



WeCloudData

Introduction to Metabase

A Powerful Data Visualization and Analytics Tool

Data Engineering Diploma

❏ What is Metabase?

- ❏ Installing Metabase using Docker on Amazon EC2
- ❏ Connecting your Database to Metabase
- ❏ Data Fundamentals
- ❏ Creating Collections in Metabase
- ❏ Creating Questions in Metabase
- ❏ Creating a Dashboard in Metabase

Agenda.



What is Metabase?

Metabase

- an open-source business intelligence and analytics tool that is used by businesses and organizations of all sizes across industries like healthcare, finance, and e-commerce.
- popular among data analysts, business users, and developers who seek a powerful yet user-friendly tool for data exploration and visualization.

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Installing Metabase using Docker on Amazon EC2

- Launch an EC2 Instance
 - Log in to your AWS Management Console
 - Navigate to EC2 dashboard
 - Click “Launch Instances” and follow the wizard to select an Ubuntu AMI (which is commonly used for Docker) or another suitable AMI
- Connect to the EC2 Instance
 - Once your instance is running, connect to it using SSH
- Install Docker



Installing Metabase using Docker on Amazon EC2

- Download and Run Metabase Docker Container
 - Pull the Metabase Docker image from Docker Hub
`docker pull metabase/metabase:latest`
 - Run the Metabase Docker container, mapping the container's port 3000 to the host's port 3000, and specifying a volume for data persistence
`docker run -d -p 3000:3000 --name metabase metabase/metabase`
 - Or, if you want to store the metadata of Metabase in your own database

Bash ▾

```
docker run -d -p 3000:3000 \  
  -e "MB_DB_TYPE=postgres" \  
  -e "MB_DB_DBNAME=<metabasea-db>" \  
  -e "MB_DB_PORT=5432" \  
  -e "MB_DB_USER=<name>" \  
  -e "MB_DB_PASS=<password>" \  
  -e "MB_DB_HOST=<my-database-host>" \  
  --name metabase metabase/metabase
```



Installing Metabase using Docker on Amazon EC2

- Access Metabase Web Interface
 - Open a web browser and navigate to your EC2 instance's public IP address or DNS name, along with port 3000
`https://<your-instance-ip>:3000`
 - follow the prompts to configure Metabase (language selection, database setup, admin account)
- Configure Security Groups and Firewall
 - Ensure that your EC2 instance's security group allows incoming traffic on port 3000

* This guide provides a basic overview, and you may need to adjust steps based on your specific requirements. Always refer to the official documentation for Docker and Metabase for the latest and most detailed instructions.

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Connecting your Database to Metabase

Supported databases

The databases listed below have official drivers maintained by the Metabase team. Customers on **paid plans** will get official support.


- * If you don't see your database listed here, see **partner and community drivers**.
- * As of version 46.6.4, Metabase **no longer supports H2 connections**. But Metabase still ships with an H2 database to include an embedded application database, as well as to provide some sample data out of the box.

- **Amazon Athena**
- **BigQuery** (Google Cloud Platform)
- **Druid**
- **MongoDB (version 4.2 or higher)**
- **MySQL (version 5.7 or higher, as well as MariaDB version 10.2 or higher)**
- **Oracle**
- **PostgreSQL**
- **Presto**
- **Redshift (Amazon Web Services)**
- **Snowflake**
- **SparkSQL**
- **SQL Server**
- **SQLite**
- **Vertica**



Connecting your Database to Metabase

Adding a database connection

- To add a database connection, click on the gear icon  in the top right, and navigate to Admin settings > Databases > Add a database.
- Fill out the fields for that database, and click Save changes at the bottom.
 - The connection settings vary from database to database. For the purpose of learning, we are using the [Snowflake database](#).
- After entering the connection details, click the “Save” button to ensure that the Metabase can connect to your database successfully.

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Data Fundamentals

If you are planning to dive into Metabase, having a solid grasp of some essential database terminology can be incredibly useful.

- **Tables**, Columns, Rows
 - Databases consist of one or more tables. Each table features at least one column and one row. Rows are composed of cells, and each cell holds a value that aligns with its respective column.
- **Columns and Fields**
 - In Metabase, the terms 'Columns' and 'Fields' are commonly used *interchangeably*, particularly when a column contains data from a single field.
 - Column: typically a list of uniform values, often sourced from a single field.
 - Example: the 'product_id' column holds ids.
 - Field: represents a specific data element within a table.
 - Example: the 'product_id' field stores individual identification codes.
- **Keys**
 - A primary key serves as a unique identifier for each row within a table.



Data Fundamentals

Common Data Types

- String Types (e.g., text, char, varchar)
 - These fields hold text snippets, commonly called "strings". They may include letters, numbers, and special characters.
- Numerical Types (e.g., integer, float, decimal)
 - These fields contain numerical data. Integers hold whole numbers, while float and decimal types can store fractional numbers.
- Temporal Types (e.g., timestamp, date, time)
 - These specialized fields store date and time information, often referred to as "timestamps".
- Boolean Types
 - These fields can have only one of two values, generally True or False.



Data Fundamentals

Data Types

In Metabase, the data type for each field can be viewed by going to the Data Browser. There, you can click on the gray book icon beside the table name to open the Data Reference page. Once on this page, select 'Fields in this table' from the left sidebar. The data types are displayed in the third column for each field.

The screenshot shows the Metabase interface. On the left sidebar, under 'DATA', the 'Browse data' option is circled in yellow. In the center sidebar, under 'DETAILS', the 'Fields in this table' option is circled in yellow. The main content area is titled 'Fields in Date Dim' and contains a table with the following data:

Field name	Field type	Data type
D Date ID D_DATE_ID	Aa No field type	type/Text
Cal Dt CAL_DT	📅 No field type	type/Date
Day Of Wk Desc DAY_OF_WK_DESC	Aa Category	type/Text
Wk Num WK_NUM	# No field type	type/Number



Data Fundamentals

Metadata

In Metabase, **admins** have the ability to modify the display names, descriptions, and semantic types (commonly referred to as field types) for fields. These adjustments give users additional context regarding the purpose of each field and guide Metabase on how to interpret various fields.

Properly classifying field types allows Metabase to automatically choose the appropriate chart format, generate maps from geographical data, or present URLs as clickable links. A list of available Metabase field types can be found on [this](#) page.

Casting to a Specific Data Type

- Click on the gear icon ⚙️ in the top right, and navigate to Admin settings > Data Model.
- Locate your database and table.
- Click on the gear icon ⚙️ at the right of a column's settings box.
- Scroll to cast to a specific data type.
- Select a casting option.

The screenshot illustrates the Metabase Admin interface for configuring field types. The top navigation bar includes 'Metabase Admin', 'Settings', 'Databases', 'Data Model', 'People', 'Permissions', 'Tools', and 'Troubleshooting'. The 'Data Model' section is active, showing a list of tables under 'Weekly Sales Inventory'. The 'Warehouse Sk' column is selected, and its settings are displayed on the right. The 'Field Type' is set to 'Category', and the 'Filtering on this field' is set to 'A list of all values'. The 'Field Type' dropdown is highlighted with a dashed arrow, and the 'Filtering on this field' dropdown is also highlighted with a dashed arrow. The 'Field Type' dropdown is labeled 'Category' and the 'Filtering on this field' dropdown is labeled 'A list of all values'.

Reference: <https://www.metabase.com/docs/latest/data-modeling/metadata-editing#field-type>

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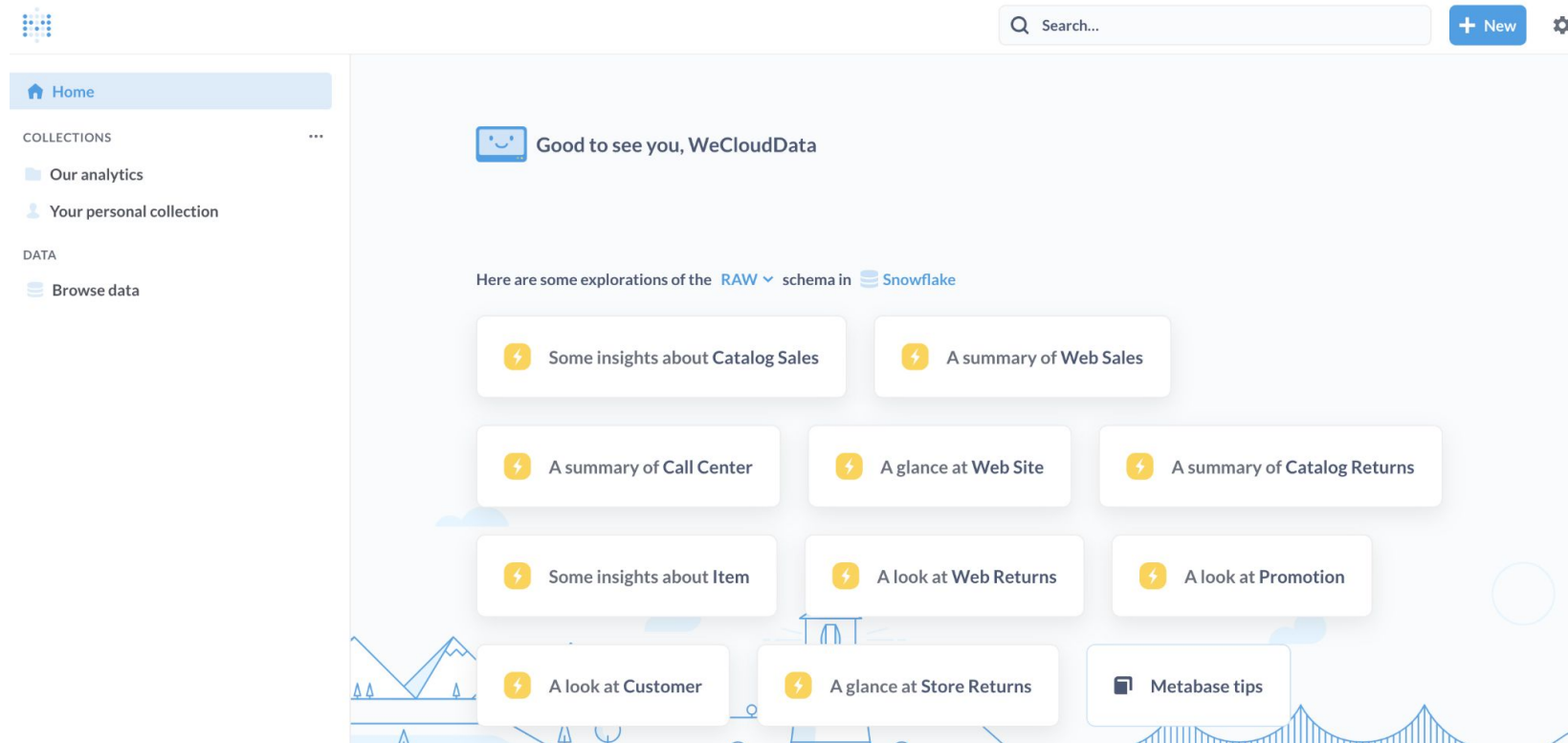
Agenda.



Creating Collections in Metabase

Congratulations! If you have successfully completed all the steps, you are now ready to begin creating queries and dashboards by utilizing this database as a data source. When creating queries, you will be able to choose the database connection you have just established.

If you are currently on the Admin settings page, click on the “Exit admin” option in the top right corner.

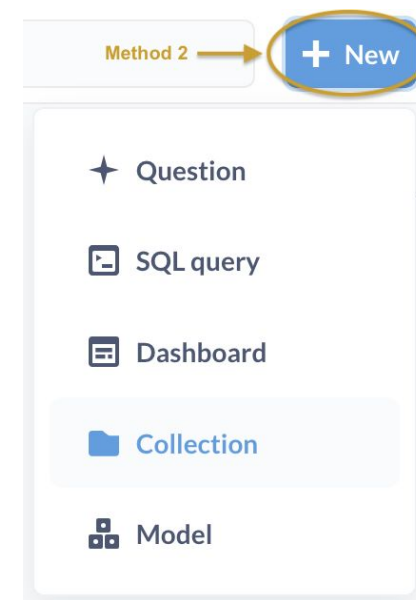
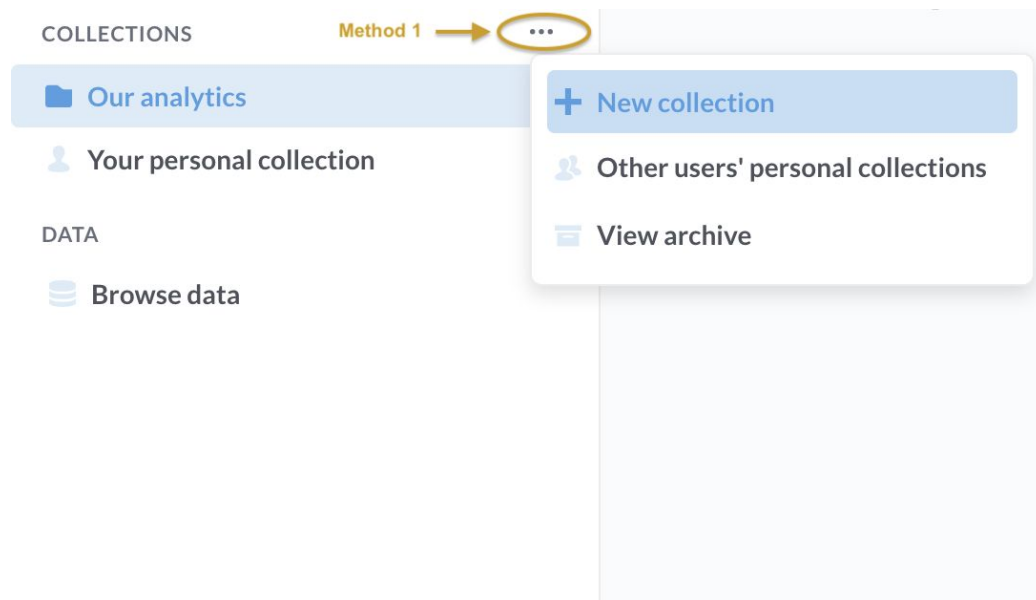




Creating Collections in Metabase

In Metabase, collections are organizational structures used to group related dashboards, questions (queries), and other content together for easier management and navigation. Collections allow you to locally organize your analytics and data visualization assets in a way that makes sense for your specific use case.

For the purpose of learning, our initial step involves creating a collection within 'Our analytics' titled 'TPC-DS project'. Within this collection, we'll proceed to generate two additional collections, known as 'Dashboards' and 'Questions (Queries)', both nested under the 'TPC-DS project' collection.



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Creating Questions in Metabase

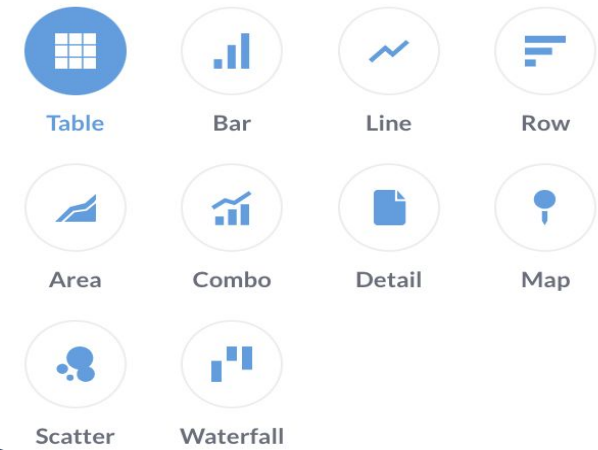
To ask a question in Metabase, click the '+New' button in the top right corner of the main navigation bar, and select either

- **Question (aka. the query builder)**
- **SQL query**

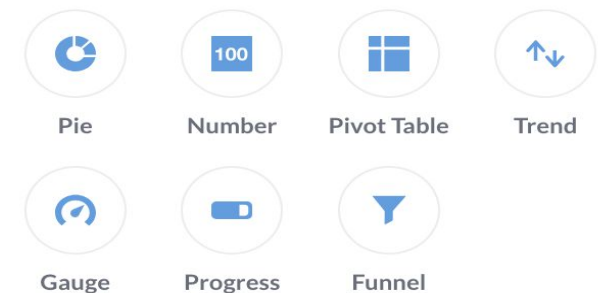
You can initiate a question from one of the following sources:

- **Raw Data**
 - specify both the database and the table within that database
- **A Saved Question**
 - The results of any previously saved question can serve as the foundation for a new inquiry.
- **A Model** 
 - A model is a uniquely crafted saved question designed as an ideal foundation for further questions. These are occasionally referred to as derived tables, as they often aggregate data from several raw tables.

* Kindly observe that with dbt transformations, building models in Metabase is no longer necessary.



OTHER CHARTS



* please check [this](#) page for more information.



Creating Questions in Metabase

Question (aka. the query builder)

- The query builder's notebook editor has three default steps:
 - Picking Data
 - Filtering
 - Summarizing and Grouping By

SQL query

In Metabase's **Query Builder**, you can apply filters directly as you construct queries, while in **SQL queries**, you must explicitly build and map filter conditions to table columns using SQL syntax.

Field Filter

Distinguishing Field Filters from simple Text, Number, and Date variables

- Field Filters are optional by default. If no value is given, the SQL query will run as if the Field Filter didn't exist. You do, however, have the option to require a value.
- **Field Filters won't work with table aliases.** Since Field Filters rely on [metadata](#) about columns in your tables (and the specific names of those tables), the filters can't "know" that you've aliased a table. And depending on the database you're using, you may need to include the full schema path in the **FROM** clause.
- Field Filters use a special syntax so they can handle SQL code behind the scenes. You simply supply a Field Filter to a **WHERE** clause (without a column or operator) and the Field Filter will manage the SQL code for you. This allows the code to account for multiple selections people make in the filter widget.



Creating Questions in Metabase

Question (aka. the query builder)

Demo #1: Detect items experiencing low stock levels, along with their corresponding week and warehouse numbers, marked as "True".

- Once you are in the query builder interface, choose the data source from which you want to query. Then select the specific table against which you want to build your query. You'll see something like this:

Snowflake / BI_NLTX / Weekly Sales Inventory

Data

Weekly Sales Inventory

Filter

Add filters to narrow your answer

Summarize

Pick the metric you want to see by Pick a column to group by

Visualize

- Filter on conditions where LOW_STOCK_FLG_WK is "True".

Filter

Add filters to narrow your answer

Weekly Sales Inventory - Low Stock Flg Wk

True (selected)
False
Empty
Not empty

Add filter

Filter

Low Stock Flg Wk is true

- Summarize the data based on YR_WK_NUM, WAREHOUSE_SK, ITEM_SK, INV_QTY_WK, WKS_SPLY, and LOW_STOCK_FLG_WK.

Summarize

Pick the metric you want to see by

Yr Wk Num Warehouse Sk Item Sk
Inv Qty Wk Wks Sply Low Stock Flg Wk

+

- Order the results based on the most recent YR_WK_NUM, and sort the values of WAREHOUSE_SK, ITEM_SK, INV_QTY_WK in ascending order.

Sort

Yr Wk Num Warehouse Sk Item Sk Inv Qty Wk

↓ ↑ ↑ ↑

- Utilize data as a table with conditional formatting based on the ITEM_SK column.

Weekly Inventory Shortages

Yr Wk Num	Warehouse Sk	Item Sk	Inv Qty Wk	Wks Sply	Low Stock Flg Wk
202,337	1	2,600	0	0	true
202,337	1	3,554	0	0	true
202,337	1	6,134	0	0	true
202,337	1	6,967	0	0	true
202,337	1	8,696	0	0	true



Creating Questions in Metabase

Question (aka. the query builder)

Demo #2: Find the total count of items experiencing weekly inventory shortages, along with their corresponding week and warehouse numbers.

- Create a new question using a previously saved question
- Choose Bar Chart as visualization type

Number of Weekly Inventory Shortages

Data

Weekly Sales Inventory

Filter

Low Stock Flg Wk is true

Summarize

count_of_items_experiencing_weekly_inventory_shortages

by Yr Wk Num Warehouse Sk

Visualize

Done

Filter Summarize Join data Sort Row limit Custom column

Distinct(column)

The number of distinct values in this column.

Distinct([Last Name])

column

The column whose distinct values to count.

Learn more

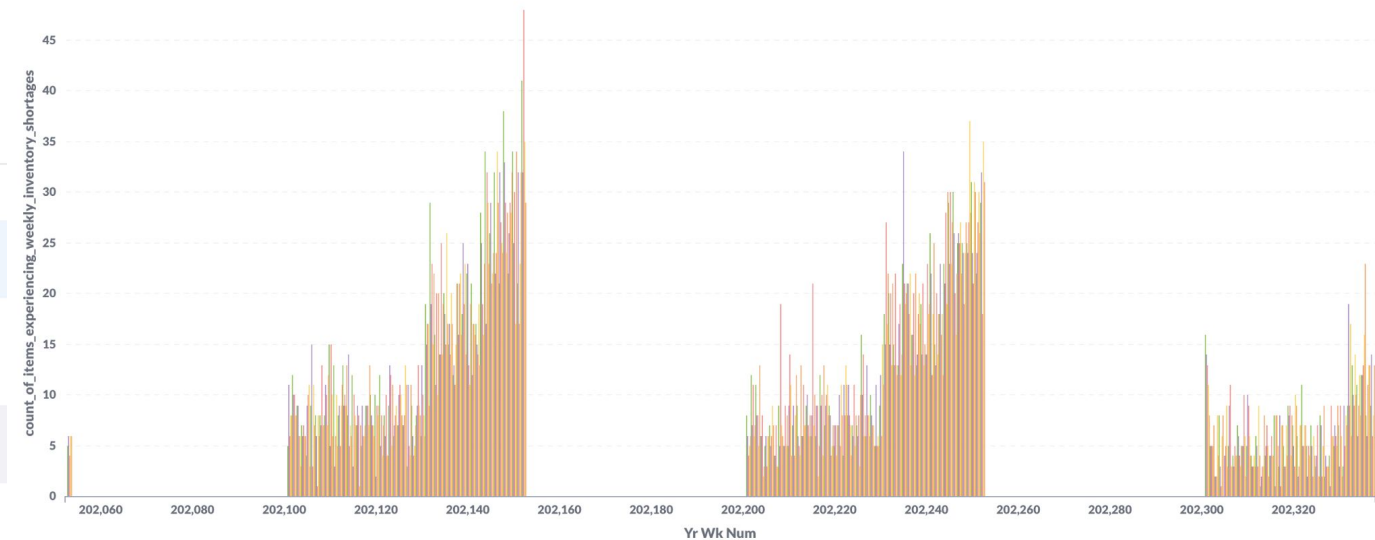
Custom Expression

= Distinct([Item Sk])

count_of_items_experiencing_weekly_inventory_shortages

Number of Weekly Inventory Shortages

1 2 3 4 5





Creating Questions in Metabase

Question (aka. the query builder)

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 - Summarizing and Grouping By

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Creating Questions in Metabase

SQL query

After clicking 'SQL query', you'll see an editor where you can write and run queries in SQL or your database's native querying language.

Demo: Identify the highest performing items of the week by analyzing sales amounts and quantities. Order the results based on the most recent YR_WK_NUM, and sort the value for the number of TOP_SELL_RANKING in ascending order.

Snowflake

```
1 with cte as (  
2   select  
3     YR_WK_NUM  
4     , ITEM_SK  
5     , sum(coalesce(SUM_AMT_WK, 0)) as sum_wk_amt  
6     , sum(coalesce(SUM_QTY_WK, 0)) as sum_wk_qty  
7     , rank() over (partition by YR_WK_NUM order by sum(coalesce(SUM_AMT_WK, 0)) desc, sum(coalesce(SUM_QTY_WK, 0)) desc) as top_sell_ranking  
8   from  
9     BI_NLTX.WEEKLY_SALES_INVENTORY  
10  group by  
11    1, 2  
12 )  
13 select  
14   *  
15 from  
16   cte  
17 order by  
18   1 desc, 5
```

YR_WK_NUM

ITEM_SK

SUM_WK_AMT

SUM_WK_QTY

TOP_SELL_RANKING

202,332	1,891	36,242.93	314	1
202,332	5,609	35,505.62	234	2
202,332	13,298	30,984.18	329	3
202,332	2,521	30,674.34	162	4

Visualization

Showing first 2,000 rows



Creating Questions in Metabase

How To Use Optional Filters in an SQL Query?

To make a filter optional, you can include it in your SQL query within a **WHERE** clause using `[[...]]` to denote that it is optional.

The screenshot shows the Metabase interface. On the left, the SQL query editor displays a query for a Snowflake database. The query is:

```
1 select
2   column_name
3 from
4   table_name
5 where 1=1
6   [[ and {{filter_name}} ]]
```

The query is titled "Aa Filter name". Below the query editor, there is a placeholder text: "Here's where your results will appear".

On the right, the "Variables" panel is open. It has tabs for "SETTINGS" and "HELP". The "SETTINGS" tab is active. The panel contains the following fields:

- Variable name:** `filter_name`
- Variable type:** A dropdown menu currently showing "Text".
- Filter widget label:** A text input field containing "Filter name".
- How should users filter on this variable?:** A group of radio buttons with options: "Dropdown list", "Search box", and "Input box" (which is selected).
- Required?:** A toggle switch currently turned off.

Dashed arrows indicate the flow of information: one arrow points from the "Variable type" dropdown in the "Variables" panel to the "Field Filter" dropdown in a separate panel on the right, and another arrow points from the "Filter widget label" text input in the "Variables" panel to the same "Field Filter" dropdown.

Variable type

Field Filter

Field to map to (required)

Select...

You'll need to **select the type of variable** you want to use from among text, number, date, or field filter.

If you opt for a field filter as the variable type, you'll also be required to specify the database table and column to which it should be mapped.



Creating Questions in Metabase

SQL query (cont.)

Demo: Identify the highest performing items of the week by analyzing sales amounts and quantities. Order the results based on the most recent YR_WK_NUM, and sort the value for the number of TOP_SELL_RANKING in ascending order.

Snowflake Warehouse sk

Top sell rk
5

```
1 with cte as (  
2   select  
3     YR_WK_NUM  
4     , ITEM_SK  
5     , sum(coalesce(SUM_AMT_WK, 0)) as sum_wk_amt  
6     , sum(coalesce(SUM_QTY_WK, 0)) as sum_wk_qty  
7     , rank() over (partition by YR_WK_NUM order by sum(coalesce(SUM_AMT_WK, 0)) desc, sum(coalesce(SUM_QTY_WK, 0)) desc) as top_sell_ranking  
8   from  
9     BI_NLTX.WEEKLY_SALES_INVENTORY  
10  where 1=1  
11    [[and {{warehouse_sk}}]]  
12  group by  
13    1, 2  
14 )  
15 select  
16   *  
17 from  
18   cte  
19 where 1=1  
20    [[and top_sell_ranking<={{top_sell_rk}}]]  
21 order by  
22   1 desc, 5]
```

Variable name
warehouse_sk

Variable type
Field Filter

Field to map to
BI_NLTX > WEEKLY SALES INVENTORY
Warehouse Sk

Filter widget type
String

Filter widget label
Warehouse sk

How should users filter on this variable?
☒ Dropdown list
☐ Search box
☐ Input box

Required?
☐

Variable name
top_sell_rk

Variable type
Number

Filter widget label
Top sell rk

Required?
☒

Default filter widget value
5

Warehouse sk
Search the list
☐ 4
☐ 3
☐ 5
☐ 2
☐ 1



Creating Questions in Metabase

SQL query (cont.)

Demo: Identify the highest performing items of the week by analyzing sales amounts and quantities. Order the results based on the most recent YR_WK_NUM, and sort the value for the number of TOP_SELL_RANKING in ascending order.

In our demo, we want to utilize data as a table with conditional formatting based on the TOP_SELL_RANKING column.

Table options

Columns

Conditional Formatting

Which columns should be affected?
TOP_SELL_RANKING

Formatting style
☐ Single color
☒ Color range

Colors

Start the range at
☒ Smallest value in this column
☐ Custom value

End the range at
☒ Largest value in this column
☐ Custom value

Add rule

Done

This question is written in SQL. Top sell rk 5 Warehouse sk

YR_WK_NUM	ITEM_SK	SUM_WK_AMT	SUM_WK_QTY	TOP_SELL_RANKING
202,332	1,891	36,242.93	314	1
202,332	5,609	35,505.62	234	2
202,332	13,298	30,984.18	329	3
202,332	2,521	30,674.34	162	4
202,332	236	29,337.21	220	5
202,331	3,013	34,408.4	189	1
202,331	14,264	31,794.49	274	2
202,331	4,159	31,435.25	265	3
202,331	16,363	29,223.45	155	4
202,331	8,605	27,826.15	342	5
202,330	1,247	27,464.64	168	1
202,330	1,580	26,143	192	2
202,330	13,526	25,583.19	219	3
202,330	10,993	24,253.72	211	4
202,330	4,862	23,402.22	162	5

Visualization

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Creating a Dashboard in Metabase


Create a New Dashboard

- Go to the Metabase homepage.
- Click on the '+ New' and then select 'Dashboard' button from the top navigation bar.
- Give your dashboard a name and description, and then click 'Create'.






Add Saved Questions to Dashboard

- On your new dashboard page, click on the  icon to edit the dashboard.
- Click on the  and you will be taken to a page where you can select from your saved questions.
- Add the questions you want to include on your dashboard.

Add Filters to Dashboard

- Click on the  to add a filter.
- Choose the type of filter you want to add.
- After adding the filter, you will need to map the filter to the relevant fields in each question by clicking the gear icon beside it.

What do you want to filter?

-  **Time**
Date range, relative date, time of day, etc.
-  **Location**
City, State, Country, ZIP code.
-  **ID**
User ID, Product ID, Event ID, etc.
-  **Number**
Subtotal, Age, Price, Quantity, etc.
-  **Text or Category**
Name, Rating, Description, etc.



Creating a Dashboard in Metabase

TPC-DS demo dashboard



warehouse number ▾ Top-ranking | Low Weeks Supply Nur

Greetings, this demonstration aims to provide you with a brief tutorial on crafting a dashboard within Metabase. We'll be utilizing both the notebook editor and SQL editor for this tutorial.

Identify the highest and lowest performing items of the week by analyzing sales amounts and quantities.

Items with Highest Weekly Sales					
YR_WK_NUM	ITEM_SK	SUM_WK_AMT	SUM_WK_QTY	TOP_SELL_RANKING	
202,337	16,255	26,025.1	97	1	
202,337	9,775	19,788.31	213	2	
202,337	11,389	18,816.93	99	3	
202,337	10,429	18,463.29	93	4	
202,337	15,025	17,782.5	75	5	
202,336	5,779	18,261.85	95	1	
202,336	2,072	18,240	96	2	
202,336	1,969	16,554.48	92	3	
202,336	7,075	15,935.79	87	4	

Rows 1-9 of 710

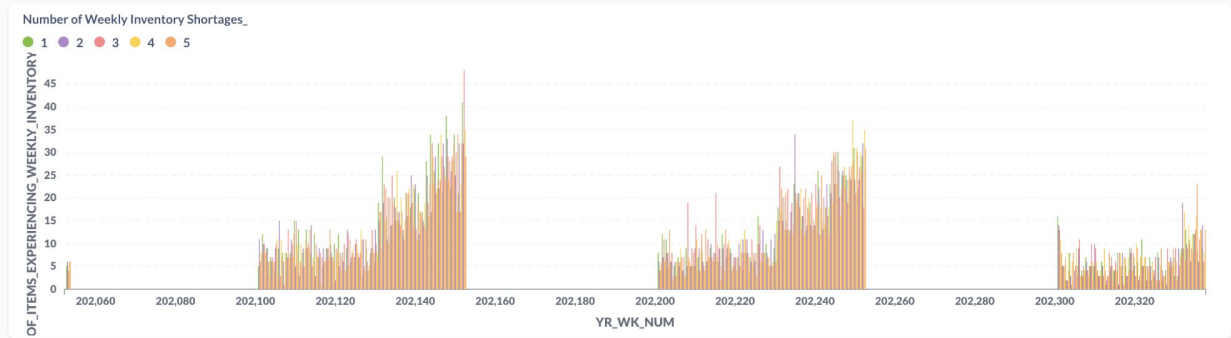
Items with Lowest Weekly Sales					
YR_WK_NUM	ITEM_SK	SUM_WK_AMT	SUM_WK_QTY	LEAST_SELL_RANKING	
202,337	2,659	0	9	1	
202,337	9,074	0	24	2	
202,337	17,264	0	26	3	
202,337	6,530	0	30	4	
202,337	4,573	0	32	5	
202,337	5,342	0	70	6	
202,337	1,220	0	93	7	
202,337	2,191	0.96	1	8	
202,337	8,594	4.36	4	9	
202,337	2,456	4.56	3	10	

Rows 1-10 of 1421

Detect items experiencing low stock levels, along with their corresponding week and warehouse number, marked as "True."

Weekly Inventory Shortages_					
YR_WK_NUM	WAREHOUSE_SK	ITEM_SK	INV_QTY_WK	WKS_SPLY	LOW_STOCK_FLG_WK
202,337	1	2,600	0	0	true
202,337	1	3,554	0	0	true
202,337	1	6,134	0	0	true
202,337	1	6,967	0	0	true
202,337	1	8,696	0	0	true
202,337	1	11,137	0	0	true
202,337	1	12,061	0	0	true

Rows 1-7 of first 2000





Useful Resources

- <https://www.metabase.com/learn/>
- <https://www.metabase.com/docs/latest/>
- <https://www.metabase.com/learn/sql-questions/field-filters>
- <https://www.metabase.com/learn/dashboards/custom-destinations>