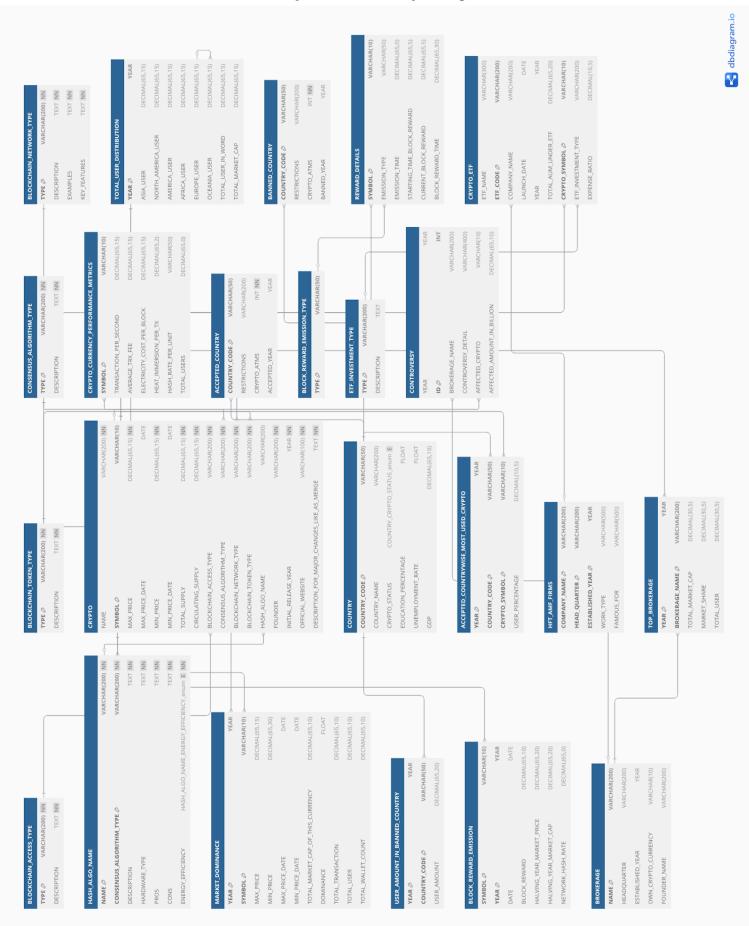
Entity Relationship Diagram



Schema Diagram



Complex Engineering Problem Project Mapping Report (Washington Accord)

This report maps the database project to the Washington Accord's **Knowledge Profile (K1-K8)**, **Complex Engineering Problem Solving Skills (P1-P7)**, and **Complex Engineering Activities (A1-A5)**, using the provided slides as reference.

Each attribute is tied to specific tables and explained in the context of the project.

Knowledge Profile (K1-K8)

- K1: A systematic, theory-based understanding of the natural sciences applicable to the discipline
 - How Applied: These attributes require understanding of physics (energy consumption, heat transfer), thermodynamics, and mathematics (cost calculations) to model the environmental impact of blockchain operations, aligning with natural sciences principles.
 - Sample Parameter: ELECTRICITY_COST_PER_BLOCK and HEAT_IMMERSION_PER_TX in the CRYPTO_CURRENCY_PERFORMANCE_METRICS table.
- K2: Conceptually based mathematics, numerical analysis, statistics, and the formal aspects of computer and information science
 - How Applied: Calculating market dominance involves statistical analysis, while hash rate computations require numerical modeling, both rooted in computer science and mathematics.
 - Sample Parameter: DOMINANCE (FLOAT, CHECK <= 100) in the MARKET_DOMINANCE table and NETWORK_HASH_RATE in the BLOCK REWARD EMISSION table.

- K3: A systematic, theory-based formulation of engineering fundamentals
 - How Applied: Modeling consensus mechanisms (e.g., PoW, PoS), hash algorithms (e.g., SHA-256, RandomX) requires engineering fundamentals of distributed systems and cryptography, ensuring accurate representation of blockchain operations.
 - Sample Parameter: CONSENSUS_ALGORITHM_TYPE in the CRYPTO and HASH_ALGO_NAME tables.
- K4: Engineering specialist knowledge that provides theoretical frameworks
 - How Applied: Understanding block reward emission models
 (e.g., halving, tailing) requires specialized knowledge of
 blockchain economics and tokenomics, providing a theoretical
 framework for supply dynamics.
 - Sample Parameter: EMISSION_TYPE in the REWARD_DETAILS table and BLOCK_REWARD_EMISSION_TYPE table.
- K5: Knowledge that supports engineering design
 - How Applied: Designing a normalized schema with FKs supports
 efficient data retrieval and integrity, crucial for engineering a scalable
 database system. Tools like DB Diagram and DataGrip were used
 to design the ER diagram, schema diagram, and ensure
 normalization.
 - Sample Parameter: FK relationships in the CRYPTO table (e.g., BLOCKCHAIN_ACCESS_TYPE, BLOCKCHAIN_TOKEN_TYPE).

- K6: Knowledge of engineering practice (technology)
 - How Applied: Specifying hardware (e.g., ASIC, GPU) for mining reflects practical knowledge of blockchain technology and its computational requirements. For make this project we use DBMS knowledge. Data from CoinMarketCap, Cambridge Bitcoin Electricity Consumption Index, CryptoCompare, and Whattomine was integrated using SQL Server Management Studio.
 - Sample Parameter: This project, HARDWARE_TYPE in the HASH ALGO NAME table.

- K7: Comprehension of the role of engineering in society
 - How Applied: These attributes address regulatory, ethical, and social impacts of cryptocurrencies, such as public safety and economic implications, aligning with engineering's societal role.
 - Sample Parameter: CRYPTO_STATUS in the COUNTRY table and CONTROVERSY_DETAIL in the CONTROVERSY table.
- K8: Engagement with selected knowledge in the research literature
 - How Applied: Assessing energy efficiency requires engaging with research on sustainable blockchain technologies, ensuring the project aligns with current environmental studies.
 - Sample Parameter: ENERGY_EFFICIENCY in the HASH_ALGO_NAME table.

Complex Engineering Problem-Solving Skills (P1-P7)

- P1: Cannot be resolved without in-depth engineering knowledge
 - How Applied: Calculating energy costs and heat per transaction requires deep knowledge of electrical engineering and thermodynamics, as these are not trivial metrics and involve complex modeling.
 - Sample Parameter: ELECTRICITY_COST_PER_BLOCK and HEAT_IMMERSION_PER_TX in the CRYPTO_CURRENCY_PERFORMANCE_METRICS table.
- P2: Involve wide-ranging or conflicting technical, engineering, and other issues
 - How Applied: Balancing regulatory compliance (legal issues)
 with technical implementation (blockchain accessibility)
 involves conflicting requirements, such as privacy versus
 transparency.
 - Sample Parameter: CRYPTO_STATUS in the COUNTRY table and RESTRICTIONS in the ACCEPTED_COUNTRY and BANNED_COUNTRY tables.

- P3: Has no obvious solution and requires abstract thinking
 - How Applied: Calculating market dominance requires abstract modeling of market share, with no obvious formula, as it involves dynamic market data and competitive analysis.
 - Sample Parameter: DOMINANCE in the MARKET_DOMINANCE table.

- P4: Involve infrequently encountered issues
 - How Applied: Controversies in crypto markets (e.g., hacks, fraud)
 are infrequent but impactful, requiring unique risk assessment and
 mitigation strategies.
 - Sample Parameter: CONTROVERSY_DETAIL in the CONTROVERSY table.
- P5: Are outside problems encompassed by standards and codes
 - How Applied: Halving events and their market impacts are not governed by standard financial codes, requiring custom analysis beyond traditional frameworks.
 - Sample Parameter: BLOCK_REWARD_EMISSION table's
 HALVING YEAR MARKET PRICE and HALVING YEAR MARKET CAP.
- P6: Involve diverse groups of stakeholders with widely varying needs
 - How Applied: The table addresses the needs of diverse stakeholders (investors, regulators, developers) with varying interests in regional adoption trends and market growth.
 - Sample Parameter: TOTAL_USER_DISTRIBUTION table's regional user attributes (e.g., ASIA_USER, EUROPE_USER).
- P7: Are high-level problems including many component parts or sub-problems
 - How Applied: The CRYPTO table integrates multiple sub-problems (access type, consensus mechanism, token type), forming a high-level system for crypto analysis.

 Sample Parameter: Multiple FKs in the CRYPTO table (e.g., BLOCKCHAIN ACCESS TYPE, CONSENSUS ALGORITHM TYPE).

Complex Engineering Activities (A1-A5)

- A1: Involve the use of diverse resources
 - How Applied: Managing ETF data involves diverse resources, including financial data (AUM), human resources (firms), and technology (database systems), to support investment analysis.
 - Sample Parameter: CRYPTO_ETF table's TOTAL_AUM_UNDER_ETF and COMPANY_NAME.
- A2: Require resolution of significant problems arising from interactions
 - How Applied: Balancing energy efficiency (environmental concern) with consensus mechanisms (technical requirement) resolves conflicts between sustainability and performance.
 - Sample Parameter: HASH_ALGO_NAME table's ENERGY_EFFICIENCY and CRYPTO table's CONSENSUS_ALGORITHM_TYPE.

- A3: Involve creative use of engineering principles
 - How Applied: Modeling emission types (e.g., halving, tailing)
 creatively applies engineering principles to predict supply dynamics
 and market impacts, a novel challenge in blockchain.

- Sample Parameter: BLOCK_REWARD_EMISSION_TYPE and REWARD DETAILS tables' emission models.
- A4: Have significant consequences in a range of contexts
 - How Applied: Controversies can impact financial markets, while regulatory status affects global adoption, both with significant economic and social consequences.
 - Sample Parameter: CONTROVERSY table's
 AFFECTED_AMOUNT_IN_BILLION and COUNTRY table's
 CRYPTO_STATUS.
- A5: Can extend beyond previous experiences by applying principles-based approaches.
 - How Applied: Analyzing crypto usage by country extends beyond traditional financial analysis, using principles-based data modeling to explore new adoption patterns.
 - Sample Parameter: ACCEPTED_COUNTRYWISE_MOST_USED_CRYPTO table's USER_PERCENTAGE.

QUERIES

Question 1:

Write a query to display the cryptocurrencies whose transaction fees are greater than or equal to 1 USD, and show them in ascending order of their transaction fees.

Query:

SELECT * FROM CRYPTO_CURRENCY_PERFORMANCE_METRICS WHERE

CRYPTO_CURRENCY_PERFORMANCE_METRICS.AVERAGE_TRX_FEE>=1 ORDER BY

AVERAGE_TRX_FEE ASC;

	SYMBOL	TRANSACTION_PER_SECOND	AVERAGE_TRX_FEE	ELECTRICITY_COST_PER_BLOCK	HEAT_IMMERSION_PER_TX	HASH_RATE_PER_UNIT	TOTAL_USERS
1	DAI	15.00000000000000	1.452000000000000	0.005000000000000	0.02	N/A	500000
2	ETH	15.00000000000000	1.4520000000000000	0.005000000000000	0.02	N/A	500000
3	GRT	15.000000000000000	1.4520000000000000	0.005000000000000	0.02	N/A	400000
4	LDO	15.00000000000000	1.452000000000000	0.005000000000000	0.02	N/A	300000
5	LINK	15.00000000000000	1.4520000000000000	0.005000000000000	0.02	N/A	600000
6	MANA	15.000000000000000	1.452000000000000	0.005000000000000	0.02	N/A	300000
7	MKR	15.000000000000000	1.452000000000000	0.005000000000000	0.02	N/A	300000
8	ONDO	15.000000000000000	1.4520000000000000	0.005000000000000	0.02	N/A	200000
9	SAND	15.000000000000000	1.452000000000000	0.005000000000000	0.02	N/A	400000
10	SHIB	15.000000000000000	1.452000000000000	0.005000000000000	0.02	N/A	1000000
11	USDC	15.000000000000000	1.452000000000000	0.005000000000000	0.02	N/A	8000000
12	USDT	15.00000000000000	1.4520000000000000	0.005000000000000	0.02	N/A	10000000
13	AAVE	15.00000000000000	1.4520000000000000	0.005000000000000	0.02	N/A	400000
14	AXS	15.000000000000000	1.452000000000000	0.005000000000000	0.02	N/A	500000
15	BTC	7.000000000000000	3.0250000000000000	1449.000000000000000	5216.40	2.31E+09	1000000

Question 2:

Write a query to display the all-time maximum price, all-time minimum price, the date of the maximum price, the date of the minimum price, and the maximum return of any cryptocurrency. The query should calculate the return as the percentage difference between the maximum and minimum prices.

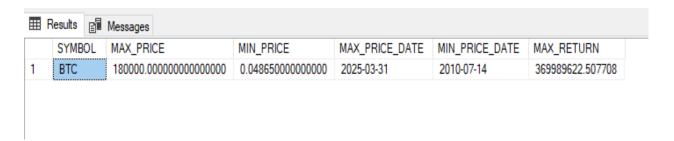
Query:

```
WITH TMP AS
```

```
( SELECT SYMBOL, MAX_PRICE, MIN_PRICE, MAX_PRICE_DATE, MIN_PRICE_DATE,
```

(MAX_PRICE - MIN_PRICE) * 100 / NULLIF(MIN_PRICE, 0) AS MAX_RETURN

FROM CRYPTO) SELECT * FROM TMP WHERE SYMBOL = 'BTC';



Question 3:

Write a query to display the brokerages that have their headquarters in countries where cryptocurrency is accepted and legal.

Query:

SELECT BROKERAGE.NAME, BROKERAGE.HEADQUARTER, COUNTRY.CRYPTO_STATUS

FROM BROKERAGE JOIN COUNTRY ON

BROKERAGE.HEADQUARTER LIKE '%' + COUNTRY.COUNTRY_NAME

-- BROKERAGE.HEADQUARTER LIKE '%' + COUNTRY.COUNTRY_NAME + '%'

WHERE COUNTRY.CRYPTO STATUS = 'ACCEPTED';

	NAME	HEADQUARTER	CRYPTO_STATUS
1	FTX	Nassau, Bahamas	ACCEPTED
2	Binance	George Town, Cayman Islands	ACCEPTED
3	Gate.io	George Town, Cayman Islands	ACCEPTED
4	Capital.com	Limassol, Cyprus	ACCEPTED
5	Bitfinex	Hong Kong	ACCEPTED
6	AvaTrade	Dublin, Ireland	ACCEPTED
7	eToro	Tel Aviv, Israel	ACCEPTED
8	Mt. Gox	Shibuya, Tokyo, Japan	ACCEPTED
9	Bitstamp	Luxembourg City, Luxembourg	ACCEPTED
10	Crypto.com	Singapore	ACCEPTED
11	NiceHash	Ljubljana, Slovenia	ACCEPTED
12	Bitget	Victoria, Seychelles	ACCEPTED
13	KuCoin	Victoria, Seychelles	ACCEPTED
14	окх	Victoria, Seychelles	ACCEPTED

Question 4:

Write a query to display year-over-year cryptocurrency user growth and market capitalization growth. The query should show each year, the total number of users (with 'million' appended), the percentage growth in users compared to the previous year, the total market cap (with 'billion' appended), and the percentage market cap growth relative to the previous year's total users.

Query:

	year	total_user	user_growth	market_cap	market_growth
1	2010	0.02000000000000 million	400.000000%	0.000300000000000 billion	7.250000%
2	2011	0.070000000000000 million	250.000000%	0.04000000000000 billion	198.500000%
3	2012	0.15000000000000 million	114.285714%	0.13000000000000 billion	128.571428%
4	2013	0.50000000000000 million	233.333333%	1.500000000000000 billion	913.333333%
5	2014	1.50000000000000 million	200.000000%	5.00000000000000 billion	700.000000%
6	2015	3.00000000000000 million	100.000000%	7.000000000000000 billion	133.333333%
7	2016	8.0000000000000 million	166.666666%	17.00000000000000 bill	333.333333%
8	2017	30.50000000000000 mill	281.250000%	600.00000000000000 b	7287.500000%
9	2018	50.00000000000000 mill	63.934426%	120.000000000000000 ь	-1573.77049
10	2019	80.0000000000000 mill	60.000000%	250.000000000000000 ь	260.000000%
11	2020	150.000000000000000 m	87.500000%	1000.000000000000000	937.500000%
12	2021	300.00000000000000 m	100.000000%	2900.000000000000000	1266.666666%
13	2022	420.000000000000000 m	40.000000%	1000.000000000000000	-633.333333%
14	2023	580.00000000000000 m	38.095238%	1750.000000000000000	178.571428%
15	2024	833.700000000000000 m	43.741379%	3800.000000000000000	353.448275%
16	2025	926.750000000000000 m	11.161089%	2970.000000000000000	-99.556195%

Question 5:

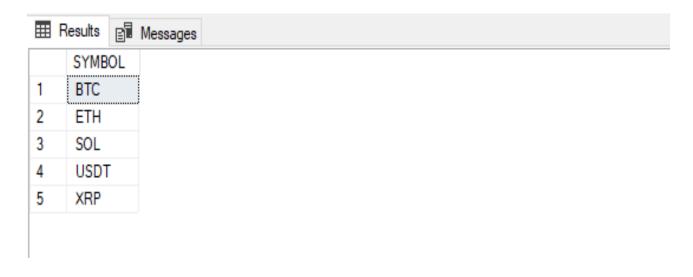
Write a query to display the cryptocurrency symbols that are present in both the CRYPTO and MARKET_DOMINANCE tables for the year 2025.

Query:

SELECT SYMBOL FROM CRYPTO INTERSECT

SELECT SYMBOL FROM MARKET_DOMINANCE

WHERE YEAR = 2025;



Question 6:

Write a query to display the total number of cryptocurrencies for each consensus algorithm type.

Query:

SELECT CONSENSUS_ALGORITHM_TYPE,count(CONSENSUS_ALGORITHM_TYPE)
from CRYPTO group by CONSENSUS_ALGORITHM_TYPE;

III	Results Messages	
	CONSENSUS_ALGORITHM_TYPE	(No column name)
1	AuxPoW	1
2	DPoS	1
3	Hashgraph aBFT	1
4	Lachesis aBFT	1
5	Liquid PoS	1
6	N/A	2
7	Nightshade PoS	1
8	NPoS	2
9	Ouroboros PoS	1
10	PoA	2
11	PoC	1
12	PoH+PoS	1
13	PoRep/PoSt	1
14	PoS	11
15	PoS (ETH)	7
16	PoS (Oracle)	1
17	PoSA	1
18	PoW	5
19	Pure PoS	1
20	RandomX PoW	1
21	Ripple Protocol	1
22	SCP	1
23	Snowman PoS	1
24	Tendemint BFT	3
25	Threshold Relay	1

Question 7:

Write a query to display the total number of cryptocurrencies for each specific consensus algorithm, such as PoS, PoW, and AuxPoW. Use having for this.

Query:

SELECT CONSENSUS_ALGORITHM_TYPE,COUNT(CONSENSUS_ALGORITHM_TYPE)
FROM CRYPTO group by CONSENSUS_ALGORITHM_TYPE

HAVING CONSENSUS_ALGORITHM_TYPE='PoW'

OR CONSENSUS_ALGORITHM_TYPE='PoS' or CONSENSUS_ALGORITHM_TYPE='AuxPoW';

	CONSENSUS_ALGORITHM_TYPE	
1	AuxPoW	1
2	PoS	11
3	PoW	5

Question 8:

Write a query to display a combined list of cryptocurrency symbols from countries where cryptocurrencies are accepted

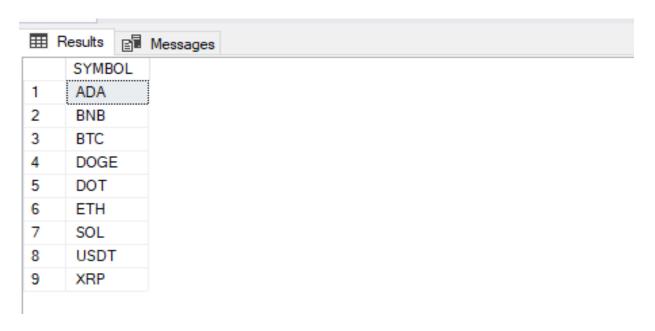
(ACCEPTED_COUNTRYWISE_MOST_USED_CRYPTO) and from banned countries (USER_AMOUNT_IN_BANNED_COUNTRY) for the year 2024. Also, include affected cryptocurrencies from the CONTROVERSY table for the same year, excluding any null values.

Query:

SELECT CRYPTO_SYMBOL AS SYMBOL FROM
ACCEPTED_COUNTRYWISE_MOST_USED_CRYPTO

WHERE YEAR = 2024 UNION SELECT AFFECTED CRYPTO AS SYMBOL

FROM CONTROVERSY WHERE YEAR = 2024 AND AFFECTED CRYPTO IS NOT NULL;



Question 9:

Write an SQL query to increase the AVERAGE_TRX_FEE by 10% for all cryptocurrencies in the CRYPTO_CURRENCY_PERFORMANCE_METRICS table where the current AVERAGE_TRX_FEE is greater than 1. After updating, display the entire table.

Query:

```
UPDATE CRYPTO_CURRENCY_PERFORMANCE_METRICS
SET AVERAGE_TRX_FEE = AVERAGE_TRX_FEE * 1.10
WHERE AVERAGE_TRX_FEE > 1;
SELECT * FROM CRYPTO_CURRENCY_PERFORMANCE_METRICS;
```

	SYMBOL	TRANSACTION_PER_SECOND	AVERAGE_TRX_FEE	ELECTRICITY_COST_PER_BLOCK	HEAT_IMMERSION_PER_TX	HASH_RATE_PER_UNIT	TOTAL_USERS
1	AAVE	15.000000000000000	1.756920000000000	0.005000000000000	0.02	N/A	400000
2	ADA	250.00000000000000	0.0500000000000000	0.000500000000000	0.00	N/A	1000000
3	ALGO	6000.000000000000000	0.001000000000000	0.000500000000000	0.00	N/A	500000
4	APT	10000.000000000000000	0.010000000000000	0.00100000000000	0.00	N/A	200000
5	ARB	40.000000000000000	0.0500000000000000	0.005000000000000	0.02	N/A	600000
6	ATOM	10000.000000000000000	0.010000000000000	0.00100000000000	0.00	N/A	500000
7	AVAX	4500.000000000000000	0.0200000000000000	0.00100000000000	0.00	N/A	800000
8	AXS	15.000000000000000	1.756920000000000	0.005000000000000	0.02	N/A	500000
9	BCH	7.000000000000000	0.0500000000000000	200.000000000000000	720.00	1.43E+07	300000
10	BNB	100.000000000000000	0.1000000000000000	0.01000000000000	0.04	N/A	5000000
11	BTC	7.000000000000000	3.660250000000000	1449.000000000000000	5216.40	2.31E+09	1000000
12	CHZ	100.000000000000000	0.010000000000000	0.00100000000000	0.00	N/A	300000
13	CRO	300.000000000000000	0.010000000000000	0.00100000000000	0.00	N/A	500000
14	DAI	15.000000000000000	1.756920000000000	0.005000000000000	0.02	N/A	500000
15	DOGE	7.000000000000000	0.5000000000000000	100.000000000000000	360.00	1.67E+06	500000
16	DOT	1000.000000000000000	0.010000000000000	0.00100000000000	0.00	N/A	700000
17	ETC	7.000000000000000	0.1000000000000000	150.000000000000000	540.00	6.43E+06	200000
18	ETH	15.000000000000000	1.756920000000000	0.005000000000000	0.02	N/A	500000
19	FET	1000.000000000000000	0.010000000000000	0.00100000000000	0.00	N/A	400000
20	FIL	3000.000000000000000	0.010000000000000	0.00100000000000	0.00	N/A	400000
21	FTM	300.000000000000000	0.001000000000000	0.00100000000000	0.00	N/A	500000
22	GRT	15.000000000000000	1.756920000000000	0.005000000000000	0.02	N/A	400000
23	HBAR	10000.0000000000000000	0.000100000000000	0.00010000000000	0.00	N/A	400000
24	HNT	2000.000000000000000	0.001000000000000	0.00100000000000	0.00	N/A	300000
25	ICP	11000 0000000000000000	0.000100000000000	0.001000000000000	0.00	N/A	500000

Question 10:

Write a query to display the cryptocurrency symbols, names, and their maximum prices, along with a price tier classification. The price tier should categorize the maximum price as 'High Price' (greater than 10,000), 'Medium Price' (between 100 and 10,000), and 'Low Price' (less than 100). Sort the results in descending order of maximum price.

Query:

```
SELECT SYMBOL, NAME, MAX_PRICE,

CASE

WHEN MAX_PRICE > 10000 THEN 'High Price'

WHEN MAX_PRICE BETWEEN 100 AND 10000 THEN 'Medium Price'

ELSE 'Low Price'

END AS PRICE_TIER FROM CRYPTO ORDER BY MAX_PRICE DESC;
```

III	Results	Messages		
	SYMBOL	NAME	MAX_PRICE	PRICE_TIER
1	BTC	Bitcoin	180000.0000000000000000	High Price
2	ETH	Ethereum	6000.000000000000000	Medium Price
3	ZEC	Zcash	5941.800000000000000	Medium Price
4	MKR	Maker	4095.000000000000000	Medium Price
5	BCH	Bitcoin Cash	3785.820000000000000	Medium Price
6	BNB	Binance Coin	717.480000000000000	Medium Price
7	ICP	Internet Co	700.650000000000000	Medium Price
8	AAVE	Aave	661.690000000000000	Medium Price
9	KSM	Kusama	621.710000000000000	Medium Price
10	XMR	Monero	542.330000000000000	Medium Price
11	LTC	Litecoin	410.2600000000000000	Medium Price
12	SOL	Solana	259.960000000000000	Medium Price
13	FIL	Filecoin	236.840000000000000	Medium Price
14	ETC	Ethereum C	167.090000000000000	Medium Price
15	AXS	Axie Infinity	164.900000000000000	Medium Price
16	AVAX	Avalanche	144.960000000000000	Medium Price
17	DOT	Polkadot	54.980000000000000	Low Price
18	HNT	Helium	54.880000000000000	Low Price
19	LINK	Chainlink	52.700000000000000	Low Price
20	INJ	Injective	44.950000000000000	Low Price
21	ATOM	Cosmos	44.450000000000000	Low Price
22	NEAR	NEAR Prot	20.440000000000000	Low Price
23	APT	Aptos	20.250000000000000	Low Price
24	XTZ	Tezos	9.120000000000000	Low Price
25	SAND	The Sandbox	8 400000000000000	Low Price