SU_Stock

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2-)

Create Table Statements:

```
CREATE TABLE Company
(
symbol VARCHAR(10) PRIMARY KEY,
Name VARCHAR(100) NOT NULL,
Outstanding_Shares BIGINT NOT NULL
);

CREATE TABLE Stock
(
symbol VARCHAR(10),
date DATE,
highest FLOAT,
lowest FLOAT,
opening FLOAT,
closing FLOAT,
volume BIGINT,
PRIMARY KEY (symbol, date),
FOREIGN KEY (symbol) REFERENCES Company(symbol)
);
```

3-)

Functional Dependencies for Each Table

Company Table:

- **Attributes:** Symbol, Name, Outstanding_Shares
- **Functional Dependencies:**
    - **Symbol → Name, Outstanding_Shares**

The primary key **Symbol** uniquely determines both **Name** and **Outstanding_Shares**. No attribute or set of attributes other than the key determines any other attribute.

Stock Table:

- **Attributes:** Symbol, Date, Highest, Lowest, Opening, Closing, Volume
- **Functional Dependencies:**
    - **(Symbol, Date) → Highest, Lowest, Opening, Closing, Volume**

The composite primary key **(Symbol, Date)** uniquely determines all the other attributes in the **Stock** table.

BCNF Evaluation

Company Table:

- **Dependency:** Symbol → Name, Outstanding_Shares
- **Evaluation:** The determinant **Symbol** is the primary key and hence a superkey. No partial dependency or non-prime attribute dependency exists.
- **Conclusion:** The **Company** table is in BCNF.

Stock Table:

- **Dependency:** (Symbol, Date) → Highest, Lowest, Opening, Closing, Volume
- **Evaluation:** The determinant **(Symbol, Date)** is the composite primary key and hence a superkey. No attribute functionally determines the primary key or part of it.
- **Conclusion:** The **Stock** table is in BCNF.

Conclusion

Both tables (**Company** and **Stock**) are in BCNF as every functional dependency in each table has a superkey as its determinant. There is no need for decomposition since there are no violations of BCNF rules.

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INSERT Operations:

INSERT INTO Company (Symbol, Name, Outstanding_Shares) VALUES

('AAPL', 'Apple Inc.', 4371000000),

('GOOGL', 'Alphabet Inc.', 300900000),

('MSFT', 'Microsoft Corp.', 7603000000),

('AMZN', 'Amazon.com Inc.', 504000000),

('FB', 'Meta Platforms Inc.', 2400000000),

('TSLA', 'Tesla Inc.', 1000000000),

('BRK.A', 'Berkshire Hathaway Inc.', 1382000),

('V', 'Visa Inc.', 2107000000),

('JNJ', 'Johnson & Johnson', 2601000000),

('WMT', 'Walmart Inc.', 2800000000);

INSERT INTO Stock (Symbol, Date, Highest, Lowest, Opening, Closing, Volume) VALUES

('AAPL', '2023-10-01', 150.25, 147.30, 148.00, 149.55, 90000000),

('AAPL', '2023-10-02', 152.00, 148.20, 149.80, 150.70, 88000000),

('GOOGL', '2023-10-01', 120.50, 117.75, 118.00, 119.50, 42000000),

('MSFT', '2023-10-01', 305.20, 300.10, 301.50, 304.00, 78000000),

('AMZN', '2023-10-01', 125.80, 123.00, 124.30, 125.40, 50000000),

('TSLA', '2023-10-01', 900.00, 880.00, 890.00, 895.00, 80000000),

('FB', '2023-10-01', 310.00, 305.00, 307.50, 309.45, 60000000),

('BRK.A', '2023-10-01', 450000.00, 440000.00, 445000.00, 448000.00, 500),

('V', '2023-10-01', 230.00, 225.00, 228.00, 229.50, 45000000),

('JNJ', '2023-10-01', 175.00, 170.00, 171.00, 174.50, 40000000);

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SELECT * FROM Company;

Snapshot:

symbol	Name	Outstanding_Shares
AAPL	Apple Inc.	4371000000
AMZN	Amazon.com Inc.	504000000
BRK.A	Berkshire Hathaway Inc.	1382000
FB	Meta Platforms Inc.	2400000000
GOOGL	Alphabet Inc.	300900000
JNJ	Johnson & Johnson	2601000000
MSFT	Microsoft Corp.	7603000000
TSLA	Tesla Inc.	1000000000
V	Visa Inc.	2107000000
WMT	Walmart Inc.	2800000000
NULL	NULL	NULL

SELECT * FROM Stock;

Snapshot:

symbol	date	highest	lowest	opening	closing	volume
AAPL	2023-10-01	150.25	147.3	148	149.55	90000000
AAPL	2023-10-02	152	148.2	149.8	150.7	88000000
AMZN	2023-10-01	125.8	123	124.3	125.4	50000000
BRK.A	2023-10-01	450000	440000	445000	448000	500
FB	2023-10-01	310	305	307.5	309.45	60000000
GOOGL	2023-10-01	120.5	117.75	118	119.5	42000000
JNJ	2023-10-01	175	170	171	174.5	40000000
MSFT	2023-10-01	305.2	300.1	301.5	304	78000000
TSLA	2023-10-01	900	880	890	895	80000000
V	2023-10-01	230	225	228	229.5	45000000
NULL	NULL	NULL	NULL	NULL	NULL	NULL

6-)

Query in English:

"Retrieve the names and symbols of all companies along with the opening and closing stock prices on a specific date."

Relational Algebra Equivalent:

C= Company Table, S=Stock Table

$\pi Name,Symbol,Opening,Closing(\sigma Date='specific-date'(C \bowtie C.Symbol=S.SymbolS))$

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```
SELECT C.Name, C.Symbol, S.Opening, S.Closing
FROM Company AS C
JOIN Stock AS S ON C.Symbol = S.Symbol
WHERE S.Date = '2023-10-01';
```

Displays all opening and closing prices of all stocks on '2023-10-01':

Name	Symbol	Opening	Closing
Apple Inc.	AAPL	148	149.55
Amazon.com Inc.	AMZN	124.3	125.4
Berkshire Hathaway Inc.	BRK.A	445000	448000
Meta Platforms Inc.	FB	307.5	309.45
Alphabet Inc.	GOOGL	118	119.5
Johnson & Johnson	JNJ	171	174.5
Microsoft Corp.	MSFT	301.5	304
Tesla Inc.	TSLA	890	895
Visa Inc.	V	228	229.5

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Query in English:

Calculate the total trading volume, average, minimum, and maximum closing prices for each company over a specified date range, displaying the company name and those values.

Name	TotalVolume	AverageClosingPrice	MinimumClosingPrice	MaximumClosingPrice
Apple Inc.	178000000	150.125	149.55	150.7
Amazon.com Inc.	50000000	125.4000015258789	125.4	125.4
Berkshire Hathaway Inc.	500	448000	448000	448000
Meta Platforms Inc.	60000000	309.45001220703125	309.45	309.45
Alphabet Inc.	42000000	119.5	119.5	119.5
Johnson & Johnson	40000000	174.5	174.5	174.5
Microsoft Corp.	00	304	304	304
Tesla Inc.	80000000	895	895	895
Visa Inc.	45000000	229.5	229.5	229.5

Microsoft Corp.

SQL Query:

```
SELECT C.Name,
    SUM(S.Volume) AS TotalVolume,
    AVG(S.Closing) AS AverageClosingPrice,
    MIN(S.Closing) AS MinimumClosingPrice,
    MAX(S.Closing) AS MaximumClosingPrice
FROM Company AS C
JOIN Stock AS S ON C.Symbol = S.Symbol
WHERE S.Date BETWEEN '2023-10-01' AND '2023-10-07'
GROUP BY C.Name;
```

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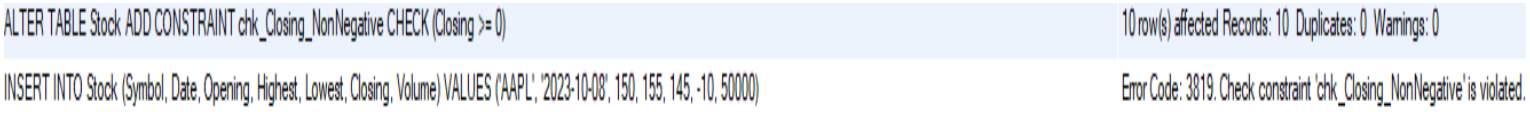
```
ALTER TABLE Stock
ADD CONSTRAINT chk_Closing_NonNegative CHECK (Closing >= 0);

INSERT INTO Stock (Symbol, Date, Opening, Highest, Lowest, Closing, Volume)
VALUES ('AAPL', '2023-10-08', 150, 155, 145, -10, 50000);
```



Indicated check constraint “chk_Closing_NonNegative” was added, which doesn’t allow Closing column to have any negative value. When tried to insert a negative closing value the “chk_Closing_NonNegative” is violated prompt is displayed.