	No	No
4	Yes	No	No
5	Yes	Yes	Yes
6	Yes	No	No
8	Yes	Yes	Yes
10	Yes	No	No

Analysis

- *Top ranked cryptocurrencies*

  The top ranked cryptocurrencies by coin market cap are listed below:

```
138     # Top 10 coin market cap ranked cryptocurrencies
139 •   SELECT cmc_rank "CMC Rank", cmc_name "Name of the cryptocurrency", price, market_cap "Market Capitalization"
140     FROM cryptodata
141     ORDER BY cmc_rank ASC
142     LIMIT 10;
```

CMC Rank	Name of the cryptocurrency	price	Market Capitalization
1	Bitcoin	29758.35532	567000000000
2	Ethereum	2015.402679	243000000000
3	Tether	0.999072793	75681882724
4	USD Coin	0.999812388	50993337983
5	BNB	297.0113509	48495114806
6	XRP	0.416470828	20133491375
7	Cardano	0.562727026	19031575776
8	Solana	53.96528935	18211193413
9	Binance USD	1.000841979	17750350433
10	Dogecoin	0.087364264	11590683657

  Bitcoin has been ranked 1st with a price value of 30,000 approx. We can also see that the dominance of cryptocurrencies is more given its market capitalization and ranking. Bitcoin has a market capitalization of 567 billion. Next in line is Ethereum with a market capitalization of 243 billion. The price difference is drastic(67%) between the top two ranked cryptocurrencies.

- *Highest active trading pairs for cryptocurrencies.*

  Crypto coins can be purchased in exchange of other coins. i.e., assets that can be traded for each other on an exchange The highest number of active trading pairs available for cryptocurrencies across supported exchanges is listed below.

```
144     # Highest active trading pairs for cryptocurrencies.
145 •   SELECT cmc_name "Name of the cryptocurrency", num_market_pairs "Active trading pairs"
146     FROM cryptodata
147     ORDER BY num_market_pairs DESC
148     LIMIT 3;
```

Name of the cryptocurrency	Active trading pairs
Tether	33404
Bitcoin	9431
Wrapped BNB	6467

Tether has the highest number of active trading pairs available. i.e., it accepts other 33404 cryptocurrencies in exchange. Next come Bitcoin which accepts 9431 other cryptocurrencies.

- *Obtain descriptive statistics for price and volume of cryptocurrencies*

  As part of initial analysis, descriptive statistics for price and volume was obtained.

```
150     # Central tendencies of price for cryptocurrience
151 •   SELECT
152         min(price) "Minimum Price",
153         round(max(price),2) "Maximum Price",
154         round(avg(price),2) "Average Price",
155         round(stddev(price),2) "Standard Deviation of Price",
156         round(variance(price),2) "Variance of Price"
157     FROM cryptodata;
```

Minimum Price	Maximum Price	Average Price	Standard Deviation of Price	Variance of Price
1.96e-17	306897.46	202.23	4932.48	24329378.74

The minimum price was in cents and the maximum price went up to 3,06,900 USD. The spread in the price attribute was around 4932 USD.

- *Currencies that would be suitable for mining.*

  A lot of investors look for cryptocurrencies that can be mined after purchasing. It is important to know if the cryptocurrencies can be mined. Thus, the list of cryptocurrencies that can be mined is obtained.

```
168    # Currencies that would be suitable for mining
169 •  SELECT d.id, cmc_name, price, round(max_supply-total_supply,2) "Mineable Units"
170    FROM cryptodata d
171    INNER JOIN cryptotag t
172    ON d.id = t.id
173    INNER JOIN cryptosupply s
174    ON d.id = s.id
175    WHERE mineable_tag='Yes' AND max_supply > 0;
```

The mineable units were calculated for the cryptocurrencies that had the option to mine.

id	cmc_name	price	Mineable Units
1	Bitcoin	29758.35532	1958625
2	Litecoin	67.08523961	0
4	Terracoin	0.023786539	19064603.57
8	Feathercoin	0.016367095	0
18	Digitalcoin	0.002975836	9286869.16
25	Goldcoin	0.028247396	28220751
35	Phoenixcoin	0.005956532	11666987.87

It was observed that Bitcoin had around 20,00,000 mineable units left. The 0 in the mineable units mean that those cryptocurrencies don't have any mineable units left and they are maxed out. Litecoin and Feathercoin are of that type.

- *Coins that are almost completely mined*

  The coins that are almost completely mined were calculated using the below query.

```
177    # Coins that are almost completely mined
178 •  SELECT d.id, cmc_name, price, round(max_supply-total_supply,2) "Mineable Units"
179    FROM cryptodata d
180    INNER JOIN cryptotag t
181    ON d.id = t.id
182    INNER JOIN cryptosupply s
183    ON d.id = s.id
184    WHERE mineable_tag='Yes' AND max_supply > 0
185    ORDER BY abs(max_supply-total_supply) ASC;
```

id	cmc_name	price	Mineable Units
4841	suterusu	0.000907328	0
5647	Kadena	2.901547672	0
5665	Helium	8.883962616	0
5821	Aleph.im	0.261864779	0
470	Viacoin	0.07288033	1637.39
234	e-Gulden	0.07704492	8668
2575	Bitcoin Private	1.373422375	58281

The above list shows that they have the remaining mineable units left. The 0 in the mineable units mean that those cryptocurrencies don't have any mineable units left.

- *Currencies that would be suitable for exchange and payments*

The cryptocurrencies that can suitable for exchange and payments are listed below.

```
187    # Currencies that would be suitable for exchange and payments
188 •  SELECT d.id, cmc_name, price, exchange_tag, payments_tag
189    FROM cryptodata d
190    INNER JOIN cryptotag t
191    ON d.id = t.id
192    WHERE exchange_tag='Yes' OR payments_tag='Yes' AND price BETWEEN 0 AND 10000;
193
```

id	cmc_name	price	exchange_tag	payments_tag
2	Litecoin	67.08523961	Yes	No
5	Peercoin	0.338469611	Yes	Yes
8	Feathercoin	0.016367095	Yes	Yes
52	XRP	0.416470828	Yes	No
74	Dogecoin	0.087364264	Yes	Yes
99	Vertcoin	0.161613505	Yes	Yes
109	DigiByte	0.012297759	Yes	Yes
131	Dash	57.20472023	Yes	No

We can observe that Peercoin, Dogecoin, Vertcoin, DigiByte are suitable for both exchange and payments whereas Litecoin and Dash are only suitable for exchange.

- *Stable coins in a given price range*

Every investor wants to know the stability in prices before purchasing a crypto coin. For any investor with a constraint in price say a limit between 0 to 1000USD, the below list depicts the stable coins for the past 30 days with that price limit.

```
194    # Stable coins in a given price range
195 •  SELECT d.id, cmc_name, price, abs(percent_change_30d) "Percentage change"
196    FROM cryptodata d
197    INNER JOIN cryptopctch p
198    ON d.id=p.id
199    WHERE price BETWEEN 0 AND 1000
200    ORDER BY abs(percent_change_30d) ASC;
```

id	cmc_name	price	Percentage change
2766	Cryptaur	0.000140148	0
3755	Moneynet	0.0000712	0
8934	StakerDAO	0.005913793	0
8950	Cash Tech	0.003341306	0
10896	CumStar	0.000000000623	0
9839	blockbank	0.018067638	0.00333583
6727	Reserve	0.997636408	0.00417504

The percentage change 0 can mean that there hasn't been any change in the crypto currency for the past 30 days which can also be a disadvantage for investors planning to invest on it.

- *Volatile coins in a given price range*

The coins with fluctuating price changes are listed below.

```
202     # Volatile coins in a given price range
203 •   SELECT d.id, cmc_name, price, abs(percent_change_30d) "Percentage change"
204     FROM cryptodata d
205     INNER JOIN cryptopctch p
206     ON d.id=p.id
207     WHERE abs(percent_change_30d) < 1000 AND price BETWEEN 0 AND 1000
208     ORDER BY abs(percent_change_30d) DESC;
```

id	cmc_name	price	Percentage change
13248	Asia Pacific Electronic Coin	8.106062895	720.2344651
20115	DELOT.IO	0.005209781	686.3911273
19707	QUINT	0.698925997	627.3029459
18023	SKY FRONTIER	0.0000000413	626.1600393
16342	Odin Platform	0.002425023	614.3011581
3998	Krios	0.002620023	563.2289605
5529	ASYAGRO	0.049790614	552.8764772

The same price constraint was given, and we found that Asia Pacific Electronic coin had the highest percentage change of 720% in the past 30 days. This type of coins can be called as volatile coins given its unpredictability. Then comes DELOT.IO with 686% change during the last 30 days.

- *Top Drops in 90 days*

The percentage drop of cryptocurrencies was obtained for a duration of 90 days. The SQL code is given below.

```
210     # Top Drops in 90 days
211 •   SELECT d.id, cmc_name, price, percent_change_90d
212     FROM cryptodata d
213     INNER JOIN cryptopctch p
214     ON d.id=p.id
215     WHERE percent_change_90d < 0 AND percent_change_90d <1000
216     ORDER BY percent_change_90d ASC;
217
```

id	cmc_name	price	percent_change_90d
18598	LordToken	0.024401325	-99.99991961
4172	Terra	0.000187111	-99.99966713
11178	Wrapped LUNA Token	0.000182616	-99.99966376
17013	Lido Bonded LUNA	0.002866496	-99.99486674
2444	CRYPTO20	0.004362166	-99.87616423
6735	Nexalt	0.0000266	-99.87500953
19409	Tiger shares	57.0495051	-99.84879495
7544	The Luxury Coin	0.087867516	-99.81951513
14599	PANDAINU	0.00000595	-99.80688962

The list shows the cryptocurrencies which had a huge drop during the 90 days duration. We can see that there is almost 100% drop in the percentage changes and the price values are nearly cents. Investors can use this data to consider purchasing the cryptocurrencies.

- *Top Rises in 90 days*

  The percentage rise of cryptocurrencies was obtained for a duration of 90 days.

```
219     # Top Rises in 90 days
220 •   SELECT d.id, cmc_name, price, percent_change_90d
221     FROM cryptodata d
222     INNER JOIN cryptopctch p
223     ON d.id=p.id
224     WHERE percent_change_90d > 0 AND percent_change_90d <1000
225     ORDER BY percent_change_90d DESC;
226
```

id	cmc_name	price	percent_change_90d
14235	Shiba Interstellar	0.00000000117	894.1197758
8007	Natural Farm Union Protocol	0.202922127	862.7054863
18069	STEPN	1.437847307	836.3572285
3311	Castle	0.005651944	752.4165244
12489	Guardian	9.458588316	747.8835526
17318	CATCOIN	0.00000000351	736.0259772
3800	FidexToken	0.0000993	730.8819145
18059	QMALL TOKEN	0.817288789	720.8821143
18876	ApeCoin	8.111622416	710.8406254

Shiba Interstellar had a huge rise in price accounting to 894% of increase in its price for a duration of 90 days. We can also observe the price us nearly in cents

Natural Farm Union Protocol had a rise of 862% with the current price value in cents. It was analyzed that even though there is an increase in price, the current prices of these cryptocurrencies are comparatively lesser than those of cryptocurrencies with price drop. Investors would look out for the stability in prices while considering purchasing the cryptocurrency.

Conclusion

Through the analysis, we gathered the following insights:

- The top ranked cryptocurrencies by coin market cap includes Bitcoin with current price value of 29,758 USD, Ethereum with a price value of 2015 USD and Tether with price value in cents.
- Tether has the highest number of active trading pairs available. i.e., it accepts other 33404 cryptocurrencies in exchange. Next come Bitcoin which accepts 9431 other cryptocurrencies.
- While checking currencies that would be suitable for mining, It was observed that Bitcoin had around 20,00,000 mineable units left and few cryptocurrencies like Litecoin and Feathercoin had 0 mining units.
- Cryptocurrencies such as Suterusu, Kadena, Helium and Aleph.im have almost completely mined.
- Cryptocurrencies like Peercoin, Dogecoin, Vertcoin, DigiByte are suitable for both exchange and payments whereas Litecoin and Dash are only suitable for exchange.
- Stable coins such as Cryptaur, Moneynet, Cash Tech and volatile coins such as Asia Pacific Electronic Coin, Delot.io, Krios, Odin Platform were identified for a given period.
- A drop of almost 100% and a rise of almost 862% in the price changes was recorded for a duration of 90 days.

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