Assets management System

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Question 1

What is the average performance metric (e.g. CAGR) of a specific fund over the last year

SQL :

```sql
WITH latest_nav AS (
    SELECT assetid, nav, date
    FROM ams.assetdata
    WHERE assetid = 147620
    ORDER BY date DESC
    LIMIT 1
),
last_year_nav AS (
    SELECT assetid, nav, date
    FROM ams.assetdata
    WHERE assetid = 147620
      AND date = (SELECT MAX(date) FROM ams.assetdata WHERE assetid = 147620
AND date <= (SELECT date - INTERVAL '1 year' FROM latest_nav))
)
SELECT
    l.assetid,
    ROUND(((l.nav - ly.nav) / ly.nav) * 100, 2) AS percentage_change
FROM latest_nav l
JOIN last_year_nav ly ON l.assetid = ly.assetid;
```

Relational Algebra :

$$\text{Latest\_NAV} = \pi_{\text{assetid, nav, date}}(\sigma_{\text{assetid}=147620}(\text{ams.assetdata}))$$

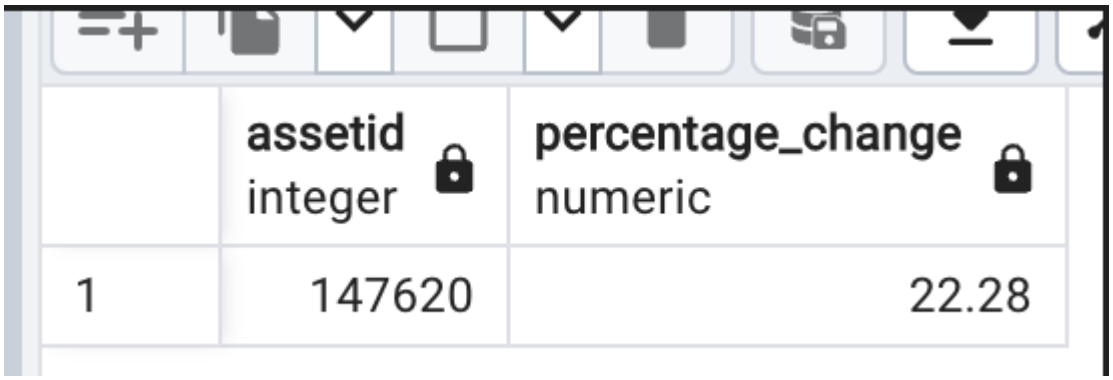
$$\text{One\_Year\_Ago} = \text{Latest\_NAV\_Date} - \text{INTERVAL '1 year'}$$

$$\text{Last\_Year\_NAV} = \pi_{\text{assetid, nav, date}}(\sigma_{\text{assetid}=147620 \wedge \text{date}=\max(\text{date} \leq \text{One\_Year\_Ago})}(\text{ams.assetdata}))$$

$$\text{NAV\_Join} = \text{Latest\_NAV} \bowtie_{\text{Latest\_NAV.assetid}=\text{Last\_Year\_NAV.assetid}} \text{Last\_Year\_NAV}$$

$$\text{Result} = \pi_{\text{NAV\_Join.assetid, percentage\_change}=\text{ROUND}\left(\frac{(\text{Latest\_NAV.nav}-\text{Last\_Year\_NAV.nav})}{\text{Last\_Year\_NAV.nav}} \times 100,2\right)}(\text{NAV\_Join})$$

Output :



	assetid integer	percentage_change numeric
1	147620	22.28

Question 2

What is the transaction history of a specific User and Assets across different funds?

SQL :

```sql
SELECT *FROM ams.Transaction t
JOIN ams.Portfolio p ON t.PortfolioID = p.PortfolioID
WHERE p.UserID = 'DEF006'
AND t.AssetID IN (
SELECT AssetID
FROM ams.Asset
WHERE AssetID = '147620'
);
```

Relational Algebra :

$$\text{Portfolio\_DEF006} = \sigma_{\text{UserID}='DEF006'}(\text{ams.Portfolio})$$

$$\text{User\_Transactions} = \text{ams.Transaction} \bowtie_{\text{Transaction.PortfolioID}=\text{Portfolio\_DEF006.PortfolioID}} \text{Portfolio\_DEF006}$$

$$\text{Asset\_147620} = \sigma_{\text{AssetID}='147620'}(\text{ams.Asset})$$

$$\text{Result} = \sigma_{\text{User\_Transactions.AssetID}=\text{Asset\_147620.AssetID}}(\text{User\_Transactions} \bowtie \text{Asset\_147620})$$

Combining all togerther

$$\text{Result} = \sigma_{\text{User\_Transactions.AssetID}=\text{Asset\_147620.AssetID}}((\text{ams.Transaction} \bowtie_{\text{Transaction.PortfolioID}=\text{PortfolioID}} \sigma_{\text{UserID}='DEF006'}(\text{ams.Portfolio})) \bowtie \sigma_{\text{AssetID}='147620'}(\text{ams.Asset}))$$

Output :

	transactionid integer	amount integer	portfolioid integer	assetid integer	transactiontype character varying (20)	time timestamp without time zone	unit numeric (10,4)	portfolioid integer	portfolioname character varying (100)	creationdate timestamp without time zone
1	100000019	3500	112345678	147620	Buy	2023-01-01 00:00:00	228.6984	112345678	Direct	2023-01-11 09:45:00
2	100000020	3500	112345678	147620	Buy	2023-02-01 00:00:00	242.8195	112345678	Direct	2023-01-11 09:45:00
3	100000021	3500	112345678	147620	Buy	2023-03-01 00:00:00	241.9132	112345678	Direct	2023-01-11 09:45:00
4	100000022	3500	112345678	147620	Buy	2023-04-01 00:00:00	242.6680	112345678	Direct	2023-01-11 09:45:00
5	100000023	3500	112345678	147620	Buy	2023-05-01 00:00:00	228.1319	112345678	Direct	2023-01-11 09:45:00
6	100000024	3500	112345678	147620	Buy	2023-06-01 00:00:00	224.2871	112345678	Direct	2023-01-11 09:45:00
7	100000025	3500	112345678	147620	Buy	2023-07-01 00:00:00	219.4770	112345678	Direct	2023-01-11 09:45:00
8	100000026	3500	112345678	147620	Buy	2023-08-01 00:00:00	215.6235	112345678	Direct	2023-01-11 09:45:00
9	100000027	3500	112345678	147620	Buy	2023-09-01 00:00:00	220.8620	112345678	Direct	2023-01-11 09:45:00
10	100000028	3500	112345678	147620	Buy	2023-10-01 00:00:00	220.2920	112345678	Direct	2023-01-11 09:45:00

Question 3

What is the total invested and current value of all assets within a specific portfolio?

SQL :

```sql
SELECT
    SUM(ad.NAV * t.Unit) AS TotalCurrentValue,
    SUM(t.Amount) AS TotalAmount
FROM ams.Transaction t
JOIN ams.Asset a ON t.AssetID = a.AssetID
JOIN ams.Portfolio p ON t.PortfolioID = p.PortfolioID
JOIN ams.AssetData ad ON a.AssetID = ad.AssetID
WHERE p.PortfolioID = '123456789'
  AND ad.Date = (
      SELECT MAX(Date)
      FROM ams.AssetData
      WHERE AssetID = a.AssetID
  );
```

Relationa Algebra :

$$\text{Filtered\_Portfolio} = \sigma_{\text{PortfolioID}='123456789'}(\text{ams.Portfolio})$$

$$\text{Portfolio\_Transactions} = \text{ams.Transaction} \bowtie_{\text{Transaction.PortfolioID}=\text{Filtered\_Portfolio.PortfolioID}} \text{Filtered\_Portfolio}$$

$$\text{Transactions\_With\_Assets} = \text{Portfolio\_Transactions} \bowtie_{\text{Transaction.AssetID}=\text{Asset.AssetID}} \text{ams.Asset}$$

$$\text{Latest\_Date\_Per\_Asset} = \pi_{\text{AssetID, max\_date}=\max(\text{Date})}(\text{ams.AssetData})$$

$$\text{Latest\_NAV\_Data} = \text{Latest\_Date\_Per\_Asset} \bowtie_{\text{Latest\_Date\_Per\_Asset.AssetID}=\text{AssetData.AssetID} \wedge \text{Latest\_Date\_Per\_Asset.max\_date}=\text{AssetData.Date}} \text{ams.AssetData}$$

$$\text{Transactions\_With\_Latest\_NAV} = \text{Transactions\_With\_Assets} \bowtie_{\text{Transactions\_With\_Assets.AssetID}=\text{Latest\_NAV\_Data.AssetID}} \text{Latest\_NAV\_Data}$$

$$\text{Result} = \gamma_{\text{TotalCurrentValue}=\sum(\text{NAV}\times\text{Unit}),\text{TotalAmount}=\sum(\text{Amount})}(\text{Transactions\_With\_Latest\_NAV})$$

Output :

	totalcurrentvalue numeric	totalamount bigint
1	48281.70416428	26500

Question 4

What is the overall performance comparison of our hedge fund against a specific benchmark index?

SQL :

```sql
WITH latest_nav AS (
    SELECT
        t.portfolioid,
        t.assetid,
        ad.nav AS current_nav,
        t.unit
    FROM ams.transaction t
```

```
    JOIN ams.assetdata ad ON t.assetid = ad.assetid
    WHERE ad.date = (SELECT MAX(date) FROM ams.assetdata WHERE assetid =
t.assetid)
),
portfolio_investment AS (
    SELECT
        t.portfolioid,
        SUM(t.amount) AS total_invested
    FROM ams.transaction t
    GROUP BY t.portfolioid
),
performance AS (
    SELECT
        ln.portfolioid,
        SUM(ln.current_nav * ln.unit) AS total_current_value,
        pi.total_invested,
        ROUND(((SUM(ln.current_nav * ln.unit) - pi.total_invested) /
pi.total_invested) * 100, 2) AS overall_performance_percentage
    FROM latest_nav ln
    JOIN portfolio_investment pi ON ln.portfolioid = pi.portfolioid
    GROUP BY ln.portfolioid, pi.total_invested
)
SELECT
    SUM(total_current_value) AS total_current_value,
    SUM(total_invested) AS total_invested,
    ROUND(AVG(overall_performance_percentage), 2) AS
average_overall_performance_percentage
FROM performance;
```

Relational Algebra :

$$\text{Latest\_Date\_Per\_Asset} = \pi_{\text{AssetID},\ \text{max\_date}=\max(\text{Date})}(\text{ams.AssetData})$$

$$\text{Latest\_NAV\_Data} = \text{Latest\_Date\_Per\_Asset} \bowtie_{\text{Latest\_Date\_Per\_Asset.AssetID}=\text{AssetData.AssetID} \wedge \text{Latest\_Date\_Per\_Asset.max\_date}=\text{AssetData.Date}} \text{ams.AssetData}$$

$$\text{Latest\_NAV} = \pi_{\text{Transaction.PortfolioID, Transaction.AssetID, Latest\_NAV\_Data.NAV AS current\_nav, Transaction.Unit}}(\text{ams.Transaction} \bowtie_{\text{Transaction.AssetID}=\text{Latest\_NAV\_Data.AssetID}} \text{Latest\_NAV\_Data})$$

$$\text{Portfolio\_Investment} = \gamma_{\text{PortfolioID},\text{total\_invested}=\sum(\text{Amount})}(\text{ams.Transaction})$$

For Performance

For each portfolio, calculate the total_current_value, total_invested, and overall_performance_percentage.

Join Latest_NAV with Portfolio_Investment: Join to access the current NAV-based values and total invested amounts.

$$\text{Result} = \gamma_{\text{total\_current\_value}=\sum(\text{total\_current\_value}),\text{total\_invested}=\sum(\text{total\_invested}),\text{average\_overall\_performance\_percentage}=\text{ROUND}(\text{AVG}(\text{overall\_performance\_percentage}),2)}(\text{Performance})$$

Output :

	total_current_value numeric	total_invested numeric	average_overall_performance_percentage numeric
1	5443825.84449231	3345500	63.73

Question 5

what is the performance of customer care ?

SQL :

```sql
SELECT
    COUNT(CASE WHEN status IN ('Open', 'Pending') THEN 1 END) AS
open_pending_count,
    COUNT(CASE WHEN status = 'Closed' THEN 1 END) AS closed_count,
    AVG(CASE WHEN status = 'Closed' THEN endtime - creationtime END) AS
avg_resolution_time
FROM ams.supportticket;
```

Relational Algebra :

$$\text{Open\_Pending\_Tickets} = \sigma_{\text{status} \in \{\text{'Open'},\text{'Pending'}\}}(\text{ams.supportticket})$$

$$\text{Closed\_Tickets} = \sigma_{\text{status}=\text{'Closed'}}(\text{ams.supportticket})$$

$$\text{Open\_Pending\_Count} = \gamma_{\text{open\_pending\_count}=\text{COUNT}(\text{TicketID})}(\text{Open\_Pending\_Tickets})$$

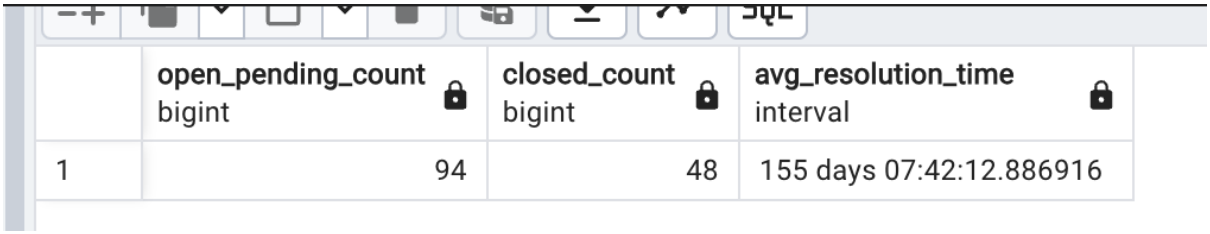
$$\text{Closed\_Count} = \gamma_{\text{closed\_count}=\text{COUNT}(\text{TicketID})}(\text{Closed\_Tickets})$$

$$\text{Resolution\_Time} = \pi_{\text{TicketID},\ \text{resolution\_time}=(\text{endtime}-\text{creationtime})}(\text{Closed\_Tickets})$$

$$\text{Avg\_Resolution\_Time} = \gamma_{\text{avg\_resolution\_time}=\text{AVG}(\text{resolution\_time})}(\text{Resolution\_Time})$$

$$\text{Result} = \pi_{\text{open\_pending\_count,closed\_count,avg\_resolution\_time}}(\text{Open\_Pending\_Count} \times \text{Closed\_Count} \times \text{Avg\_Resolution\_Time})$$

Output :



	open_pending_count bigint	closed_count bigint	avg_resolution_time interval
1	94	48	155 days 07:42:12.886916

Question 6

What is the total amount invested by each investor across all funds?

SQL :

```sql
SELECT p.UserID, SUM(t.Amount) AS TotalAmountInvested
FROM ams.Transaction t
JOIN ams.Portfolio p ON t.PortfolioID = p.PortfolioID
GROUP BY p.UserID;
```

Relational Algebra :

$$\text{TotalAmountInvested} = \gamma_{\text{UserID,TotalAmountInvested}=\sum(\text{Amount})}(\pi_{\text{UserID,Amount}}(\text{ams.Transaction} \bowtie_{\text{Transaction.PortfolioID}=\text{Portfolio.PortfolioID}} \text{ams.Portfolio}))$$

Output :

	userid character varying (6)	totalamountinvested bigint
1	MNO002	73000
2	MNO008	86000
3	GHI002	85500
4	GHI007	120000
5	ABC002	89000
6	MNO004	42000
7	DEF007	102500
8	GHI006	103500
9	MNO009	106500
10	MNO001	83000
11	DEF001	73000
12	ABC001	136500
13	JKL005	104000
14	ABC004	116000

Question 7

Which fund has the highest number of investors?

SQL :

```sql
SELECT t.AssetID, COUNT(DISTINCT p.UserID) AS UserCount
FROM ams.Transaction t
JOIN ams.Portfolio p ON t.PortfolioID = p.PortfolioID
GROUP BY t.AssetID
ORDER BY UserCount DESC
LIMIT 1;
```

Relational Algebra :

$$\text{Max\_UserCount\_Asset} = \tau_{\text{UserCount DESC}}(\gamma_{\text{AssetID,UserCount}=\text{COUNT(UserID)}}(\delta(\pi_{\text{AssetID,UserID}}(\text{ams.Transaction} \bowtie_{\text{Transaction.PortfolioID}=\text{Portfolio.PortfolioID}} \text{ams.Portfolio}))))[1]$$

Output :

	assetid integer	usercount bigint
1	127042	35

Question 8

Generate a report summarizing the total buys, sells, and net investment for each client in the past year

SQl :

```sql
SELECT
    p.userid,
    SUM(CASE WHEN t.transactiontype = 'Buy' THEN 1 ELSE 0 END) AS
total_buy_count,
    SUM(CASE WHEN t.transactiontype = 'Sell' THEN 1 ELSE 0 END) AS
total_sell_count,
    SUM(CASE WHEN t.transactiontype = 'Buy' THEN t.amount ELSE 0 END) AS
total_investment_amount
```

```
FROM ams.transaction t
JOIN ams.portfolio p ON t.portfolioid = p.portfolioid
WHERE t.time >= CURRENT_DATE - INTERVAL '1 year'
GROUP BY p.userid
ORDER BY p.userid;
```

Relational Algebra :

$$\text{Transaction\_Portfolio} = \text{ams.Transaction} \bowtie_{\text{Transaction.PortfolioID}=\text{Portfolio.PortfolioID}} \text{ams.Portfolio}$$

$$\text{Recent\_Transactions} = \sigma_{\text{time} \geq \text{CURRENT\_DATE} - \text{INTERVAL '1 year'}}(\text{Transaction\_Portfolio})$$

$$\text{User\_Transaction} = \pi_{\text{UserID,TransactionType,Amount}}(\text{Recent\_Transactions})$$

$$\text{Total\_Buy\_Count} = \gamma_{\text{UserID,Total\_Buy\_Count}=\sum(\text{CASE WHEN TransactionType} = \text{'Buy' THEN 1 ELSE 0 END})}(\text{User\_Transaction})$$

$$\text{Total\_Sell\_Count} = \gamma_{\text{UserID,Total\_Sell\_Count}=\sum(\text{CASE WHEN TransactionType} = \text{'Sell' THEN 1 ELSE 0 END})}(\text{User\_Transaction})$$

$$\text{Total\_Investment\_Amount} = \gamma_{\text{UserID,Total\_Investment\_Amount}=\sum(\text{CASE WHEN TransactionType} = \text{'Buy' THEN Amount ELSE 0 END})}(\text{User\_Transaction})$$

$$\text{Result} = \gamma_{\text{UserID,Total\_Buy\_Count,Total\_Sell\_Count,Total\_Investment\_Amount}}(\text{Total\_Buy\_Count} \times \text{Total\_Sell\_Count} \times \text{Total\_Investment\_Amount})$$

Output :

	userid character varying (6)	total_buy_count bigint	total_sell_count bigint	total_investment_amount bigint
15	GHI003	2	1	4500
16	GHI005	2	0	4500
17	GHI006	1	0	3000
18	GHI007	4	0	8500
19	JKL002	1	0	1000
20	JKL004	1	2	4000
21	JKL005	2	0	4500
22	JKL006	2	0	3000
23	JKL008	4	0	9500
24	JKL009	2	3	6000
25	MNO001	2	0	5000
26	MNO002	2	0	3500
27	MNO004	2	0	2000
28	MNO005	3	0	3500

Question 9

Identify clients with the highest asset postion across their portfolios to prioritize for personalized services.

SQL :

```sql
WITH latest_nav AS (
    SELECT
        t.portfolioid,
        p.userid,
        t.assetid,
        ad.nav AS current_nav,
        t.unit,
        (ad.nav * t.unit) AS current_value
    FROM ams.transaction t
    JOIN ams.portfolio p ON t.portfolioid = p.portfolioid
    JOIN ams.assetdata ad ON t.assetid = ad.assetid
    WHERE ad.date = (SELECT MAX(date) FROM ams.assetdata WHERE assetid =
t.assetid)
)
SELECT
    ln.userid,
    SUM(ln.current_value) AS total_current_value
FROM latest_nav ln
GROUP BY ln.userid
ORDER BY total_current_value DESC
LIMIT 1;
```

Relational Algebra :

$$\text{Transaction\_Portfolio\_AssetData} = \text{ams.Transaction} \bowtie_{\text{Transaction.PortfolioID}=\text{Portfolio.PortfolioID}} \text{ams.Portfolio} \bowtie_{\text{Transaction.AssetID}=\text{AssetData.AssetID}} \text{ams.AssetData}$$

$$\text{Latest\_Asset\_Data} = \sigma_{\text{ad.date}=\text{MAX(ad.date)}}(\text{Transaction\_Portfolio\_AssetData})$$

$$\text{Latest\_Nav} = \pi_{\text{PortfolioID,UserID,AssetID,current\_nav,Unit,current\_value}=(\text{current\_nav}\times\text{Unit})}(\text{Latest\_Asset\_Data})$$

$$\text{User\_Total\_Current\_Value} = \gamma_{\text{UserID,Total\_Current\_Value}=\sum(\text{current\_value})}(\text{Latest\_Nav})$$

$$\text{Ordered\_User\_Total\_Current\_Value} = \tau_{\text{TotalCurrentValue DESC}}(\text{User\_Total\_Current\_Value})$$

$$\text{Top\_User} = \text{Ordered\_User\_Total\_Current\_Value}[1]$$

Output :

	userid character varying (6)	total_current_value numeric
1	ABC005	303873.16003440

Output 10

What are the unique positions available in the system?

SQL :

```
SELECT DISTINCT Role, Access
FROM ams.Position;
```

Relational Algebra :

$$\pi_{\text{Role,Access}}(\text{ams.Position})$$

Output :

	role character varying (20)	access character varying (50)
1	Admin	investor
2	Broker	broker access
3	User	modifying Access
4	Investor	investor
5	Investor	view only
6	Manager	view only
7	Investor	modifying Access
8	Manager	modifying Access
9	Manager	broker access
10	Admin	modifying Access
11	Admin	broker access
12	User	view only
13	User	broker access
14	Broker	investor

Output 11

Which assets have the highest NAV recorded in the last month?

SQL :

```sql
SELECT AssetID, MAX(NAV) AS HighestNAV
FROM ams.AssetData
WHERE Date >= NOW() - INTERVAL '1 month'
GROUP BY AssetID;
```

Relational Algebra :

$$\pi_{\text{AssetID},\text{HighestNAV}=\text{MAX(NAV)}}(\sigma_{\text{Date}\geq\text{NOW}-\text{INTERVAL '1 month'}}(\text{ams.AssetData}))$$

Ouput :

	assetid integer	highestnav numeric
1	127042	124.8265
2	129046	70.6490
3	147620	19.2847
4	147704	37.9087
5	148454	14.3132

Question 12 :

Which user has created the most support tickets?

SQL :

```sql
SELECT UserID, COUNT(*) AS TicketCount
FROM ams.SupportTicket
GROUP BY UserID
ORDER BY TicketCount DESC
```

```
LIMIT 1;
```

Relational Algebra :

$$\text{Top\_User} = \tau_{\text{TicketCount DESC}}(\pi_{\text{UserID,TicketCount}=\text{COUNT}(*)}(\text{ams.SupportTicket}))[1]$$

Output :

	userid character varying (6)	ticketcount bigint
1	YYO779	4

Question 13 :

What is the average amount invested per transaction for each portfolio?

SQl :

```
SELECT p.PortfolioID, AVG(t.Amount) AS AverageInvestment
FROM ams.Portfolio p
JOIN ams.Transaction t ON p.PortfolioID = t.PortfolioID
GROUP BY p.PortfolioID;
```

Relational Algebra :

$$\pi_{\text{PortfolioID,AverageInvestment}=\text{AVG(Amount)}}(\gamma_{\text{PortfolioID}}(\text{ams.Portfolio} \bowtie \text{ams.Transaction}))$$

Output :

	portfolioid [PK] integer	averageinvestment numeric
1	567893123	2348.4848484848484848
2	990123456	2653.8461538461538462
3	889012345	1735.2941176470588235
4	789012345	2324.3243243243243243
5	234557890	3300.0000000000000000
6	234567890	2383.7209302325581395
7	667890123	2354.8387096774193548
8	223456789	2105.2631578947368421
9	987654321	3585.3658536585365854
10	901234567	2736.8421052631578947
11	445674901	3238.0952380952380952
12	678901234	2590.9090909090909091
13	567890123	2521.7391304347826087
14	456789012	1950.9803921568627451

Question 14 :

What are the details of the last 5 admin log entries?

SQL :

```
SELECT *FROM ams.AdminLog
ORDER BY actiondate DESC
LIMIT 5;
```

Relational algebra :

$$\text{Top\_AdminLog} = \tau_{\text{actiondate DESC}}(\text{ams.AdminLog})[5]$$

Output :

	userid character varying (80)	actiontype character varying (6)	actiondate timestamp without time zone	access boolean
1	DIM362	View	2024-11-09 18:07:41	true
2	CAV329	Login	2024-11-09 18:07:22.552	true
3	CND684	View	2024-11-09 18:06:55.791	true
4	MZD674	Modify	2024-11-09 18:05:38.807	true
5	ULD855	Login	2024-11-09 18:05:05.033	true

Question 15 :

What is the total number of support tickets created in the last 30 days?

SQL :

```sql
SELECT COUNT(*) AS TotalTickets
FROM ams.SupportTicket
WHERE Creationtime >= NOW() - INTERVAL '30 days';
```

Relational Algebra :

$$\text{COUNT}(*)(\sigma_{\text{Creationtime} \geq \text{NOW} - \text{INTERVAL '30 days'}}(\text{ams.SupportTicket}))$$

Output :

	totaltickets bigint
1	6

Question 16 :

Which position has the highest number of associated users?

SQL :

```sql
SELECT p.role, COUNT(u.UserID) AS UserCount
FROM ams.Position p
JOIN ams.User u ON p.userid = u.userid
GROUP BY p.role
ORDER BY UserCount DESC
LIMIT 1;
```

Relational Algebra :

$$\text{Top\_Role} = \tau_{\text{UserCount DESC}} \left(\pi_{\text{role, UserCount}=\text{COUNT(UserID)}} (\text{ams.Position} \bowtie \text{ams.User}) \right) [1]$$

Output :

	role character varying (20)	usercount bigint
1	User	563

Question 17 :

Which assets have had a NAV change greater than 20% in the 6 month?

SQL :

```sql
SELECT AssetID
FROM ams.AssetData
WHERE Date >= NOW() - INTERVAL '6 month'
GROUP BY AssetID
HAVING (MAX(NAV) - MIN(NAV)) / MIN(NAV) > 0.2;
```

Relational Algebra :

$$\pi_{\text{AssetID}} \left(\sigma_{\text{Date} \geq \text{NOW} - \text{INTERVAL '6 months'}} \left(\gamma_{\text{AssetID;MAX(NAV),MIN(NAV)}} (\text{ams.AssetData}) \right) \bowtie (\text{MAX(NAV)} - \text{MIN(NAV)}) / \text{MIN(NAV)} > 0.2 \right)$$

Output :

	assetid integer
1	147704
2	127042
3	129046

Question 18

List of Assets Managed by Each Portfolio

SQL :

```sql
SELECT p.PortfolioID, STRING_AGG(DISTINCT a.AssetID::text, ', ') AS AssetIDs
FROM ams.Portfolio p
JOIN ams.Transaction t ON p.PortfolioID = t.PortfolioID
JOIN ams.Asset a ON t.AssetID = a.AssetID
GROUP BY p.PortfolioID;
```

Relational Algebra :

$$\pi_{\text{PortfolioID,AssetIDs=STRING\_AGG(DISTINCT AssetID)}} ((\text{ams.Portfolio} \bowtie \text{ams.Transaction}) \bowtie \text{ams.Asset})$$

Output :

	portfolioid [PK] integer	assetids text
1	112345678	127042, 129046, 147620, 147704, 148454
2	112348678	127042, 129046, 147620, 147704, 148454
3	123453789	127042, 129046, 147620, 147704, 148454
4	123456780	127042, 129046, 147620, 147704, 148454
5	123456789	127042, 129046, 147620, 147704, 148454
6	223456789	127042, 129046, 147620, 147704, 148454
7	223459789	127042, 129046, 147620, 147704, 148454
8	234557890	127042, 129046, 147620, 147704, 148454
9	234564890	127042, 129046, 147620, 147704, 148454
10	234567890	127042, 129046, 147620, 147704, 148454
11	334560890	127042, 129046, 147620, 147704, 148454
12	334567890	127042, 129046, 147620, 147704, 148454
13	345678001	127042, 129046, 147620, 147704, 148454
14	345678901	127042, 129046, 147620, 147704, 148454

Question 19 :

Number of Transactions per Asset

SQL :

```
SELECT t.AssetID, COUNT(t.TransactionID) AS TransactionCount
FROM ams.Transaction t
```

```
GROUP BY t.AssetID;
```

Relational Algebra :

$$\pi_{\text{AssetID},\text{TransactionCount}=\text{COUNT}(\text{TransactionID})}(\gamma_{\text{AssetID}}(\text{ams.Transaction}))$$

Output :

	assetid integer	transactioncount bigint
1	147704	329
2	148454	309
3	147620	313
4	129046	316
5	127042	325

Question 20 :

Which fund has the highest number of investors?

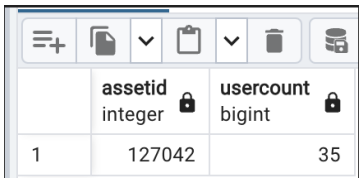
SQL :

```
SELECT t.AssetID, COUNT(DISTINCT p.UserID) AS UserCount
FROM ams.Transaction t
JOIN ams.Portfolio p ON t.PortfolioID = p.PortfolioID
GROUP BY t.AssetID
ORDER BY UserCount DESC
LIMIT 1;
```

Relational Algebra :

$$\pi_{\text{AssetID, UserCount=COUNT(DISTINCT UserID)}} (\sigma_{\text{OrderBy UserCount DESC}} (\gamma_{\text{AssetID}} (\text{ams.Transaction} \bowtie \text{ams.Portfolio})))$$

Output :



	assetid integer	usercount bigint
1	127042	35