Generating SQL for SQLite using Ollama, ChromaDB

This notebook runs through the process of using the `vanna` Python package to generate SQL using AI (RAG + LLMs) including connecting to a database and training. If you're not ready to train on your own database, you can still try it using a sample SQLite database.

Which LLM do you want to use?

- OpenAI via Vanna.AI (Recommended)

  Use Vanna.AI for free to generate your queries
- OpenAI

  Use OpenAI with your own API key
- Azure OpenAI

  If you have OpenAI models deployed on Azure
- [Selected] Ollama

  Use Ollama locally for free. Requires additional setup.
- Mistral via Mistral API

  If you have a Mistral API key
- Other LLM

  If you have a different LLM model

Where do you want to store the 'training' data?

- Vanna Hosted Vector DB (Recommended)

  Use Vanna.AIs hosted vector database (pgvector) for free. This is usable across machines with no additional setup.
- [Selected] ChromaDB

  Use ChromaDBs open-source vector database for free locally. No additional setup is necessary -- all database files will be created and stored locally.
- Marqo

  Use Marqo locally for free. Requires additional setup. Or use their hosted option.
- Other VectorDB

  Use any other vector database. Requires additional setup.

Setup

!pwd!pip install vanna!pip install 'vanna[chromadb]'!pip install ollama!pip show vanna # 0.5.5, 0.2.1!pip show ollama # 0.2.0

In [1]:

```
import warnings
import re
```

```
warnings.filterwarnings('ignore', category=DeprecationWarning, message='^Num
# warnings.filterwarnings('ignore', category=DeprecationWarning, message=re.

import os

import re
from time import time

from vanna.ollama import Ollama
from vanna.chromadb.chromadb_vector import ChromaDB_VectorStore
```

In [2]:

```
class MyVanna(ChromaDB_VectorStore, Ollama):
    def __init__(self, config=None):
        ChromaDB_VectorStore.__init__(self, config=config)
        Ollama.__init__(self, config=config)
```

In [3]:

```
file_db = "~/Downloads/chinook.sqlite"
model_name = "mistral-nemo" # 'llama3'

clean_and_train = True  # False
```

In [4]:

```
config = {
    'model': model_name,   # 'mistral' # "starcoder2"
}
vn = MyVanna(config=config)
```

In [5]:

```
hostname = os.uname().nodename
print("Hostname:", hostname)
```

```
Hostname: ducklover1
```

In [6]:

```
file_db = os.path.abspath(os.path.expanduser(file_db))
vn.connect_to_sqlite(file_db)
```

In [7]:

```
vn.run_sql_is_set
```

Out[7]:

```
True
```

In [8]:

```
def remove_collections(collection_name=None, ACCEPTED_TYPES = ["sql", "ddl",
    if not collection_name:
        collections = ACCEPTED_TYPES
    elif isinstance(collection_name, str):
        collections = [collection_name]
    elif isinstance(collection_name, list):
        collections = collection_name
    else:
        print(f"\t{collection_name} is unknown: Skipped")
        return

    for c in collections:
        if not c in ACCEPTED_TYPES:
            print(f"\t{c} is unknown: Skipped")
            continue
        # print(f"vn.remove_collection('{c}')")
        vn.remove_collection(c)
```

In [9]:

```
def strip_brackets(ddl):
    """
    This function removes square brackets from table and column names in a D

    Args:
        ddl (str): The DDL script containing square brackets.

    Returns:
        str: The DDL script with square brackets removed.
    """
    # Use regular expressions to match and replace square brackets
    pattern = r"\[([^\]]+)]"  # Match any character except ] within square b
    return re.sub(pattern, r"\1", ddl)
```

In [10]:

```
if clean_and_train:
    remove_collections()
```

Training

SQLite sample database

You only need to train once. Do not train again unless you want to add more training data.

In [11]:

```
df_ddl = vn.run_sql("SELECT type, sql FROM sqlite_master WHERE sql is not nu
```

In [12]:

```
df_ddl
```

Out[12]:

	type	sql
0	table	CREATE TABLE "albums"\r\n(\r\n [AlbumId] IN...
1	table	CREATE TABLE sqlite_sequence(name,seq)
2	table	CREATE TABLE "artists"\r\n(\r\n [ArtistId] ...
3	table	CREATE TABLE "customers"\r\n(\r\n [Customer...
4	table	CREATE TABLE "employees"\r\n(\r\n [Employee...
5	table	CREATE TABLE "genres"\r\n(\r\n [GenreId] IN...
6	table	CREATE TABLE "invoices"\r\n(\r\n [InvoiceId...
7	table	CREATE TABLE "invoice_items"\r\n(\r\n [Invo...
8	table	CREATE TABLE "media_types"\r\n(\r\n [MediaT...
9	table	CREATE TABLE "playlists"\r\n(\r\n [Playlist...
10	table	CREATE TABLE "playlist_track"\r\n(\r\n [Pla...
11	table	CREATE TABLE "tracks"\r\n(\r\n [TrackId] IN...
12	index	CREATE INDEX [IFK_AlbumArtistId] ON "albums" (...
13	index	CREATE INDEX [IFK_CustomerSupportRepId] ON "cu...
14	index	CREATE INDEX [IFK_EmployeeReportsTo] ON "emplo...
15	index	CREATE INDEX [IFK_InvoiceCustomerId] ON "invoi...
16	index	CREATE INDEX [IFK_InvoiceLineInvoiceId] ON "in...
17	index	CREATE INDEX [IFK_InvoiceLineTrackId] ON "invo...
18	index	CREATE INDEX [IFK_PlaylistTrackTrackId] ON "pl...
19	index	CREATE INDEX [IFK_TrackAlbumId] ON "tracks" ([...
20	index	CREATE INDEX [IFK_TrackGenreId] ON "tracks" ([...
21	index	CREATE INDEX [IFK_TrackMediaTypeId] ON "tracks...
22	table	CREATE TABLE sqlite_stat1(tbl,idx,stat)

In [13]:

```python
if clean_and_train:
    for ddl in df_ddl['sql'].to_list():
        ddl = strip_brackets(ddl)
        vn.train(ddl=ddl)

    # Sometimes you may want to add documentation about your business termi
    vn.train(documentation="In the chinook database invoice means order")
```

```
Adding ddl: CREATE TABLE "albums"
(
    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    Title NVARCHAR(160)  NOT NULL,
    ArtistId INTEGER  NOT NULL,
    FOREIGN KEY (ArtistId) REFERENCES "artists" (ArtistId)
                ON DELETE NO ACTION ON UPDATE NO ACTION
)
Adding ddl: CREATE TABLE sqlite_sequence(name,seq)
Adding ddl: CREATE TABLE "artists"
(
    ArtistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    Name NVARCHAR(120)
)
Adding ddl: CREATE TABLE "customers"
(
    CustomerId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    FirstName NVARCHAR(40)  NOT NULL,
    LastName NVARCHAR(20)  NOT NULL,
    Company NVARCHAR(80),
    Address NVARCHAR(70),
    City NVARCHAR(40),
    State NVARCHAR(40),
    Country NVARCHAR(40),
    PostalCode NVARCHAR(10),
    Phone NVARCHAR(24),
    Fax NVARCHAR(24),
    Email NVARCHAR(60)  NOT NULL,
    SupportRepId INTEGER,
    FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeId)
                ON DELETE NO ACTION ON UPDATE NO ACTION
)
Adding ddl: CREATE TABLE "employees"
(
    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    LastName NVARCHAR(20)  NOT NULL,
    FirstName NVARCHAR(20)  NOT NULL,
    Title NVARCHAR(30),
    ReportsTo INTEGER,
    BirthDate DATETIME,
    HireDate DATETIME,
    Address NVARCHAR(70),
    City NVARCHAR(40),
    State NVARCHAR(40),
    Country NVARCHAR(40),
    PostalCode NVARCHAR(10),
    Phone NVARCHAR(24),
    Fax NVARCHAR(24),
    Email NVARCHAR(60),
    FOREIGN KEY (ReportsTo) REFERENCES "employees" (EmployeeId)
                ON DELETE NO ACTION ON UPDATE NO ACTION
)
Adding ddl: CREATE TABLE "genres"
(
    GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    Name NVARCHAR(120)
```

```
)
Adding ddl: CREATE TABLE "invoices"
(
    InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    CustomerId INTEGER  NOT NULL,
    InvoiceDate DATETIME  NOT NULL,
    BillingAddress NVARCHAR(70),
    BillingCity NVARCHAR(40),
    BillingState NVARCHAR(40),
    BillingCountry NVARCHAR(40),
    BillingPostalCode NVARCHAR(10),
    Total NUMERIC(10,2)  NOT NULL,
    FOREIGN KEY (CustomerId) REFERENCES "customers" (CustomerId)
                ON DELETE NO ACTION ON UPDATE NO ACTION
)
Adding ddl: CREATE TABLE "invoice_items"
(
    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    InvoiceId INTEGER  NOT NULL,
    TrackId INTEGER  NOT NULL,
    UnitPrice NUMERIC(10,2)  NOT NULL,
    Quantity INTEGER  NOT NULL,
    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId)
                ON DELETE NO ACTION ON UPDATE NO ACTION,
    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId)
                ON DELETE NO ACTION ON UPDATE NO ACTION
)
Adding ddl: CREATE TABLE "media_types"
(
    MediaTypeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    Name NVARCHAR(120)
)
Adding ddl: CREATE TABLE "playlists"
(
    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    Name NVARCHAR(120)
)
Adding ddl: CREATE TABLE "playlist_track"
(
    PlaylistId INTEGER  NOT NULL,
    TrackId INTEGER  NOT NULL,
    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),
    FOREIGN KEY (PlaylistId) REFERENCES "playlists" (PlaylistId)
                ON DELETE NO ACTION ON UPDATE NO ACTION,
    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId)
                ON DELETE NO ACTION ON UPDATE NO ACTION
)
Adding ddl: CREATE TABLE "tracks"
(
    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,
    Name NVARCHAR(200)  NOT NULL,
    AlbumId INTEGER,
    MediaTypeId INTEGER  NOT NULL,
    GenreId INTEGER,
    Composer NVARCHAR(220),
    Milliseconds INTEGER  NOT NULL,
    Bytes INTEGER,
    UnitPrice NUMERIC(10,2)  NOT NULL,
    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId)
                ON DELETE NO ACTION ON UPDATE NO ACTION,
    FOREIGN KEY (GenreId) REFERENCES "genres" (GenreId)
                ON DELETE NO ACTION ON UPDATE NO ACTION,
    FOREIGN KEY (MediaTypeId) REFERENCES "media_types" (MediaTypeId)
                ON DELETE NO ACTION ON UPDATE NO ACTION
)
Adding ddl: CREATE INDEX IFK_AlbumArtistId ON "albums" (ArtistId)
Adding ddl: CREATE INDEX IFK_CustomerSupportRepId ON "customers" (SupportRep
Id)
Adding ddl: CREATE INDEX IFK_EmployeeReportsTo ON "employees" (ReportsTo)
Adding ddl: CREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)
Adding ddl: CREATE INDEX IFK_InvoiceLineInvoiceId ON "invoice_items" (Invoic
eId)
Adding ddl: CREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)
Adding ddl: CREATE INDEX IFK_PlaylistTrackTrackId ON "playlist_track" (Track
Id)
Adding ddl: CREATE INDEX IFK_TrackAlbumId ON "tracks" (AlbumId)
Adding ddl: CREATE INDEX IFK_TrackGenreId ON "tracks" (GenreId)
Adding ddl: CREATE INDEX IFK_TrackMediaTypeId ON "tracks" (MediaTypeId)
Adding ddl: CREATE TABLE sqlite_stat1(tbl,idx,stat)
Adding documentation....
```

In [14]:

```python
# show training data
training_data = vn.get_training_data()
training_data
```

Out[14]:

	id	question	content	training_data_type
0	039f9d54-59f7-5f29-8c04-14dbc3e95671-ddl	None	CREATE TABLE "artists"\r\n(\r\n ArtistId IN...	ddl
1	0db84e3d-ef41-563c-803e-21c1b985dc19-ddl	None	CREATE TABLE "invoices"\r\n(\r\n InvoiceId ...	ddl
2	10cba811-ddba-5042-9e90-d764dfcd1629-ddl	None	CREATE INDEX IFK_InvoiceCustomerId ON "invoice...	ddl
3	2c711317-b93d-5f60-a728-cb1c6fcbc040-ddl	None	CREATE INDEX IFK_CustomerSupportRepId ON "cust...	ddl
4	37319c81-65f7-50ee-956b-795de244bee5-ddl	None	CREATE TABLE sqlite_stat1(tbl,idx,stat)	ddl
5	40bd77cd-e1de-5872-8693-624117ff413c-ddl	None	CREATE INDEX IFK_InvoiceLineInvoiceId ON "invo...	ddl
6	41130543-7164-562a-90a7-0fd0a409c154-ddl	None	CREATE TABLE "albums"\r\n(\r\n AlbumId INTE...	ddl
7	458debc8-8082-5450-a17a-66028bd55ace-ddl	None	CREATE TABLE "playlists"\r\n(\r\n PlaylistI...	ddl
8	4815f3fd-925b-53ce-9dfa-0e4285d5abd3-ddl	None	CREATE TABLE "invoice_items"\r\n(\r\n Invoi...	ddl
9	48d484e9-984c-58ff-b391-75521c69d486-ddl	None	CREATE INDEX IFK_PlaylistTrackTrackId ON "play...	ddl
10	551e1120-a6ee-554f-8b8a-ccf4f22d3636-ddl	None	CREATE INDEX IFK_AlbumArtistId ON "albums" (Ar...	ddl
11	5ff4911e-45c1-5a59-9566-243a9b6a3320-ddl	None	CREATE TABLE "employees"\r\n(\r\n EmployeeI...	ddl
12	65df0648-bf05-5f75-9365-c21f54b2302d-ddl	None	CREATE TABLE "media_types"\r\n(\r\n MediaTy...	ddl
13	6b585176-e66d-5b23-8d86-ca8a80e3af3d-ddl	None	CREATE INDEX IFK_EmployeeReportsTo ON "employe...	ddl
14	868758b8-e018-55e7-8cc3-75c0e6d211c8-ddl	None	CREATE INDEX IFK_TrackAlbumId ON "tracks" (Alb...	ddl
15	9ea4613d-c1be-5a77-ada9-c54ee3f0cab7-ddl	None	CREATE INDEX IFK_TrackMediaTypeId ON "tracks" ...	ddl
16	a9c9a852-608d-5ef2-aede-26ba098d83d1-	None	CREATE INDEX IFK_TrackGenreId ON "tracks" (Gen...	ddl

	id	question	content	training_data_type
	ddl			
17	b42cc9e1-9219-5a42-9a06-de906f76239e-ddl	None	CREATE TABLE "tracks"\r\n(\r\n TrackId INTE...	ddl
18	c387b9d2-5ff4-5a07-8364-f5dab45bb2a9-ddl	None	CREATE TABLE "genres"\r\n(\r\n GenreId INTE...	ddl
19	d654f328-dc36-549e-84c3-06ee0db7e0f7-ddl	None	CREATE TABLE "playlist_track"\r\n(\r\n Play...	ddl
20	d93f0d68-023d-5afb-8121-ba346699d318-ddl	None	CREATE TABLE "customers"\r\n(\r\n CustomerI...	ddl
21	e5879308-329e-543f-a693-0c14e2f9972e-ddl	None	CREATE INDEX IFK_InvoiceLineTrackId ON "invoic...	ddl
22	ea84418b-1a28-59b4-a1f4-2fb674208adc-ddl	None	CREATE TABLE sqlite_sequence(name,seq)	ddl
0	2b4dda0a-a6ac-5e34-8f76-e41c0734d55e-doc	None	In the chinook database invoice means order	documentation

Asking the AI

Whenever you ask a new question, it will find the 10 most relevant pieces of training data and use it as part of the LLM prompt to generate the SQL.

In [15]:

```
ts_start = time()
```

```
SELECT name FROM sqlite_master WHERE type = 'table';
```

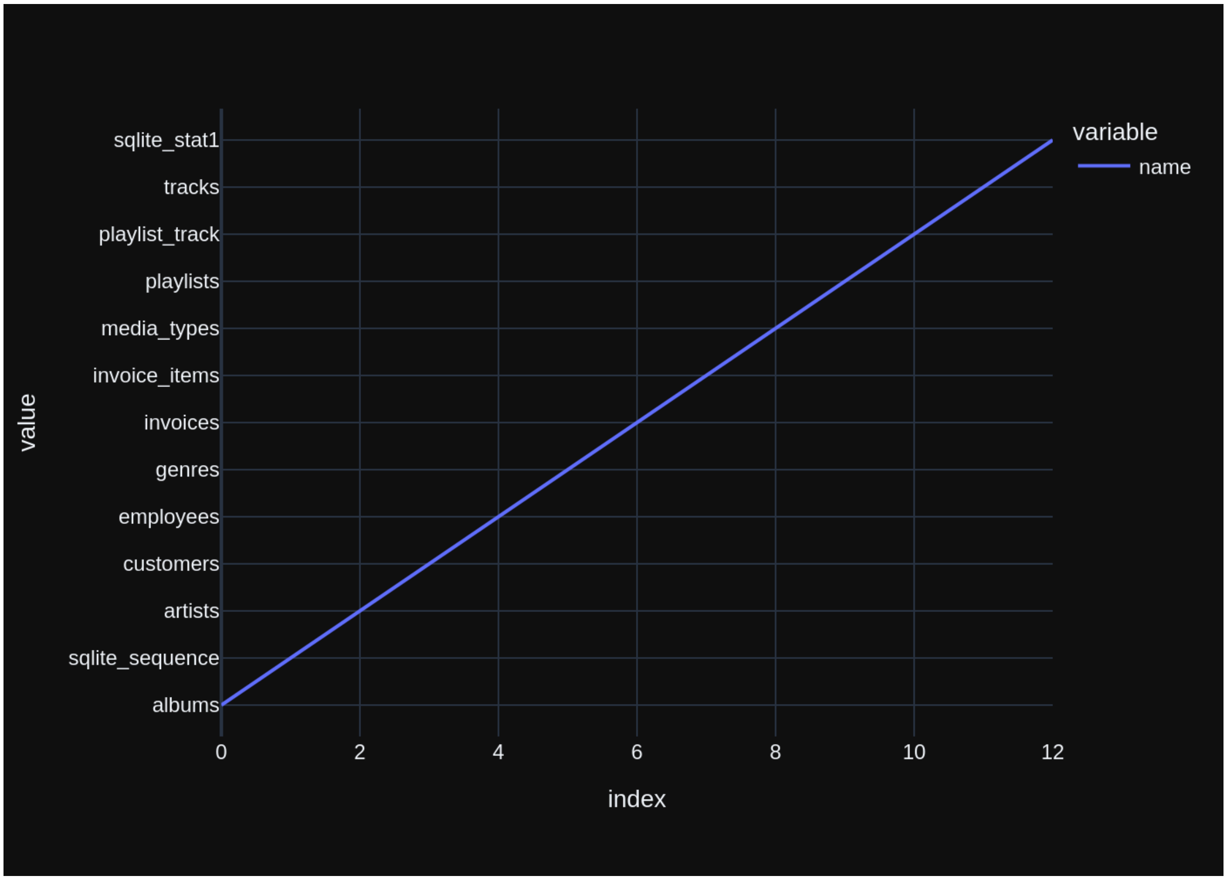
In [16]:

```
vn.ask(question="Can you list all tables in the SQLite database catalog?")
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE sqlite_stat1(tbl,idx,stat)\n\nCR
EATE TABLE sqlite_sequence(name,seq)\n\nCREATE TABLE "playlists"\r\n(\r\n
PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR
(120)\r\n)\n\nCREATE TABLE "genres"\r\n(\r\n    GenreId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE "trac
ks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    N
ame NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTE
GER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n
Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Genr
eId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_types" (MediaType
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "me
dia_types"\r\n(\r\n    MediaTypeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE "artists"\r\n(\r\n    Arti
stId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r
\n)\n\nCREATE TABLE "invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMAR
Y KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    Tra
ckId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Qua
ntity INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoice
s" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREI
GN KEY (TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE TABLE "playlist_track"\r\n(\r\n    Playlis
tId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT P
K_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KEY (Play
listId) REFERENCES "playlists" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON U
PDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "album
s"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Ti
tle NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREI
GN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nIn the chinook dat
abase invoice means order\n\n===Response Guidelines \n1. If the provided con
text is sufficient, please generate a valid SQL query without any explanatio
ns for the question. \n2. If the provided context is almost sufficient but r
equires knowledge of a specific string in a particular column, please genera
te an intermediate SQL query to find the distinct strings in that column. Pr
epend the query with a comment saying intermediate_sql \n3. If the provided
context is insufficient, please explain why it can\'t be generated. \n4. Ple
ase use the most relevant table(s). \n5. If the question has been asked and
answered before, please repeat the answer exactly as it was given before.
\n'}, {'role': 'user', 'content': 'Can you list all tables in the SQLite dat
abase catalog?'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE sqlite_stat1(tbl,idx,stat)\n\nCREATE TABLE s
qlite_sequence(name,seq)\n\nCREATE TABLE \"playlists\"\r\n(\r\n    PlaylistI
d INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)
\n\nCREATE TABLE \"genres\"\r\n(\r\n    GenreId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE \"tracks\"\r
\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name N
VARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER
NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Mill
iseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(1
0,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES \"albums\" (AlbumId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreI
d) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"media_types\" (MediaTy
peId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE
\"media_types\"\r\n(\r\n    MediaTypeId INTEGER PRIMARY KEY AUTOINCREMENT NO
T NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE \"artists\"\r\n(\r\n
ArtistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(12
0)\r\n)\n\nCREATE TABLE \"invoice_items\"\r\n(\r\n    InvoiceLineId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n
TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n
Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invo
ices\" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    F
OREIGN KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"playlist_track\"\r\n(\r\n
PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONST
RAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KE
Y (PlaylistId) REFERENCES \"playlists\" (PlaylistId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\"
(TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TAB
LE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId) \r\n\t\tO
N DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nI
n the chinook database invoice means order\n\n===Response Guidelines \n1. If
the provided context is sufficient, please generate a valid SQL query withou
t any explanations for the question. \n2. If the provided context is almost
sufficient but requires knowledge of a specific string in a particular colum
n, please generate an intermediate SQL query to find the distinct strings in
that column. Prepend the query with a comment saying intermediate_sql \n3. I
f the provided context is insufficient, please explain why it can't be gener
ated. \n4. Please use the most relevant table(s). \n5. If the question has b
een asked and answered before, please repeat the answer exactly as it was gi
ven before. \n"}, {"role": "user", "content": "Can you list all tables in th
e SQLite database catalog?"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:14:46.58725973
7Z', 'message': {'role': 'assistant', 'content': "SELECT name FROM sqlite_ma
ster WHERE type='table';"}, 'done_reason': 'stop', 'done': True, 'total_dura
tion': 57376794973, 'load_duration': 4638297069, 'prompt_eval_count': 956,
'prompt_eval_duration': 49900938000, 'eval_count': 11, 'eval_duration': 2774
019000}
LLM Response: SELECT name FROM sqlite_master WHERE type='table';
Info: Output from LLM: SELECT name FROM sqlite_master WHERE type='table';
Extracted SQL: SELECT name FROM sqlite_master WHERE type='table'
SELECT name FROM sqlite_master WHERE type='table'
               name
0             albums
```

```
1   sqlite_sequence
2           artists
3         customers
4         employees
5            genres
6          invoices
7     invoice_items
8       media_types
9         playlists
10   playlist_track
11           tracks
12     sqlite_stat1
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: 'Ca
n you list all tables in the SQLite database catalog?'\n\nThe DataFrame was
produced using this query: SELECT name FROM sqlite_master WHERE type='tabl
e'\n\nThe following is information about the resulting pandas DataFrame 'd
f': \nRunning df.dtypes gives:\n name    object\ndtype: object"}, {"role":
"user", "content": "Can you generate the Python plotly code to chart the res
ults of the dataframe? Assume the data is in a pandas dataframe called 'df'.
If there is only one value in the dataframe, use an Indicator. Respond with
only Python code. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:15:11.00719720
2Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.g
raph_objects as go\n\nif len(df) == 1:\n    fig = go.Figure(go.Indicator(val
ue=df['name'][0]))\nelse:\n    fig = go.Figure(data=[go.Bar(x=range(len(d
f)), y=df['name'])])\nfig.show()\n```"}, 'done_reason': 'stop', 'done': Tru
e, 'total_duration': 24385245284, 'load_duration': 12844602, 'prompt_eval_co
unt': 146, 'prompt_eval_duration': 7263505000, 'eval_count': 66, 'eval_durat
ion': 17053779000}
```


sqlite_stat1
tracks
playlist_track
playlists
media_types
invoice_items
invoices
genres
employees
customers
artists
sqlite_sequence
albums
value
0
2
4
6
8
10
12
index
variable
name

```
Out[16]: ("SELECT name FROM sqlite_master WHERE type='table'",
                         name
          0             albums
          1   sqlite_sequence
          2            artists
          3          customers
          4          employees
          5             genres
          6           invoices
          7      invoice_items
          8        media_types
          9          playlists
          10   playlist_track
          11           tracks
          12     sqlite_stat1,
          Figure({
              'data': [{'hovertemplate': 'variable=name<br>index=%{x}<br>value=%{y}<
         extra></extra>',
                        'legendgroup': 'name',
                        'line': {'color': '#636efa', 'dash': 'solid'},
                        'marker': {'symbol': 'circle'},
                        'mode': 'lines',
                        'name': 'name',
                        'orientation': 'v',
                        'showlegend': True,
                        'type': 'scatter',
                        'x': array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11,
         12]),
                        'xaxis': 'x',
                        'y': array(['albums', 'sqlite_sequence', 'artists', 'custome
         rs', 'employees',
                                    'genres', 'invoices', 'invoice_items', 'media_ty
         pes', 'playlists',
                                    'playlist_track', 'tracks', 'sqlite_stat1'], dty
         pe=object),
                        'yaxis': 'y'}],
              'layout': {'legend': {'title': {'text': 'variable'}, 'tracegroupgap':
         0},
                         'margin': {'t': 60},
                         'template': '...',
                         'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'index'}},
                         'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'value'}}}
          }))
```

```
In [17]: vn.ask(question="which table stores customer's orders")
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE TABLE "invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId I
NTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity
INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (Inv
oiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION\r\n)\n\nCREATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NUL
L,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n
Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r
\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVA
RCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n
SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employee
s" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREA
TE TABLE "employees"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMEN
T NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHA
R(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n
BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r
\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR
(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax
NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFE
RENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACT
ION\r\n)\n\nCREATE TABLE sqlite_sequence(name,seq)\n\nCREATE TABLE "playlist
s"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Name NVARCHAR(120)\r\n)\n\nCREATE TABLE sqlite_stat1(tbl,idx,stat)\n\nCREATE
TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "playlist_track"\r
\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r
\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n
FOREIGN KEY (PlaylistId) REFERENCES "playlists" (PlaylistId) \r\n\t\tON DELE
TE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "t
racks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCRE
ATE TABLE "media_types"\r\n(\r\n    MediaTypeId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===Additional Context \n
\nIn the chinook database invoice means order\n\n===Response Guidelines \n1.
If the provided context is sufficient, please generate a valid SQL query wit
hout any explanations for the question. \n2. If the provided context is almo
st sufficient but requires knowledge of a specific string in a particular co
lumn, please generate an intermediate SQL query to find the distinct strings
in that column. Prepend the query with a comment saying intermediate_sql \n
3. If the provided context is insufficient, please explain why it can\'t be
generated. \n4. Please use the most relevant table(s). \n5. If the question
has been asked and answered before, please repeat the answer exactly as it w
as given before. \n'}, {'role': 'user', 'content': 'Can you list all tables
```

```
in the SQLite database catalog?'}, {'role': 'assistant', 'content': "SELECT
name FROM sqlite_master WHERE type='table'"}, {'role': 'user', 'content': "w
hich table stores customer's orders"}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n 
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE \"invoice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER
NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER
NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PRI
MARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r
\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    A
ddress NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r
\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVA
RCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n
SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employe
es\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCR
EATE TABLE \"employees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVA
RCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r
\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR
(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NV
ARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo)
REFERENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION\r\n)\n\nCREATE TABLE sqlite_sequence(name,seq)\n\nCREATE TABLE \"p
laylists\"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE sqlite_stat1(tbl,idx,stat)
\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGE
R  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"playl
ist_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER
NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, Track
Id),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlists\" (PlaylistId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE TABLE \"media_types\"\r\n(\r\n    MediaTypeId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===A
dditional Context \n\nIn the chinook database invoice means order\n\n===Resp
onse Guidelines \n1. If the provided context is sufficient, please generate
```

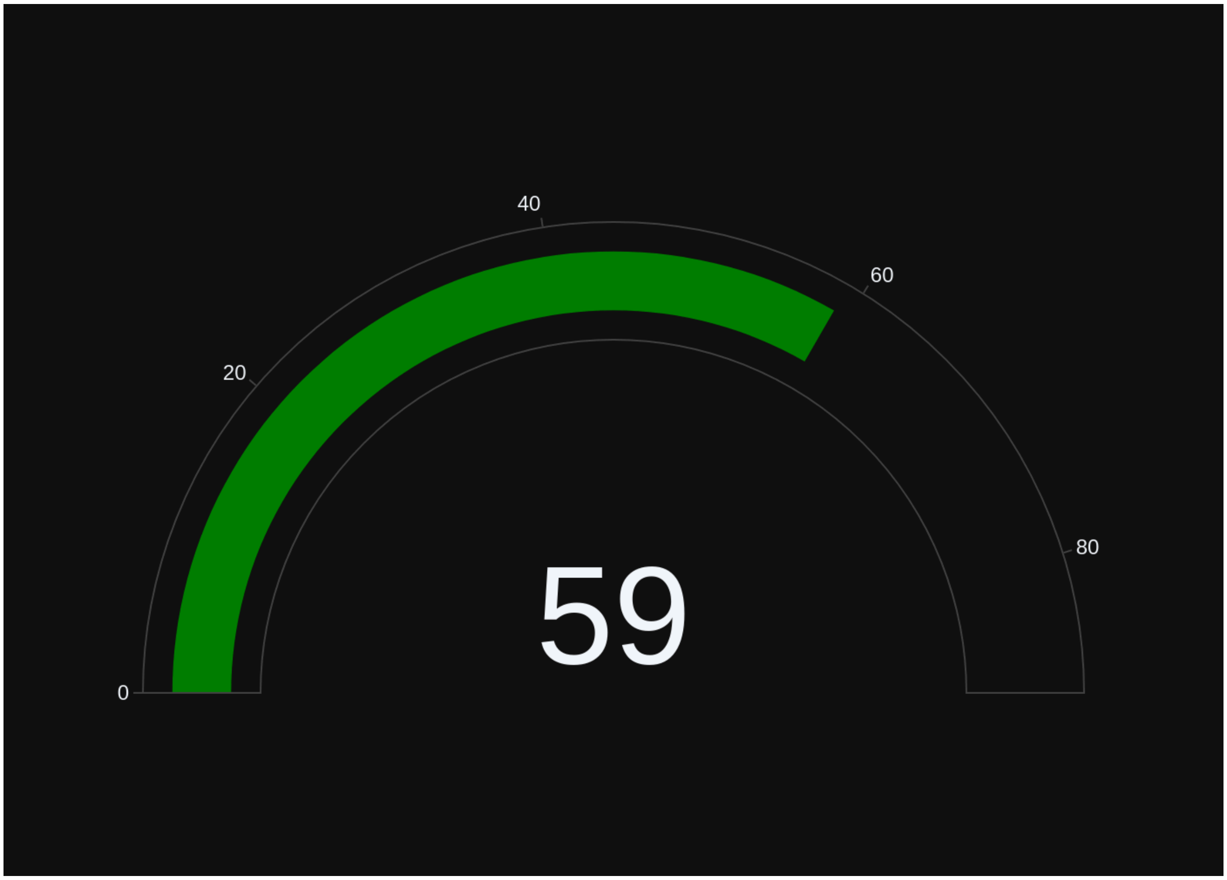
```
a valid SQL query without any explanations for the question. \n2. If the pro
vided context is almost sufficient but requires knowledge of a specific stri
ng in a particular column, please generate an intermediate SQL query to find
the distinct strings in that column. Prepend the query with a comment saying
intermediate_sql \n3. If the provided context is insufficient, please explai
n why it can't be generated. \n4. Please use the most relevant table(s). \n
5. If the question has been asked and answered before, please repeat the ans
wer exactly as it was given before. \n"}, {"role": "user", "content": "Can y
ou list all tables in the SQLite database catalog?"}, {"role": "assistant",
"content": "SELECT name FROM sqlite_master WHERE type='table'"}, {"role": "u
ser", "content": "which table stores customer's orders"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:16:21.49417196
4Z', 'message': {'role': 'assistant', 'content': 'invoices'}, 'done_reason':
'stop', 'done': True, 'total_duration': 70051383500, 'load_duration': 116988
24, 'prompt_eval_count': 1245, 'prompt_eval_duration': 69277900000, 'eval_co
unt': 3, 'eval_duration': 553897000}
LLM Response: invoices
invoices
Couldn't run sql:  Execution failed on sql 'invoices': near "invoices": synt
ax error
```

In [18]:

```
vn.ask(question="How many customers are there")
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE INDEX IFK_CustomerSupportRepId ON "customers" (SupportRepId)\n\nCRE
ATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCREME
NT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVARCH
AR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(7
0),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVAR
CHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_
InvoiceCustomerId ON "invoices" (CustomerId)\n\nCREATE TABLE "invoice_item
s"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPr
ice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREI
GN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks"
(TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE IND
EX IFK_InvoiceLineInvoiceId ON "invoice_items" (InvoiceId)\n\nCREATE TABLE
"albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOR
EIGN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACT
ION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invo
ice_items" (TrackId)\n\nCREATE TABLE "employees"\r\n(\r\n    EmployeeId INTE
GER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NU
LL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n
ReportsTo INTEGER,\r\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n
Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r
\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVA
RCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIG
N KEY (ReportsTo) REFERENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "playlists"\r\n(\r\n    Playl
istId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)
\r\n)\n\n\n===Additional Context \n\nIn the chinook database invoice means o
rder\n\n===Response Guidelines \n1. If the provided context is sufficient, p
lease generate a valid SQL query without any explanations for the question.
\n2. If the provided context is almost sufficient but requires knowledge of
a specific string in a particular column, please generate an intermediate SQ
L query to find the distinct strings in that column. Prepend the query with
a comment saying intermediate_sql \n3. If the provided context is insufficie
nt, please explain why it can\'t be generated. \n4. Please use the most rele
vant table(s). \n5. If the question has been asked and answered before, plea
se repeat the answer exactly as it was given before. \n'}, {'role': 'user',
'content': 'Can you list all tables in the SQLite database catalog?'}, {'rol
e': 'assistant', 'content': "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {'role': 'user', 'content': 'How many customers are there'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
INDEX IFK_CustomerSupportRepId ON \"customers\" (SupportRepId)\n\nCREATE TAB
LE \"customers\"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCREMENT NO
T NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVARCHAR(2
0)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(70),\r\n
City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r
\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHA
R(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId INTEGER,\r\n
FOREIGN KEY (SupportRepId) REFERENCES \"employees\" (EmployeeId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceCustome
rId ON \"invoices\" (CustomerId)\n\nCREATE TABLE \"invoice_items\"\r\n(\r\n
InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId I
NTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC
(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (Inv
oiceId) REFERENCES \"invoices\" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON U
PDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\" (TrackI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_
InvoiceLineInvoiceId ON \"invoice_items\" (InvoiceId)\n\nCREATE TABLE \"albu
ms\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOR
EIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"i
nvoice_items\" (TrackId)\n\nCREATE TABLE \"employees\"\r\n(\r\n    EmployeeI
d INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)
NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(3
0),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIME,\r\n    HireDate DAT
ETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State N
VARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r
\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(6
0),\r\n    FOREIGN KEY (ReportsTo) REFERENCES \"employees\" (EmployeeId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"playlis
ts\"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Name NVARCHAR(120)\r\n)\n\n\n===Additional Context \n\nIn the chinook databa
se invoice means order\n\n===Response Guidelines \n1. If the provided contex
t is sufficient, please generate a valid SQL query without any explanations
for the question. \n2. If the provided context is almost sufficient but requ
ires knowledge of a specific string in a particular column, please generate
an intermediate SQL query to find the distinct strings in that column. Prepe
nd the query with a comment saying intermediate_sql \n3. If the provided con
text is insufficient, please explain why it can't be generated. \n4. Please
use the most relevant table(s). \n5. If the question has been asked and answ
ered before, please repeat the answer exactly as it was given before. \n"},
{"role": "user", "content": "Can you list all tables in the SQLite database
catalog?"}, {"role": "assistant", "content": "SELECT name FROM sqlite_master
WHERE type='table'"}, {"role": "user", "content": "How many customers are th
ere"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:17:13.33655855
1Z', 'message': {'role': 'assistant', 'content': 'SELECT COUNT(*) FROM "cust
omers"'}, 'done_reason': 'stop', 'done': True, 'total_duration': 5179934181
7, 'load_duration': 14921968, 'prompt_eval_count': 1133, 'prompt_eval_durati
on': 49311308000, 'eval_count': 9, 'eval_duration': 2213443000}
LLM Response: SELECT COUNT(*) FROM "customers"
SELECT COUNT(*) FROM "customers"
   COUNT(*)
0        59
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: 'Ho
w many customers are there'\n\nThe DataFrame was produced using this query:
SELECT COUNT(*) FROM \"customers\"\n\nThe following is information about the
resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n COUNT(*)    in
t64\ndtype: object"}, {"role": "user", "content": "Can you generate the Pyth
on plotly code to chart the results of the dataframe? Assume the data is in
a pandas dataframe called 'df'. If there is only one value in the dataframe,
use an Indicator. Respond with only Python code. Do not answer with any expl
anations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:17:40.20398677
2Z', 'message': {'role': 'assistant', 'content': '```python\nimport plotly.g
raph_objects as go\n\nif df.shape[0] == 1:\n    fig = go.Figure(go.Indicator
(mode="number+gauge", value=df[\'COUNT(*)\'][0]))\nelse:\n    fig = go.Figur
e(data=[go.Bar(x=df.index, y=df[\'COUNT(*)\'])])\nfig.show()\n```'}, 'done_r
eason': 'stop', 'done': True, 'total_duration': 26846689060, 'load_duratio
n': 12074380, 'prompt_eval_count': 142, 'prompt_eval_duration': 7282241000,
'eval_count': 75, 'eval_duration': 19421852000}
```



```
Out[18]: ('SELECT COUNT(*) FROM "customers"',
             COUNT(*)
          0        59,
          Figure({
              'data': [{'mode': 'number+gauge', 'type': 'indicator', 'value': 59}],
         'layout': {'template': '...'}
          }))
```

```
In [ ]:
```

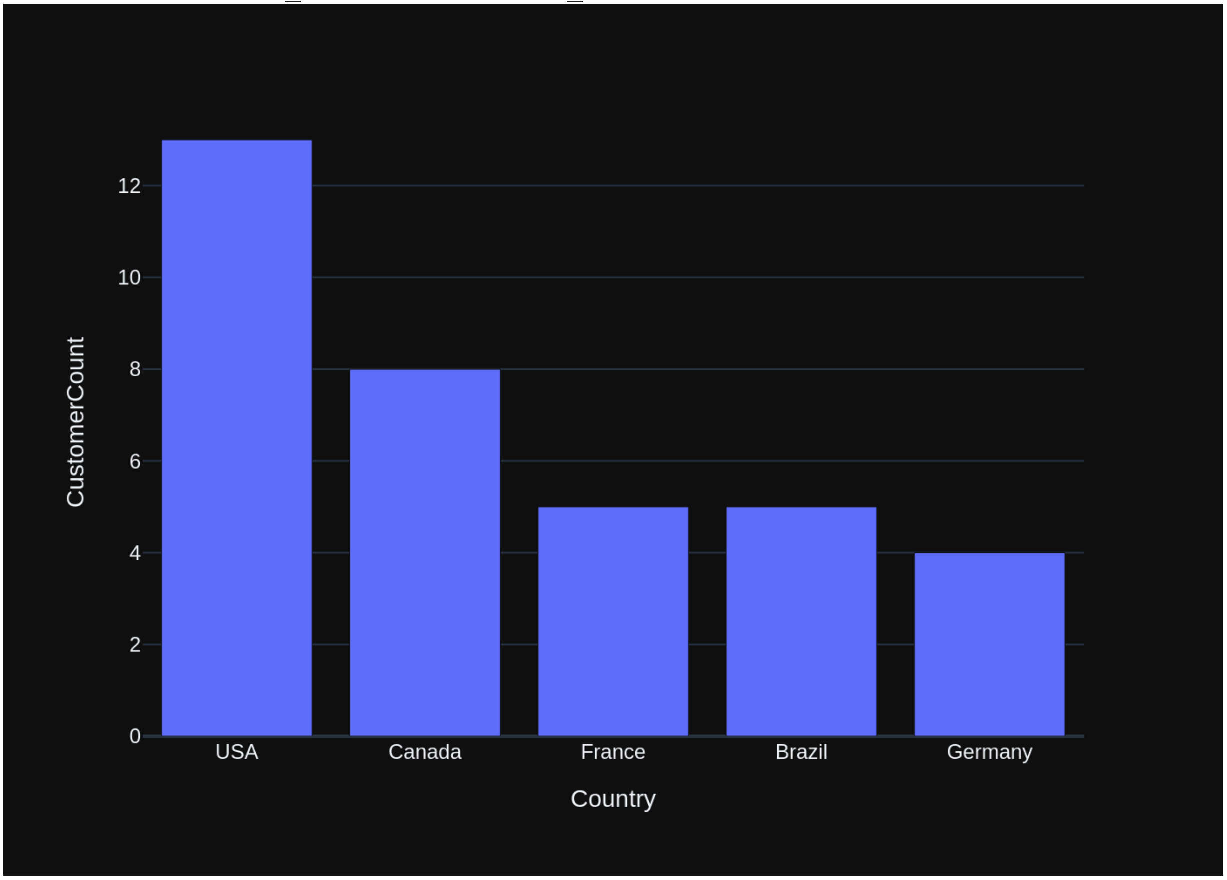
```
In [19]: vn.ask(question="what are the top 5 countries that customers come from?")
```

```
Number of requested results 10 is greater than number of elements in index
2, updating n_results = 2
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName N
VARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR
(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NV
ARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "inv
oice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NUL
L,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NU
LL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE "media_types"\r\n(\r\n    MediaTypeId INTEGER PRIMARY KE
Y AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK
_CustomerSupportRepId ON "customers" (SupportRepId)\n\nCREATE TABLE "employe
es"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r
\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIM
E,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCH
AR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    Posta
lCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n
Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES "employees" (E
mployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TA
BLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "playlist_track"\r
\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r
\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n
FOREIGN KEY (PlaylistId) REFERENCES "playlists" (PlaylistId) \r\n\t\tON DELE
TE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "t
racks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCRE
ATE TABLE sqlite_sequence(name,seq)\n\nCREATE TABLE "tracks"\r\n(\r\n    Tra
ckId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)
NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n
GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER
NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r
\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE
NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genr
es" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIG
N KEY (MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE
NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nIn the chi
nook database invoice means order\n\n===Response Guidelines \n1. If the prov
ided context is sufficient, please generate a valid SQL query without any ex
```

```
planations for the question. \n2. If the provided context is almost sufficie
nt but requires knowledge of a specific string in a particular column, pleas
e generate an intermediate SQL query to find the distinct strings in that co
lumn. Prepend the query with a comment saying intermediate_sql \n3. If the p
rovided context is insufficient, please explain why it can\'t be generated. 
\n4. Please use the most relevant table(s). \n5. If the question has been as
ked and answered before, please repeat the answer exactly as it was given be
fore. \n'}, {'role': 'user', 'content': 'How many customers are there'}, {'r
ole': 'assistant', 'content': 'SELECT COUNT(*) FROM "customers"'}, {'role': 
'user', 'content': 'Can you list all tables in the SQLite database catalo
g?'}, {'role': 'assistant', 'content': "SELECT name FROM sqlite_master WHERE
type='table'"}, {'role': 'user', 'content': 'what are the top 5 countries th
at customers come from?'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based 
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n 
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE 
TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCREMENT
NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVARCHAR
(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(70),\r
\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR
(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax 
NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId INTEG
ER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employees\" (EmployeeId) 
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"invoi
ce_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT N
ULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r
\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION 
\r\n)\n\nCREATE TABLE \"media_types\"\r\n(\r\n    MediaTypeId INTEGER PRIMAR
Y KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX
IFK_CustomerSupportRepId ON \"customers\" (SupportRepId)\n\nCREATE TABLE \"e
mployees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NO
T NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDat
e DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    Ci
ty NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n
PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(2
4),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES \"e
mployees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)
\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGE
R  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"playl
ist_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER
NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, Track
Id),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlists\" (PlaylistId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE TABLE sqlite_sequence(name,seq)\n\nCREATE TABLE \"trac
ks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INT
EGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n
Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES \"albums\" (Albu
mId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Ge
nreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"media_types\" (Medi
aTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additi
onal Context \n\nIn the chinook database invoice means order\n\n===Response
Guidelines \n1. If the provided context is sufficient, please generate a val
id SQL query without any explanations for the question. \n2. If the provided
context is almost sufficient but requires knowledge of a specific string in
a particular column, please generate an intermediate SQL query to find the d
istinct strings in that column. Prepend the query with a comment saying inte
rmediate_sql \n3. If the provided context is insufficient, please explain wh
y it can't be generated. \n4. Please use the most relevant table(s). \n5. If
the question has been asked and answered before, please repeat the answer ex
actly as it was given before. \n"}, {"role": "user", "content": "How many cu
stomers are there"}, {"role": "assistant", "content": "SELECT COUNT(*) FROM
\"customers\""}, {"role": "user", "content": "Can you list all tables in the
SQLite database catalog?"}, {"role": "assistant", "content": "SELECT name FR
OM sqlite_master WHERE type='table'"}, {"role": "user", "content": "what are
the top 5 countries that customers come from?"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:19:07.74035763
3Z', 'message': {'role': 'assistant', 'content': 'SELECT Country, COUNT(*) A
S CustomerCount FROM "customers" GROUP BY Country ORDER BY CustomerCount DES
C LIMIT 5'}, 'done_reason': 'stop', 'done': True, 'total_duration': 87458281
335, 'load_duration': 14796033, 'prompt_eval_count': 1459, 'prompt_eval_dura
tion': 80409372000, 'eval_count': 25, 'eval_duration': 6630907000}
LLM Response: SELECT Country, COUNT(*) AS CustomerCount FROM "customers" GRO
UP BY Country ORDER BY CustomerCount DESC LIMIT 5
SELECT Country, COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country
ORDER BY CustomerCount DESC LIMIT 5
   Country  CustomerCount
0      USA             13
1   Canada              8
2   France              5
3   Brazil              5
4  Germany              4
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: 'wh
at are the top 5 countries that customers come from?'\n\nThe DataFrame was p
```

```
roduced using this query: SELECT Country, COUNT(*) AS CustomerCount FROM \"c
ustomers\" GROUP BY Country ORDER BY CustomerCount DESC LIMIT 5\n\nThe follo
wing is information about the resulting pandas DataFrame 'df': \nRunning df.
dtypes gives:\n Country          object\nCustomerCount     int64\ndtype: obj
ect"}, {"role": "user", "content": "Can you generate the Python plotly code 
to chart the results of the dataframe? Assume the data is in a pandas datafr
ame called 'df'. If there is only one value in the dataframe, use an Indicat
or. Respond with only Python code. Do not answer with any explanations -- ju
st the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:19:24.82367872
4Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nfig = px.bar(df, x='Country', y='CustomerCount')\nfig.show()
\n```"}, 'done_reason': 'stop', 'done': True, 'total_duration': 17056134195,
'load_duration': 13832814, 'prompt_eval_count': 169, 'prompt_eval_duration':
9137549000, 'eval_count': 31, 'eval_duration': 7858369000}
```



Out[19]:

```
('SELECT Country, COUNT(*) AS CustomerCount FROM "customers" GROUP BY Count
ry ORDER BY CustomerCount DESC LIMIT 5',
    Country  CustomerCount
 0      USA             13
 1   Canada              8
 2   France              5
 3   Brazil              5
 4  Germany              4,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'Country=%{x}<br>CustomerCount=%{y}<extra>
</extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array(['USA', 'Canada', 'France', 'Brazil', 'Germany'],
dtype=object),
               'xaxis': 'x',
               'y': array([13,  8,  5,  5,  4]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'margin': {'t': 60},
                'template': '...',
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'Country'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'CustomerCount'}}}
 }))
```

More SQL questions

see `sample-sql-queries-sqlite-chinook.ipynb`

In [20]:

```python
question = """
    List all albums and their corresponding artist names
"""

vn.ask(question=question)
```

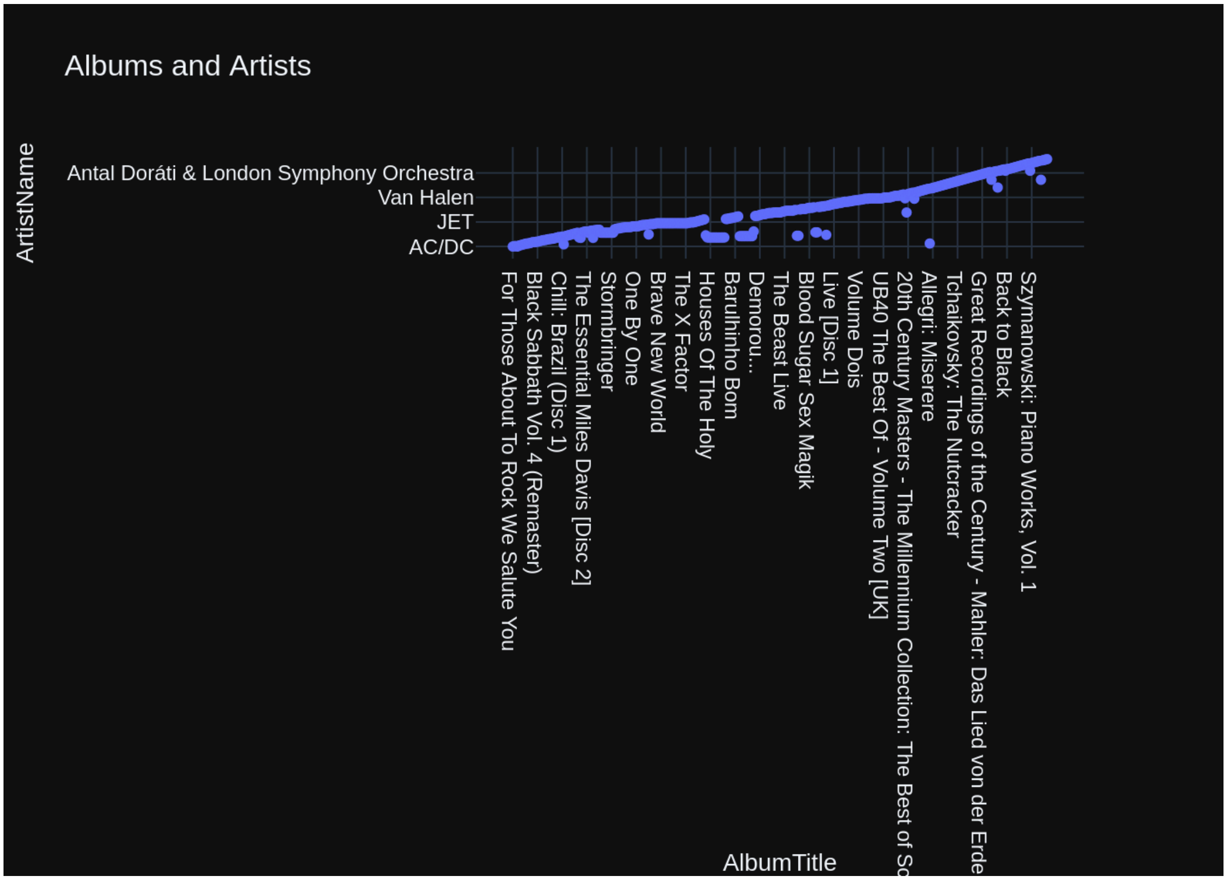
```
Number of requested results 10 is greater than number of elements in index
3, updating n_results = 3
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE INDEX IFK_AlbumArtistId ON "albums" (A
rtistId)\n\nCREATE TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AU
TOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId
INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists" (Artis
tId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "t
racks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INT
EGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n
Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Genr
eId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_types" (MediaType
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK
_TrackAlbumId ON "tracks" (AlbumId)\n\nCREATE TABLE "artists"\r\n(\r\n    Ar
tistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)
\r\n)\n\nCREATE INDEX IFK_TrackGenreId ON "tracks" (GenreId)\n\nCREATE INDEX
IFK_PlaylistTrackTrackId ON "playlist_track" (TrackId)\n\nCREATE TABLE "play
lists"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r
\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE "genres"\r\n(\r\n    GenreId I
NTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n
\nCREATE INDEX IFK_TrackMediaTypeId ON "tracks" (MediaTypeId)\n\n\n===Additi
onal Context \n\nIn the chinook database invoice means order\n\n===Response
Guidelines \n1. If the provided context is sufficient, please generate a val
id SQL query without any explanations for the question. \n2. If the provided
context is almost sufficient but requires knowledge of a specific string in
a particular column, please generate an intermediate SQL query to find the d
istinct strings in that column. Prepend the query with a comment saying inte
rmediate_sql \n3. If the provided context is insufficient, please explain wh
y it can\'t be generated. \n4. Please use the most relevant table(s). \n5. I
f the question has been asked and answered before, please repeat the answer
exactly as it was given before. \n'}, {'role': 'user', 'content': 'Can you l
ist all tables in the SQLite database catalog?'}, {'role': 'assistant', 'con
tent': "SELECT name FROM sqlite_master WHERE type='table'"}, {'role': 'use
r', 'content': 'what are the top 5 countries that customers come from?'},
{'role': 'assistant', 'content': 'SELECT Country, COUNT(*) AS CustomerCount
FROM "customers" GROUP BY Country ORDER BY CustomerCount DESC LIMIT 5'}, {'r
ole': 'user', 'content': 'How many customers are there'}, {'role': 'assistan
t', 'content': 'SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'conten
t': '  \n    List all albums and their corresponding artist names  \n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE INDEX IFK_AlbumArtistId ON \"albums\" (ArtistId)\n
\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREM
ENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER
NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"tracks
\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Na
me NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEG
ER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    
Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES \"albums\" (Albu
mId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Ge
nreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"media_types\" (Medi
aTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDE
X IFK_TrackAlbumId ON \"tracks\" (AlbumId)\n\nCREATE TABLE \"artists\"\r\n
(\r\n    ArtistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NV
ARCHAR(120)\r\n)\n\nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (GenreId)\n
\nCREATE INDEX IFK_PlaylistTrackTrackId ON \"playlist_track\" (TrackId)\n\nC
REATE TABLE \"playlists\"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINC
REMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE \"genres\"\r
\n(\r\n    GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name N
VARCHAR(120)\r\n)\n\nCREATE INDEX IFK_TrackMediaTypeId ON \"tracks\" (MediaT
ypeId)\n\n\n===Additional Context \n\nIn the chinook database invoice means
order\n\n===Response Guidelines \n1. If the provided context is sufficient,
please generate a valid SQL query without any explanations for the question.
\n2. If the provided context is almost sufficient but requires knowledge of
a specific string in a particular column, please generate an intermediate SQ
L query to find the distinct strings in that column. Prepend the query with
a comment saying intermediate_sql \n3. If the provided context is insufficie
nt, please explain why it can't be generated. \n4. Please use the most relev
ant table(s). \n5. If the question has been asked and answered before, pleas
e repeat the answer exactly as it was given before. \n"}, {"role": "user",
"content": "Can you list all tables in the SQLite database catalog?"}, {"rol
e": "assistant", "content": "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {"role": "user", "content": "what are the top 5 countries that custome
rs come from?"}, {"role": "assistant", "content": "SELECT Country, COUNT(*)
AS CustomerCount FROM \"customers\" GROUP BY Country ORDER BY CustomerCount
DESC LIMIT 5"}, {"role": "user", "content": "How many customers are there"},
{"role": "assistant", "content": "SELECT COUNT(*) FROM \"customers\""}, {"ro
le": "user", "content": "  \n    List all albums and their corresponding art
ist names  \n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:20:18.13689288
9Z', 'message': {'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTit
le, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId =
ar.ArtistId'}, 'done_reason': 'stop', 'done': True, 'total_duration': 532101
32287, 'load_duration': 14232518, 'prompt_eval_count': 793, 'prompt_eval_dur
ation': 43474226000, 'eval_count': 35, 'eval_duration': 9254272000}
LLM Response: SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM "albu
ms" a JOIN "artists" ar ON a.ArtistId = ar.ArtistId
SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN "ar
tists" ar ON a.ArtistId = ar.ArtistId
                                            AlbumTitle  \
0                For Those About To Rock We Salute You
1                                    Balls to the Wall
2                                    Restless and Wild
3                                    Let There Be Rock
4                                             Big Ones
..                                                 ...
342                             Respighi:Pines of Rome
343  Schubert: The Late String Quartets & String Qu...
```

```
344                                Monteverdi: L'Orfeo
345                              Mozart: Chamber Music
346  Koyaanisqatsi (Soundtrack from the Motion Pict...

                                            ArtistName
0                                                AC/DC
1                                               Accept
2                                               Accept
3                                                AC/DC
4                                            Aerosmith
..                                                 ...
342                                     Eugene Ormandy
343                             Emerson String Quartet
344  C. Monteverdi, Nigel Rogers - Chiaroscuro; Lon...
345                                      Nash Ensemble
346                              Philip Glass Ensemble

[347 rows x 2 columns]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    List all albums and their corresponding artist names  \n'\n\nThe DataF
rame was produced using this query: SELECT a.Title AS AlbumTitle, ar.Name AS
ArtistName FROM \"albums\" a JOIN \"artists\" ar ON a.ArtistId = ar.ArtistId
\n\nThe following is information about the resulting pandas DataFrame 'df':
\nRunning df.dtypes gives:\n AlbumTitle    object\nArtistName    object\ndty
pe: object"}, {"role": "user", "content": "Can you generate the Python plotl
y code to chart the results of the dataframe? Assume the data is in a pandas
dataframe called 'df'. If there is only one value in the dataframe, use an I
ndicator. Respond with only Python code. Do not answer with any explanations
-- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:20:59.45659930
2Z', 'message': {'role': 'assistant', 'content': '```python\nimport plotly.e
xpress as px\n\nif len(df) > 1:\n    fig = px.scatter(df, x=\'AlbumTitle\',
y=\'ArtistName\', title=\'Albums and Artists\')\n    fig.show()\nelse:\n
fig = px.bar(df, x=\'AlbumTitle\', y=\'ArtistName\', title=\'Album Title\',
height=300)\n    fig.add_trace(go.Indicator(mode="number", value=df.iloc[0]
[\'ArtistName\']))\n    fig.update_layout(paper_bgcolor="#F5F5DC")\n    fig.
show()\n```'}, 'done_reason': 'stop', 'done': True, 'total_duration': 412920
93991, 'load_duration': 15777676, 'prompt_eval_count': 180, 'prompt_eval_dur
ation': 9802990000, 'eval_count': 119, 'eval_duration': 31341739000}
```


Albums and Artists
ArtistName
Antal Doráti & London Symphony Orchestra
Van Halen
JET
AC/DC
For Those About To Rock We Salute You
Black Sabbath Vol. 4 (Remaster)
Chill: Brazil (Disc 1)
The Essential Miles Davis [Disc 2]
Stormbringer
One By One
Brave New World
The X Factor
Houses Of The Holy
Barulhinho Bom
Demorou...
The Beast Live
Blood Sugar Sex Magik
Live [Disc 1]
Volume Dois
UB40 The Best Of - Volume Two [UK]
20th Century Masters - The Millennium Collection: The Best of Sc
Allegri: Miserere
Tchaikovsky: The Nutcracker
Great Recordings of the Century - Mahler: Das Lied von der Erde
Back to Black
Szymanowski: Piano Works, Vol. 1
AlbumTitle

Out[20]:

```
('SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN
"artists" ar ON a.ArtistId = ar.ArtistId',
                                              AlbumTitle  \
 0                 For Those About To Rock We Salute You
 1                                     Balls to the Wall
 2                                     Restless and Wild
 3                                     Let There Be Rock
 4                                              Big Ones
 ..                                                  ...
 342                              Respighi:Pines of Rome
 343  Schubert: The Late String Quartets & String Qu...
 344                                 Monteverdi: L'Orfeo
 345                               Mozart: Chamber Music
 346  Koyaanisqatsi (Soundtrack from the Motion Pict...

                                              ArtistName
 0                                                 AC/DC
 1                                                Accept
 2                                                Accept
 3                                                 AC/DC
 4                                             Aerosmith
 ..                                                  ...
 342                                      Eugene Ormandy
 343                              Emerson String Quartet
 344  C. Monteverdi, Nigel Rogers - Chiaroscuro; Lon...
 345                                       Nash Ensemble
 346                               Philip Glass Ensemble

 [347 rows x 2 columns],
 Figure({
     'data': [{'hovertemplate': 'AlbumTitle=%{x}<br>ArtistName=%{y}<extra>
</extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'symbol': 'circle'},
               'mode': 'markers',
               'name': '',
               'orientation': 'v',
               'showlegend': False,
               'type': 'scatter',
               'x': array(['For Those About To Rock We Salute You', 'Balls
to the Wall',
                           'Restless and Wild', ..., "Monteverdi: L'Orfeo",
                           'Mozart: Chamber Music',
                           'Koyaanisqatsi (Soundtrack from the Motion Pictu
re)'], dtype=object),
               'xaxis': 'x',
               'y': array(['AC/DC', 'Accept', 'Accept', ...,
                           'C. Monteverdi, Nigel Rogers - Chiaroscuro; Lond
on Baroque; London Cornett & Sackbu',
                           'Nash Ensemble', 'Philip Glass Ensemble'], dtype
=object),
               'yaxis': 'y'}],
     'layout': {'legend': {'tracegroupgap': 0},
                'template': '...',
                'title': {'text': 'Albums and Artists'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'AlbumTitle'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'ArtistName'}}}
 }))
```

In [21]:

```
question = """
    Find all tracks with a name containing "What" (case-insensitive)
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
4, updating n_results = 4
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE INDEX IFK_TrackGenreId ON "tracks" (Ge
nreId)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON "playlist_track" (TrackI
d)\n\nCREATE TABLE "tracks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGE
R,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Comp
oser NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTE
GER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId)
REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (GenreId) \r\n\t\tON DEL
ETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENC
ES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTI
ON\r\n)\n\nCREATE INDEX IFK_TrackAlbumId ON "tracks" (AlbumId)\n\nCREATE IND
EX IFK_TrackMediaTypeId ON "tracks" (MediaTypeId)\n\nCREATE TABLE "playlist_
track"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT
NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackI
d),\r\n    FOREIGN KEY (PlaylistId) REFERENCES "playlists" (PlaylistId) \r\n
\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) RE
FERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION
\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n
\nCREATE INDEX IFK_AlbumArtistId ON "albums" (ArtistId)\n\nCREATE TABLE "pla
ylists"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r
\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE "genres"\r\n(\r\n    GenreId I
NTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n
\n\n===Additional Context \n\nIn the chinook database invoice means order\n
\n===Response Guidelines \n1. If the provided context is sufficient, please
generate a valid SQL query without any explanations for the question. \n2. I
f the provided context is almost sufficient but requires knowledge of a spec
ific string in a particular column, please generate an intermediate SQL quer
y to find the distinct strings in that column. Prepend the query with a comm
ent saying intermediate_sql \n3. If the provided context is insufficient, pl
ease explain why it can\'t be generated. \n4. Please use the most relevant t
able(s). \n5. If the question has been asked and answered before, please rep
eat the answer exactly as it was given before. \n'}, {'role': 'user', 'conte
nt': '  \n    List all albums and their corresponding artist names  \n'},
{'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTitle, ar.Name AS A
rtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId = ar.ArtistId'},
{'role': 'user', 'content': 'Can you list all tables in the SQLite database
catalog?'}, {'role': 'assistant', 'content': "SELECT name FROM sqlite_master
WHERE type='table'"}, {'role': 'user', 'content': 'what are the top 5 countr
ies that customers come from?'}, {'role': 'assistant', 'content': 'SELECT Co
untry, COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY
CustomerCount DESC LIMIT 5'}, {'role': 'user', 'content': 'How many customer
s are there'}, {'role': 'assistant', 'content': 'SELECT COUNT(*) FROM "custo
mers"'}, {'role': 'user', 'content': '  \n    Find all tracks with a name co
ntaining "What" (case-insensitive)\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (GenreId)\n\n
CREATE INDEX IFK_PlaylistTrackTrackId ON \"playlist_track\" (TrackId)\n\nCRE
ATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT N
OT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n
MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARC
HAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES
\"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n
FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"med
ia_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE INDEX IFK_TrackAlbumId ON \"tracks\" (AlbumId)\n\nCREATE INDEX
IFK_TrackMediaTypeId ON \"tracks\" (MediaTypeId)\n\nCREATE TABLE \"playlist_
track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NO
T NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackI
d),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlists\" (PlaylistId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId)
REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACT
ION\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackI
d)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums\" (ArtistId)\n\nCREATE TABL
E \"playlists\"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE \"genres\"\r\n(\r\n
GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(12
0)\r\n)\n\n\n===Additional Context \n\nIn the chinook database invoice means
order\n\n===Response Guidelines \n1. If the provided context is sufficient,
please generate a valid SQL query without any explanations for the question.
\n2. If the provided context is almost sufficient but requires knowledge of
a specific string in a particular column, please generate an intermediate SQ
L query to find the distinct strings in that column. Prepend the query with
a comment saying intermediate_sql \n3. If the provided context is insufficie
nt, please explain why it can't be generated. \n4. Please use the most relev
ant table(s). \n5. If the question has been asked and answered before, pleas
e repeat the answer exactly as it was given before. \n"}, {"role": "user",
"content": "  \n    List all albums and their corresponding artist names
\n"}, {"role": "assistant", "content": "SELECT a.Title AS AlbumTitle, ar.Nam
e AS ArtistName FROM \"albums\" a JOIN \"artists\" ar ON a.ArtistId = ar.Art
istId"}, {"role": "user", "content": "Can you list all tables in the SQLite
database catalog?"}, {"role": "assistant", "content": "SELECT name FROM sqli
te_master WHERE type='table'"}, {"role": "user", "content": "what are the to
p 5 countries that customers come from?"}, {"role": "assistant", "content":
"SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY Count
ry ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "How m
any customers are there"}, {"role": "assistant", "content": "SELECT COUNT(*)
FROM \"customers\""}, {"role": "user", "content": "  \n    Find all tracks w
ith a name containing \"What\" (case-insensitive)\n"}]
Info: Ollama Response:
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2Z', 'message': {'role': 'assistant', 'content': "SELECT * FROM tracks WHERE
Name LIKE '%What%'"}, 'done_reason': 'stop', 'done': True, 'total_duration':
51223687067, 'load_duration': 12277881, 'prompt_eval_count': 867, 'prompt_ev
al_duration': 47872435000, 'eval_count': 11, 'eval_duration': 2679243000}
LLM Response: SELECT * FROM tracks WHERE Name LIKE '%What%'
SELECT * FROM tracks WHERE Name LIKE '%What%'
    TrackId                                          Name  AlbumId  \
0        26                                 What It Takes        5
1        88                                  What You Are       10
```
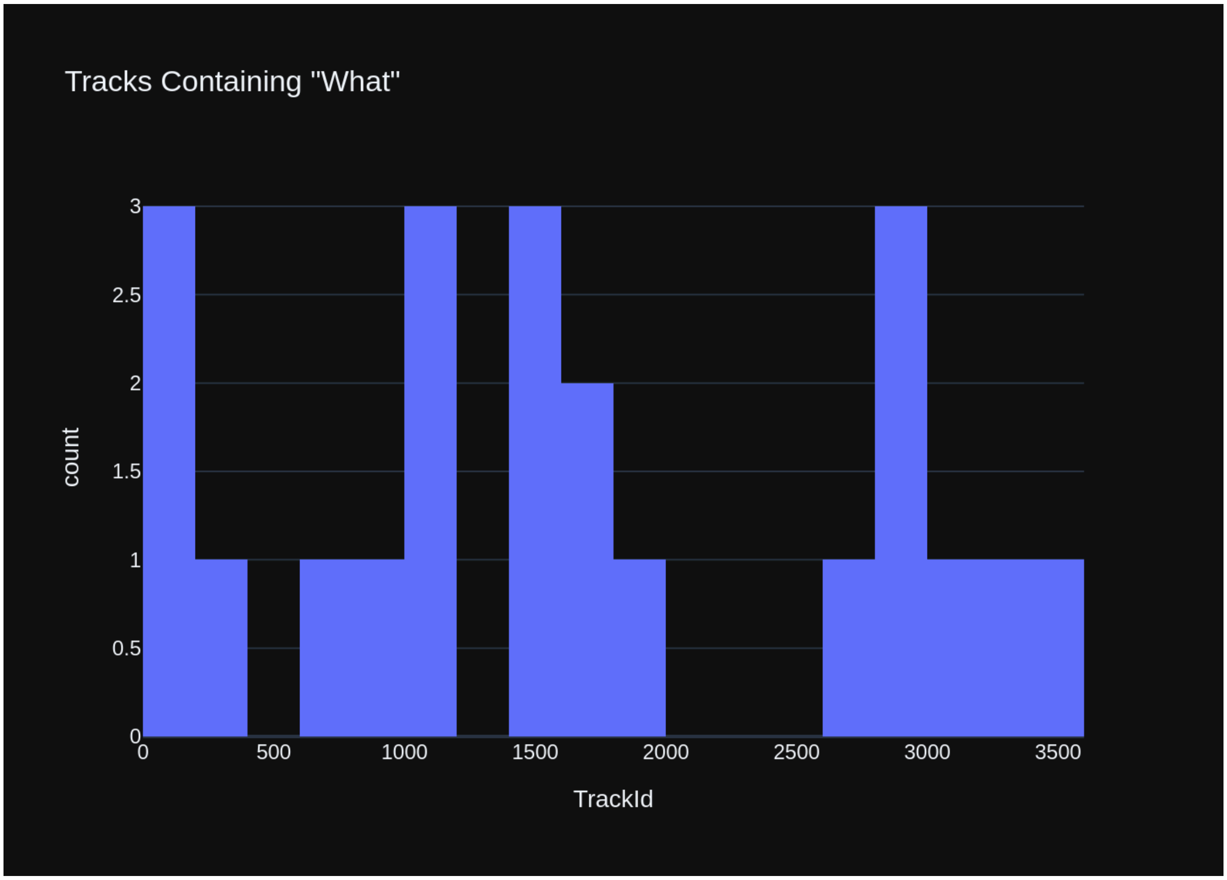

```
2       130                             Do what cha wanna       13
3       342                   What is and Should Never Be       30
4       607                                       So What       48
5       960                                    What A Day       76
6      1000                                 What If I Do?       80
7      1039                              What Now My Love       83
8      1145                                   Whatsername       89
9      1440             Whatever It Is, I Just Can't Stop      116
10     1469                         Look What You've Done      119
11     1470                             Get What You Need      119
12     1628              What Is And What Should Never Be      133
13     1778  You're What's Happening (In The World Today)      146
14     1823                                       So What      149
15     2772           I Don't Know What To Do With Myself      223
16     2884                                 What Kate Did      231
17     2893                      Whatever the Case May Be      230
18     2992    I Still Haven't Found What I'm Looking for      237
19     3007    I Still Haven't Found What I'm Looking For      238
20     3258              Whatever Gets You Thru the Night      255
21     3475                          What Is It About Men      322

    MediaTypeId  GenreId                                           Composer
\
0             1        1             Steven Tyler, Joe Perry, Desmond Child
1             1        1                           Audioslave/Chris Cornell
2             1        2                                        George Duke
3             1        1                            Jimmy Page/Robert Plant
4             1        2                                        Miles Davis
5             1        1              Mike Bordin, Billy Gould, Mike Patton
6             1        1  Dave Grohl, Taylor Hawkins, Nate Mendel, Chris...
7             1       12          carl sigman/gilbert becaud/pierre leroyer
8             1        4                                          Green Day
9             1        1                                   Jay Kay/Kay, Jay
10            1        4                                          N. Cester
11            1        4                      C. Cester/C. Muncey/N. Cester
12            1        1                           Jimmy Page, Robert Plant
13            1       14              Allen Story/George Gordy/Robert Gordy
14            1        3                                       Culmer/Exalt
15            1        7                                               None
16            3       19                                               None
17            3       19                                               None
18            1        1      Bono/Clayton, Adam/Mullen Jr., Larry/The Edge
19            1        1                                                 U2
20            2        9                                               None
21            2        9  Delroy "Chris" Cooper, Donovan Jackson, Earl C...

    Milliseconds      Bytes  UnitPrice
0         310622   10144730       0.99
1         249391    5988186       0.99
2         274155    9018565       0.99
3         260675    8497116       0.99
4         564009   18360449       0.99
5         158275    5203430       0.99
6         302994    9929799       0.99
7         149995    4913383       0.99
8         252316    8244843       0.99
```

```
9         247222    8249453       0.99
10        230974    7517083       0.99
11        247719    8043765       0.99
12        287973    9369385       0.99
13        142027    4631104       0.99
14        189152    6162894       0.99
15        221387    7251478       0.99
16       2610250  484583988       1.99
17       2616410  183867185       1.99
18        353567   11542247       0.99
19        280764    9306737       0.99
20        215084    3499018       0.99
21        209573    3426106       0.99
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    Find all tracks with a name containing \"What\" (case-insensitive)
\n'\n\nThe DataFrame was produced using this query: SELECT * FROM tracks WHE
RE Name LIKE '%What%'\n\nThe following is information about the resulting pa
ndas DataFrame 'df': \nRunning df.dtypes gives:\n TrackId           int64\nN
ame             object\nAlbumId           int64\nMediaTypeId       int64\nGe
nreId           int64\nComposer         object\nMilliseconds      int64\nByt
es             int64\nUnitPrice       float64\ndtype: object"}, {"role": "us
er", "content": "Can you generate the Python plotly code to chart the result
s of the dataframe? Assume the data is in a pandas dataframe called 'df'. If
there is only one value in the dataframe, use an Indicator. Respond with onl
y Python code. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:22:13.04873908
2Z', 'message': {'role': 'assistant', 'content': '```python\nimport plotly.e
xpress as px\n\nfig = px.histogram(df, x=\'TrackId\', nbins=len(df), title=
\'Tracks Containing "What"\')\nfig.show()\n```'}, 'done_reason': 'stop', 'do
ne': True, 'total_duration': 22164433682, 'load_duration': 54452637, 'prompt
_eval_count': 209, 'prompt_eval_duration': 10847283000, 'eval_count': 44, 'e
val_duration': 11159807000}
```


Tracks Containing "What"
count
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
TrackId

```
Out[21]: ("SELECT * FROM tracks WHERE Name LIKE '%What%'",
              TrackId                                         Name  AlbumId  \
          0        26                                What It Takes        5   
          1        88                                 What You Are       10   
          2       130                             Do what cha wanna       13   
          3       342                 What is and Should Never Be       30   
          4       607                                      So What       48   
          5       960                                   What A Day       76   
          6      1000                                What If I Do?       80   
          7      1039                             What Now My Love       83   
          8      1145                                  Whatsername       89   
          9      1440           Whatever It Is, I Just Can't Stop      116   
          10     1469                           Look What You've Done      119   
          11     1470                             Get What You Need      119   
          12     1628               What Is And What Should Never Be      133   
          13     1778  You're What's Happening (In The World Today)      146   
          14     1823                                      So What      149   
          15     2772             I Don't Know What To Do With Myself      223   
          16     2884                                What Kate Did      231   
          17     2893                   Whatever the Case May Be      230   
          18     2992    I Still Haven't Found What I'm Looking for      237   
          19     3007    I Still Haven't Found What I'm Looking For      238   
          20     3258              Whatever Gets You Thru the Night      255   
          21     3475                         What Is It About Men      322   

              MediaTypeId  GenreId                                    Compose
          r  \
          0             1        1             Steven Tyler, Joe Perry, Desmond Chil
          d   
          1             1        1                              Audioslave/Chris Cornel
          l   
          2             1        2                                          George Duk
          e   
          3             1        1                               Jimmy Page/Robert Plan
          t   
          4             1        2                                          Miles Davi
          s   
          5             1        1              Mike Bordin, Billy Gould, Mike Patto
          n   
          6             1        1  Dave Grohl, Taylor Hawkins, Nate Mendel, Chri
          s...   
          7             1       12          carl sigman/gilbert becaud/pierre leroye
          r   
          8             1        4                                            Green Da
          y   
          9             1        1                                    Jay Kay/Kay, Ja
          y   
          10            1        4                                           N. Ceste
          r   
          11            1        4                       C. Cester/C. Muncey/N. Ceste
          r   
          12            1        1                             Jimmy Page, Robert Plan
          t   
          13            1       14              Allen Story/George Gordy/Robert Gord
          y   
          14            1        3                                          Culmer/Exal
```

```
t
 15            1        7                                               Non
e
 16            3       19                                               Non
e
 17            3       19                                               Non
e
 18            1        1      Bono/Clayton, Adam/Mullen Jr., Larry/The Edg
e
 19            1        1                                                 U
2
 20            2        9                                               Non
e
 21            2        9  Delroy "Chris" Cooper, Donovan Jackson, Earl
C...

     Milliseconds      Bytes  UnitPrice
 0         310622   10144730       0.99
 1         249391    5988186       0.99
 2         274155    9018565       0.99
 3         260675    8497116       0.99
 4         564009   18360449       0.99
 5         158275    5203430       0.99
 6         302994    9929799       0.99
 7         149995    4913383       0.99
 8         252316    8244843       0.99
 9         247222    8249453       0.99
 10        230974    7517083       0.99
 11        247719    8043765       0.99
 12        287973    9369385       0.99
 13        142027    4631104       0.99
 14        189152    6162894       0.99
 15        221387    7251478       0.99
 16       2610250  484583988       1.99
 17       2616410  183867185       1.99
 18        353567   11542247       0.99
 19        280764    9306737       0.99
 20        215084    3499018       0.99
 21        209573    3426106       0.99  ,
 Figure({
     'data': [{'alignmentgroup': 'True',
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>',
               'legendgroup': '',
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               'name': '',
               'nbinsx': 22,
               'offsetgroup': '',
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               'showlegend': False,
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1145, 1440, 1469, 1470,
                           1628, 1778, 1823, 2772, 2884, 2893, 2992, 3007,
3258, 3475]),
               'xaxis': 'x',
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'template': '...',
                'title': {'text': 'Tracks Containing "What"'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'TrackId'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'count'}}}
 }))
```

In [22]:

```python
question = """
    Get the total number of invoices for each customer
"""

vn.ask(question=question)
```

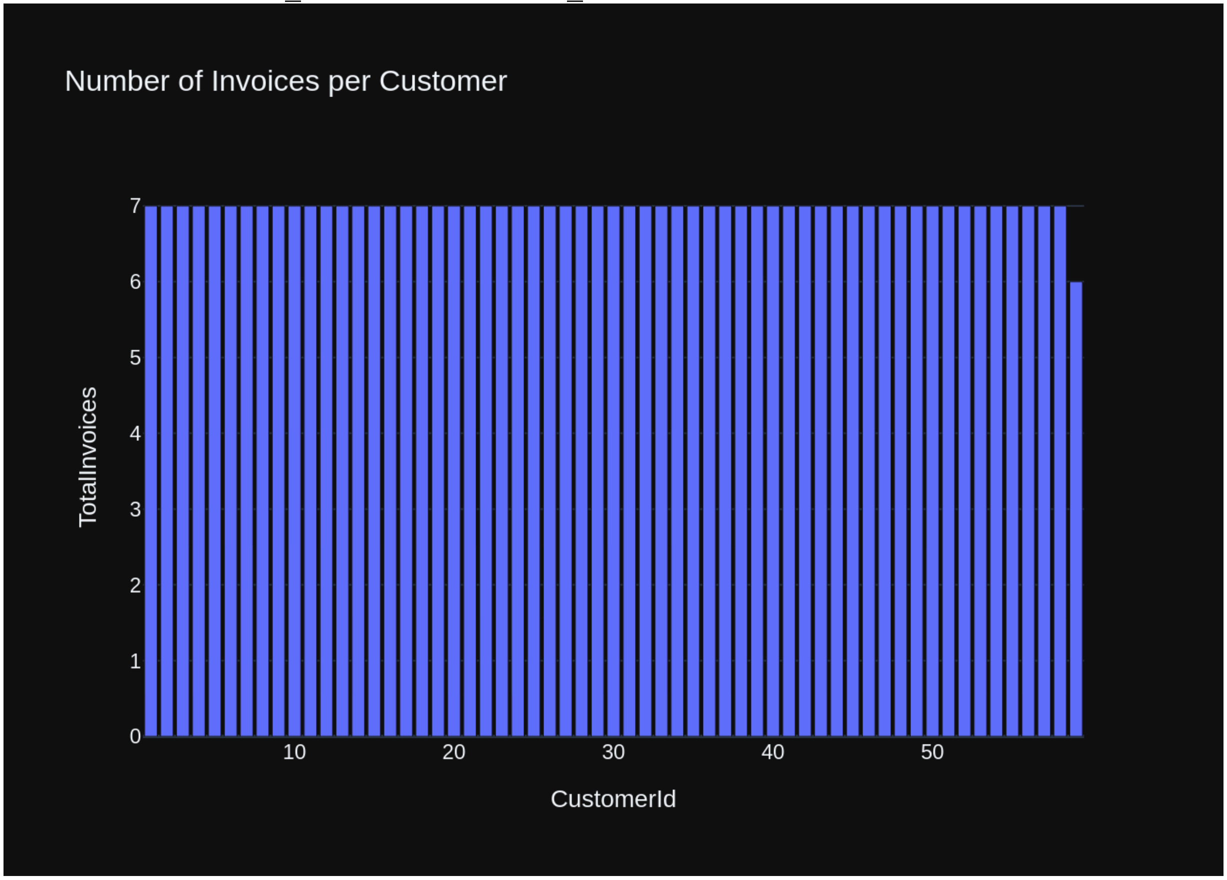
```
Number of requested results 10 is greater than number of elements in index
5, updating n_results = 5
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please 
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)\n\nCREATE IN
DEX IFK_InvoiceLineInvoiceId ON "invoice_items" (InvoiceId)\n\nCREATE TABLE
"invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT
NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NU
LL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT N
ULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nC
REATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCRE
MENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVAR
CHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(7
0),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVAR
CHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_
CustomerSupportRepId ON "customers" (SupportRepId)\n\nCREATE TABLE "employee
s"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r
\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIM
E,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCH
AR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    Posta
lCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n
Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES "employees" (E
mployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE IN
DEX IFK_EmployeeReportsTo ON "employees" (ReportsTo)\n\nCREATE TABLE "track
s"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Na
me NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEG
ER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n
Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Genr
eId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_types" (MediaType
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional
Context \n\nIn the chinook database invoice means order\n\n===Response Guide
lines \n1. If the provided context is sufficient, please generate a valid SQ
L query without any explanations for the question. \n2. If the provided cont
ext is almost sufficient but requires knowledge of a specific string in a pa
rticular column, please generate an intermediate SQL query to find the disti
nct strings in that column. Prepend the query with a comment saying intermed
iate_sql \n3. If the provided context is insufficient, please explain why it
can\'t be generated. \n4. Please use the most relevant table(s). \n5. If the
question has been asked and answered before, please repeat the answer exactl
y as it was given before. \n'}, {'role': 'user', 'content': 'How many custom
```

```
ers are there'}, {'role': 'assistant', 'content': 'SELECT COUNT(*) FROM "cus
tomers"'}, {'role': 'user', 'content': 'what are the top 5 countries that cu
stomers come from?'}, {'role': 'assistant', 'content': 'SELECT Country, COUN
T(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY CustomerCou
nt DESC LIMIT 5'}, {'role': 'user', 'content': '  \n    List all albums and 
their corresponding artist names  \n'}, {'role': 'assistant', 'content': 'SE
LECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN "arti
sts" ar ON a.ArtistId = ar.ArtistId'}, {'role': 'user', 'content': '  \n    
Find all tracks with a name containing "What" (case-insensitive)\n'}, {'rol
e': 'assistant', 'content': "SELECT * FROM tracks WHERE Name LIKE '%Wha
t%'"}, {'role': 'user', 'content': 'Can you list all tables in the SQLite da
tabase catalog?'}, {'role': 'assistant', 'content': "SELECT name FROM sqlite
_master WHERE type='table'"}, {'role': 'user', 'content': '  \n    Get the t
otal number of invoices for each customer\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based 
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\" 
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE 
INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerId)\n\nCREATE INDEX IFK
_InvoiceLineInvoiceId ON \"invoice_items\" (InvoiceId)\n\nCREATE TABLE \"inv
oice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT 
NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NUL
L,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NU
LL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId) \r\n
\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) RE
FERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)
\n\nCREATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AU
TOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastNa
me NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARC
HAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country 
NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employees\" (Employee
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK
_CustomerSupportRepId ON \"customers\" (SupportRepId)\n\nCREATE TABLE \"empl
oyees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r
\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NU
LL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DA
TETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City N
VARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    
PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(2
4),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES \"e
mployees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)
\n\nCREATE INDEX IFK_EmployeeReportsTo ON \"employees\" (ReportsTo)\n\nCREAT
```

```
E TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    Me
diaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHA
R(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES 
\"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    
FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"med
ia_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\n\n===Additional Context \n\nIn the chinook database invoice means ord
er\n\n===Response Guidelines \n1. If the provided context is sufficient, ple
ase generate a valid SQL query without any explanations for the question. \n
2. If the provided context is almost sufficient but requires knowledge of a 
specific string in a particular column, please generate an intermediate SQL 
query to find the distinct strings in that column. Prepend the query with a 
comment saying intermediate_sql \n3. If the provided context is insufficien
t, please explain why it can't be generated. \n4. Please use the most releva
nt table(s). \n5. If the question has been asked and answered before, please 
repeat the answer exactly as it was given before. \n"}, {"role": "user", "co
ntent": "How many customers are there"}, {"role": "assistant", "content": "S
ELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "what are t
he top 5 countries that customers come from?"}, {"role": "assistant", "conte
nt": "SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY 
Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "
\n    List all albums and their corresponding artist names  \n"}, {"role": 
"assistant", "content": "SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName 
FROM \"albums\" a JOIN \"artists\" ar ON a.ArtistId = ar.ArtistId"}, {"rol
e": "user", "content": "  \n    Find all tracks with a name containing \"Wha
t\" (case-insensitive)\n"}, {"role": "assistant", "content": "SELECT * FROM 
tracks WHERE Name LIKE '%What%'"}, {"role": "user", "content": "Can you list 
all tables in the SQLite database catalog?"}, {"role": "assistant", "conten
t": "SELECT name FROM sqlite_master WHERE type='table'"}, {"role": "user", 
"content": "  \n    Get the total number of invoices for each customer\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:23:36.42786388
9Z', 'message': {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT
(*) AS TotalInvoices FROM "invoices" GROUP BY CustomerId'}, 'done_reason': 
'stop', 'done': True, 'total_duration': 83273939302, 'load_duration': 143413
54, 'prompt_eval_count': 1392, 'prompt_eval_duration': 77264024000, 'eval_co
unt': 20, 'eval_duration': 5185555000}
LLM Response: SELECT CustomerId, COUNT(*) AS TotalInvoices FROM "invoices" G
ROUP BY CustomerId
SELECT CustomerId, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY Custom
erId
    CustomerId  TotalInvoices
0            1              7
1            2              7
2            3              7
3            4              7
4            5              7
5            6              7
6            7              7
7            8              7
8            9              7
9           10              7
10          11              7
```

```
11          12              7
12          13              7
13          14              7
14          15              7
15          16              7
16          17              7
17          18              7
18          19              7
19          20              7
20          21              7
21          22              7
22          23              7
23          24              7
24          25              7
25          26              7
26          27              7
27          28              7
28          29              7
29          30              7
30          31              7
31          32              7
32          33              7
33          34              7
34          35              7
35          36              7
36          37              7
37          38              7
38          39              7
39          40              7
40          41              7
41          42              7
42          43              7
43          44              7
44          45              7
45          46              7
46          47              7
47          48              7
48          49              7
49          50              7
50          51              7
51          52              7
52          53              7
53          54              7
54          55              7
55          56              7
56          57              7
57          58              7
58          59              6
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    Get the total number of invoices for each customer\n'\n\nThe DataFrame
was produced using this query: SELECT CustomerId, COUNT(*) AS TotalInvoices
FROM \"invoices\" GROUP BY CustomerId\n\nThe following is information about
the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n CustomerId
int64\nTotalInvoices    int64\ndtype: object"}, {"role": "user", "content":
"Can you generate the Python plotly code to chart the results of the datafra
me? Assume the data is in a pandas dataframe called 'df'. If there is only o
ne value in the dataframe, use an Indicator. Respond with only Python code.
Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:23:52.97036736
6Z', 'message': {'role': 'assistant', 'content': 'fig = px.bar(df, x="Custom
erId", y="TotalInvoices", title=\'Number of Invoices per Customer\')\nfig.sh
ow()'}, 'done_reason': 'stop', 'done': True, 'total_duration': 16522785633,
'load_duration': 55287070, 'prompt_eval_count': 171, 'prompt_eval_duration':
8718552000, 'eval_count': 30, 'eval_duration': 7658046000}
```



```
Out[22]: ('SELECT CustomerId, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY Cus
         tomerId',
              CustomerId  TotalInvoices
          0             1              7
          1             2              7
          2             3              7
          3             4              7
          4             5              7
          5             6              7
          6             7              7
          7             8              7
          8             9              7
          9            10              7
          10           11              7
          11           12              7
          12           13              7
          13           14              7
          14           15              7
          15           16              7
          16           17              7
          17           18              7
          18           19              7
          19           20              7
          20           21              7
          21           22              7
          22           23              7
          23           24              7
          24           25              7
          25           26              7
          26           27              7
          27           28              7
          28           29              7
          29           30              7
          30           31              7
          31           32              7
          32           33              7
          33           34              7
          34           35              7
          35           36              7
          36           37              7
          37           38              7
          38           39              7
          39           40              7
          40           41              7
          41           42              7
          42           43              7
          43           44              7
          44           45              7
          45           46              7
          46           47              7
          47           48              7
          48           49              7
          49           50              7
          50           51              7
          51           52              7
          52           53              7
```

```
 53           54               7
 54           55               7
 55           56               7
 56           57               7
 57           58               7
 58           59               6,
 Figure({
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a></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12,
13, 14, 15, 16, 17, 18,
                           19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30,
31, 32, 33, 34, 35, 36,
                           37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48,
49, 50, 51, 52, 53, 54,
                           55, 56, 57, 58, 59]),
               'xaxis': 'x',
               'y': array([7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
7, 7, 7, 7, 7, 7, 7, 7,
                           7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
7, 7, 7, 7, 7, 7, 7, 7,
                           7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 6]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'template': '...',
                'title': {'text': 'Number of Invoices per Customer'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'CustomerId'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'TotalInvoices'}}}
 }))
```

In [23]:

```
question = """
    Find the total number of invoices per country:
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
6, updating n_results = 6
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please 
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId 
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE TABLE "invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY 
AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId I
NTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity 
INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (Inv
oiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY 
(TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceCustomerId ON "invoices" (Custom
erId)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON "invoice_items" (InvoiceI
d)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nCR
EATE TABLE "employees"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREM
ENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARC
HAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    
BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r
\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR
(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax 
NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFE
RENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACT
ION\r\n)\n\nCREATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY 
KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    
LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address 
NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Co
untry NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(2
4),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    Sup
portRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees" 
(EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE 
TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON 
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "tracks"\r\n(\r\n    
TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(20
0)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NUL
L,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Millisecond
s INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  N
OT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\t
ON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERE
NCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    
FOREIGN KEY (MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON 
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeReport
sTo ON "employees" (ReportsTo)\n\n\n===Additional Context \n\nIn the chinook 
database invoice means order\n\n===Response Guidelines \n1. If the provided 
context is sufficient, please generate a valid SQL query without any explana
tions for the question. \n2. If the provided context is almost sufficient bu
t requires knowledge of a specific string in a particular column, please gen
erate an intermediate SQL query to find the distinct strings in that column. 
Prepend the query with a comment saying intermediate_sql \n3. If the provide
d context is insufficient, please explain why it can\'t be generated. \n4. P
```

```
lease use the most relevant table(s). \n5. If the question has been asked an
d answered before, please repeat the answer exactly as it was given before.
\n'}, {'role': 'user', 'content': '  \n    Get the total number of invoices
for each customer\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId,
COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'u
ser', 'content': 'what are the top 5 countries that customers come from?'},
{'role': 'assistant', 'content': 'SELECT Country, COUNT(*) AS CustomerCount
FROM "customers" GROUP BY Country ORDER BY CustomerCount DESC LIMIT 5'}, {'r
ole': 'user', 'content': 'How many customers are there'}, {'role': 'assistan
t', 'content': 'SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'conten
t': '  \n    List all albums and their corresponding artist names  \n'}, {'r
ole': 'assistant', 'content': 'SELECT a.Title AS AlbumTitle, ar.Name AS Arti
stName FROM "albums" a JOIN "artists" ar ON a.ArtistId = ar.ArtistId'}, {'ro
le': 'user', 'content': '  \n    Find all tracks with a name containing "Wha
t" (case-insensitive)\n'}, {'role': 'assistant', 'content': "SELECT * FROM t
racks WHERE Name LIKE '%What%'"}, {'role': 'user', 'content': 'Can you list
all tables in the SQLite database catalog?'}, {'role': 'assistant', 'conten
t': "SELECT name FROM sqlite_master WHERE type='table'"}, {'role': 'user',
'content': '  \n    Find the total number of invoices per country:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE \"invoice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER
NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER
NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerI
d)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON \"invoice_items\" (InvoiceId)
\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)\n\nCR
EATE TABLE \"employees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVA
RCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r
\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR
(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NV
ARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo)
REFERENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION\r\n)\n\nCREATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NUL
L,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n
Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r
\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVA
RCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n
SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employe
es\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCR
EATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT
NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT
NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"tracks\"\r
\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name N
VARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER
NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Mill
iseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(1
0,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES \"albums\" (AlbumId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreI
d) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"media_types\" (MediaTy
peId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX I
FK_EmployeeReportsTo ON \"employees\" (ReportsTo)\n\n\n===Additional Context
\n\nIn the chinook database invoice means order\n\n===Response Guidelines \n
1. If the provided context is sufficient, please generate a valid SQL query
without any explanations for the question. \n2. If the provided context is a
lmost sufficient but requires knowledge of a specific string in a particular
column, please generate an intermediate SQL query to find the distinct strin
gs in that column. Prepend the query with a comment saying intermediate_sql
\n3. If the provided context is insufficient, please explain why it can't be
generated. \n4. Please use the most relevant table(s). \n5. If the question
has been asked and answered before, please repeat the answer exactly as it w
as given before. \n"}, {"role": "user", "content": "  \n    Get the total nu
mber of invoices for each customer\n"}, {"role": "assistant", "content": "SE
LECT CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY Custom
erId"}, {"role": "user", "content": "what are the top 5 countries that custo
mers come from?"}, {"role": "assistant", "content": "SELECT Country, COUNT
(*) AS CustomerCount FROM \"customers\" GROUP BY Country ORDER BY CustomerCo
unt DESC LIMIT 5"}, {"role": "user", "content": "How many customers are ther
e"}, {"role": "assistant", "content": "SELECT COUNT(*) FROM \"customers\""},
{"role": "user", "content": "  \n    List all albums and their corresponding
artist names  \n"}, {"role": "assistant", "content": "SELECT a.Title AS Albu
mTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artists\" ar ON a.Art
istId = ar.ArtistId"}, {"role": "user", "content": "  \n    Find all tracks
with a name containing \"What\" (case-insensitive)\n"}, {"role": "assistan
t", "content": "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {"role": "u
ser", "content": "Can you list all tables in the SQLite database catalog?"},
{"role": "assistant", "content": "SELECT name FROM sqlite_master WHERE type
='table'"}, {"role": "user", "content": "  \n    Find the total number of in
voices per country:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:25:20.80196485
1Z', 'message': {'role': 'assistant', 'content': 'SELECT Country, COUNT(*) A
S TotalInvoices FROM "invoices" GROUP BY BillingCountry'}, 'done_reason': 's
top', 'done': True, 'total_duration': 87725115315, 'load_duration': 1359850
4, 'prompt_eval_count': 1495, 'prompt_eval_duration': 81471080000, 'eval_cou
nt': 20, 'eval_duration': 5210941000}
LLM Response: SELECT Country, COUNT(*) AS TotalInvoices FROM "invoices" GROU
P BY BillingCountry
SELECT Country, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY BillingCo
untry
```

```
Couldn't run sql:  Execution failed on sql 'SELECT Country, COUNT(*) AS Tota
lInvoices FROM "invoices" GROUP BY BillingCountry': no such column: Country
```

In [24]:

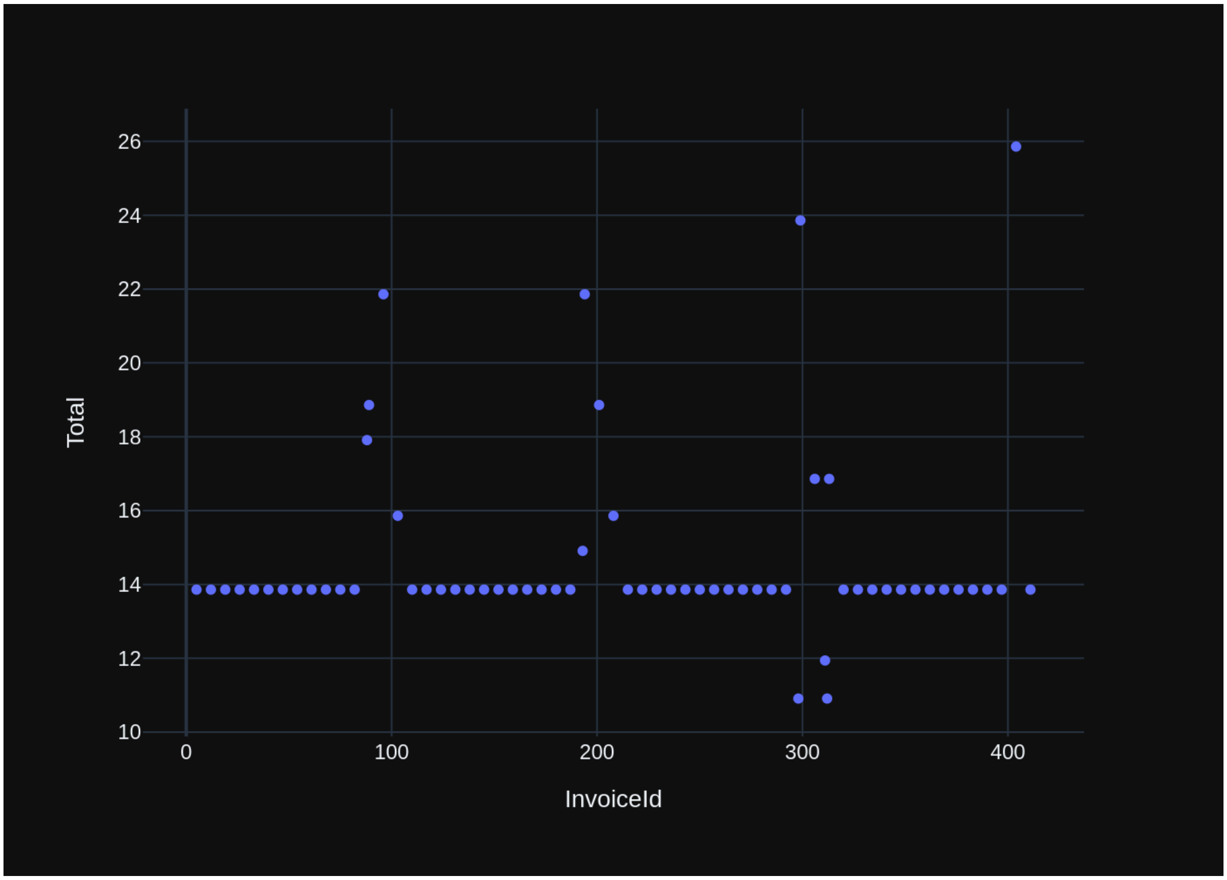
```
question = """
    List all invoices with a total exceeding $10:
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
6, updating n_results = 6
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoice_items"\r\n(\r\n    Invo
iceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEG
ER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,
2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (Invoice
Id) REFERENCES "invoices" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLi
neInvoiceId ON "invoice_items" (InvoiceId)\n\nCREATE TABLE "invoices"\r\n(\r
\n    InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerI
d INTEGER  NOT NULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAd
dress NVARCHAR(70),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVA
RCHAR(40),\r\n    BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVAR
CHAR(10),\r\n    Total NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (Customer
Id) REFERENCES "customers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items"
(TrackId)\n\nCREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)\n
\nCREATE TABLE "tracks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMEN
T NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n
MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARC
HAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES
"albums" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    F
OREIGN KEY (GenreId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTI
ON ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_t
ypes" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n
CREATE INDEX IFK_EmployeeReportsTo ON "employees" (ReportsTo)\n\nCREATE TABL
E "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCREMENT NOT N
ULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVARCHAR(20)
NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(70),\r\n    C
ity NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r
\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHA
R(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId INTEGER,\r\n
FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeId) \r\n\t\tON DE
LETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "employees"\r\n(\r\n
EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    LastName NVARC
HAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r\n    Title NVA
RCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIME,\r\n    HireD
ate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n
State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR
(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARC
HAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES "employees" (EmployeeId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_Cus
tomerSupportRepId ON "customers" (SupportRepId)\n\n\n===Additional Context
\n\nIn the chinook database invoice means order\n\n===Response Guidelines \n
1. If the provided context is sufficient, please generate a valid SQL query
without any explanations for the question. \n2. If the provided context is a
lmost sufficient but requires knowledge of a specific string in a particular
column, please generate an intermediate SQL query to find the distinct strin
gs in that column. Prepend the query with a comment saying intermediate_sql
\n3. If the provided context is insufficient, please explain why it can\'t b
e generated. \n4. Please use the most relevant table(s). \n5. If the questio
n has been asked and answered before, please repeat the answer exactly as it
was given before. \n'}, {'role': 'user', 'content': '  \n    Get the total n
```

```
umber of invoices for each customer\n'}, {'role': 'assistant', 'content': 'S
ELECT CustomerId, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY Custome
rId'}, {'role': 'user', 'content': 'what are the top 5 countries that custom
ers come from?'}, {'role': 'assistant', 'content': 'SELECT Country, COUNT(*)
AS CustomerCount FROM "customers" GROUP BY Country ORDER BY CustomerCount DE
SC LIMIT 5'}, {'role': 'user', 'content': 'How many customers are there'},
{'role': 'assistant', 'content': 'SELECT COUNT(*) FROM "customers"'}, {'rol
e': 'user', 'content': '  \n    List all albums and their corresponding arti
st names  \n'}, {'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTit
le, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId =
ar.ArtistId'}, {'role': 'user', 'content': '  \n    Find all tracks with a n
ame containing "What" (case-insensitive)\n'}, {'role': 'assistant', 'conten
t': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role': 'user', 'cont
ent': 'Can you list all tables in the SQLite database catalog?'}, {'role':
'assistant', 'content': "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {'role': 'user', 'content': '  \n    List all invoices with a total ex
ceeding $10:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoice_items\"\r\n(\r\n    InvoiceLineId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NU
LL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NU
LL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERE
NCES \"invoices\" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON D
ELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineInvo
iceId ON \"invoice_items\" (InvoiceId)\n\nCREATE TABLE \"invoices\"\r\n(\r\n
InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTE
GER  NOT NULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress
NVARCHAR(70),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR
(40),\r\n    BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR
(10),\r\n    Total NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId)
REFERENCES \"customers\" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\"
(TrackId)\n\nCREATE INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerId)
\n\nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGE
R,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Comp
oser NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTE
GER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId)
REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACT
ION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFER
ENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeReportsTo ON \"employees\" (ReportsT
o)\n\nCREATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    Last
Name NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVA
RCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Count
ry NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(2
4),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    Sup
portRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employees
\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREA
TE TABLE \"employees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREM
ENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARC
HAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n
BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r
\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR
(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax
NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFE
RENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO A
CTION\r\n)\n\nCREATE INDEX IFK_CustomerSupportRepId ON \"customers\" (Suppor
tRepId)\n\n\n===Additional Context \n\nIn the chinook database invoice means
order\n\n===Response Guidelines \n1. If the provided context is sufficient,
please generate a valid SQL query without any explanations for the question.
\n2. If the provided context is almost sufficient but requires knowledge of
a specific string in a particular column, please generate an intermediate SQ
L query to find the distinct strings in that column. Prepend the query with
a comment saying intermediate_sql \n3. If the provided context is insufficie
nt, please explain why it can't be generated. \n4. Please use the most relev
ant table(s). \n5. If the question has been asked and answered before, pleas
e repeat the answer exactly as it was given before. \n"}, {"role": "user",
"content": "  \n    Get the total number of invoices for each customer\n"},
{"role": "assistant", "content": "SELECT CustomerId, COUNT(*) AS TotalInvoic
es FROM \"invoices\" GROUP BY CustomerId"}, {"role": "user", "content": "wha
t are the top 5 countries that customers come from?"}, {"role": "assistant",
"content": "SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GRO
UP BY Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "conte
nt": "How many customers are there"}, {"role": "assistant", "content": "SELE
CT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "  \n    List
all albums and their corresponding artist names  \n"}, {"role": "assistant",
"content": "SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM \"album
s\" a JOIN \"artists\" ar ON a.ArtistId = ar.ArtistId"}, {"role": "user", "c
ontent": "  \n    Find all tracks with a name containing \"What\" (case-inse
nsitive)\n"}, {"role": "assistant", "content": "SELECT * FROM tracks WHERE N
ame LIKE '%What%'"}, {"role": "user", "content": "Can you list all tables in
the SQLite database catalog?"}, {"role": "assistant", "content": "SELECT nam
e FROM sqlite_master WHERE type='table'"}, {"role": "user", "content": "  \n
List all invoices with a total exceeding $10:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:26:31.91273910
2Z', 'message': {'role': 'assistant', 'content': ' SELECT * FROM "invoices"
WHERE Total > 10'}, 'done_reason': 'stop', 'done': True, 'total_duration': 7
1067930029, 'load_duration': 15127988, 'prompt_eval_count': 1429, 'prompt_ev
al_duration': 66498446000, 'eval_count': 14, 'eval_duration': 3542464000}
LLM Response:  SELECT * FROM "invoices" WHERE Total > 10
 SELECT * FROM "invoices" WHERE Total > 10
    InvoiceId  CustomerId          InvoiceDate             BillingAddress  \
0           5          23  2009-01-11 00:00:00            69 Salem Street
1          12           2  2009-02-11 00:00:00    Theodor-Heuss-Straße 34
2          19          40  2009-03-14 00:00:00             8, Rue Hanovre
3          26          19  2009-04-14 00:00:00           1 Infinite Loop
4          33          57  2009-05-15 00:00:00           Calle Lira, 198
..        ...         ...                  ...                        ...
59        383          10  2013-08-12 00:00:00  Rua Dr. Falcão Filho, 155
60        390          48  2013-09-12 00:00:00      Lijnbaansgracht 120bg
```

```
61        397          27  2013-10-13 00:00:00            1033 N Park Ave
62        404           6  2013-11-13 00:00:00              Rilská 3174/6
63        411          44  2013-12-14 00:00:00            Porthaninkatu 9

   BillingCity BillingState  BillingCountry BillingPostalCode  Total
0       Boston           MA             USA              2113  13.86
1    Stuttgart         None         Germany             70174  13.86
2        Paris         None          France             75002  13.86
3    Cupertino           CA             USA             95014  13.86
4     Santiago         None           Chile              None  13.86
..         ...          ...             ...               ...    ...
59   São Paulo           SP          Brazil         01007-010  13.86
60   Amsterdam           VV     Netherlands              1016  13.86
61      Tucson           AZ             USA             85719  13.86
62      Prague         None  Czech Republic             14300  25.86
63    Helsinki         None         Finland             00530  13.86

[64 rows x 9 columns]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    List all invoices with a total exceeding $10:\n'\n\nThe DataFrame was
produced using this query:  SELECT * FROM \"invoices\" WHERE Total > 10\n\nT
he following is information about the resulting pandas DataFrame 'df': \nRun
ning df.dtypes gives:\n InvoiceId              int64\nCustomerId
int64\nInvoiceDate           object\nBillingAddress        object\nBillingCi
ty           object\nBillingState          object\nBillingCountry        obj
ect\nBillingPostalCode     object\nTotal                float64\ndtype: obje
ct"}, {"role": "user", "content": "Can you generate the Python plotly code t
o chart the results of the dataframe? Assume the data is in a pandas datafra
me called 'df'. If there is only one value in the dataframe, use an Indicato
r. Respond with only Python code. Do not answer with any explanations -- jus
t the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:26:49.58841397
3Z', 'message': {'role': 'assistant', 'content': "import plotly.express as p
x\n\nfig = px.scatter(df, x='InvoiceId', y='Total')\nfig.show()"}, 'done_rea
son': 'stop', 'done': True, 'total_duration': 17649207251, 'load_duration':
13065784, 'prompt_eval_count': 204, 'prompt_eval_duration': 10724168000, 'ev
al_count': 27, 'eval_duration': 6823986000}
```


Total
26
24
22
20
18
16
14
12
10
0
100
200
300
400
InvoiceId

```
Out[24]: (' SELECT * FROM "invoices" WHERE Total > 10',
              InvoiceId  CustomerId          InvoiceDate             BillingAddress
         \
          0           5          23  2009-01-11 00:00:00            69 Salem Street
          1          12           2  2009-02-11 00:00:00    Theodor-Heuss-Straße 34
          2          19          40  2009-03-14 00:00:00             8, Rue Hanovre
          3          26          19  2009-04-14 00:00:00            1 Infinite Loop
          4          33          57  2009-05-15 00:00:00            Calle Lira, 198
          ..        ...         ...                  ...                        ...
          59        383          10  2013-08-12 00:00:00  Rua Dr. Falcão Filho, 155
          60        390          48  2013-09-12 00:00:00     Lijnbaansgracht 120bg
          61        397          27  2013-10-13 00:00:00            1033 N Park Ave
          62        404           6  2013-11-13 00:00:00              Rilská 3174/6
          63        411          44  2013-12-14 00:00:00            Porthaninkatu 9

             BillingCity BillingState  BillingCountry BillingPostalCode  Total
          0       Boston           MA             USA              2113  13.86
          1    Stuttgart         None         Germany             70174  13.86
          2        Paris         None          France             75002  13.86
          3    Cupertino           CA             USA             95014  13.86
          4     Santiago         None           Chile              None  13.86
          ..         ...          ...             ...               ...    ...
          59   São Paulo           SP          Brazil         01007-010  13.86
          60   Amsterdam           VV     Netherlands              1016  13.86
          61      Tucson           AZ             USA             85719  13.86
          62      Prague         None  Czech Republic             14300  25.86
          63    Helsinki         None         Finland             00530  13.86

          [64 rows x 9 columns],
          Figure({
              'data': [{'hovertemplate': 'InvoiceId=%{x}<br>Total=%{y}<extra></extra
         >',
                        'legendgroup': '',
                        'marker': {'color': '#636efa', 'symbol': 'circle'},
                        'mode': 'markers',
                        'name': '',
                        'orientation': 'v',
                        'showlegend': False,
                        'type': 'scatter',
                        'x': array([  5,  12,  19,  26,  33,  40,  47,  54,  61,  6
         8,  75,  82,  88,  89,
                                     96, 103, 110, 117, 124, 131, 138, 145, 152, 15
         9, 166, 173, 180, 187,
                                    193, 194, 201, 208, 215, 222, 229, 236, 243, 25
         0, 257, 264, 271, 278,
                                    285, 292, 298, 299, 306, 311, 312, 313, 320, 32
         7, 334, 341, 348, 355,
                                    362, 369, 376, 383, 390, 397, 404, 411]),
                        'xaxis': 'x',
                        'y': array([13.86, 13.86, 13.86, 13.86, 13.86, 13.86, 13.86,
         13.86, 13.86, 13.86,
                                    13.86, 13.86, 17.91, 18.86, 21.86, 15.86, 13.86,
         13.86, 13.86, 13.86,
                                    13.86, 13.86, 13.86, 13.86, 13.86, 13.86, 13.86,
         13.86, 14.91, 21.86,
                                    18.86, 15.86, 13.86, 13.86, 13.86, 13.86, 13.86,
13.86, 13.86, 13.86,
                           13.86, 13.86, 13.86, 13.86, 10.91, 23.86, 16.86,
11.94, 10.91, 16.86,
                           13.86, 13.86, 13.86, 13.86, 13.86, 13.86, 13.86,
13.86, 13.86, 13.86,
                           13.86, 13.86, 25.86, 13.86]),
               'yaxis': 'y'}],
     'layout': {'legend': {'tracegroupgap': 0},
                'margin': {'t': 60},
                'template': '...',
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'InvoiceId'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'Total'}}}
 }))
```

In [25]:

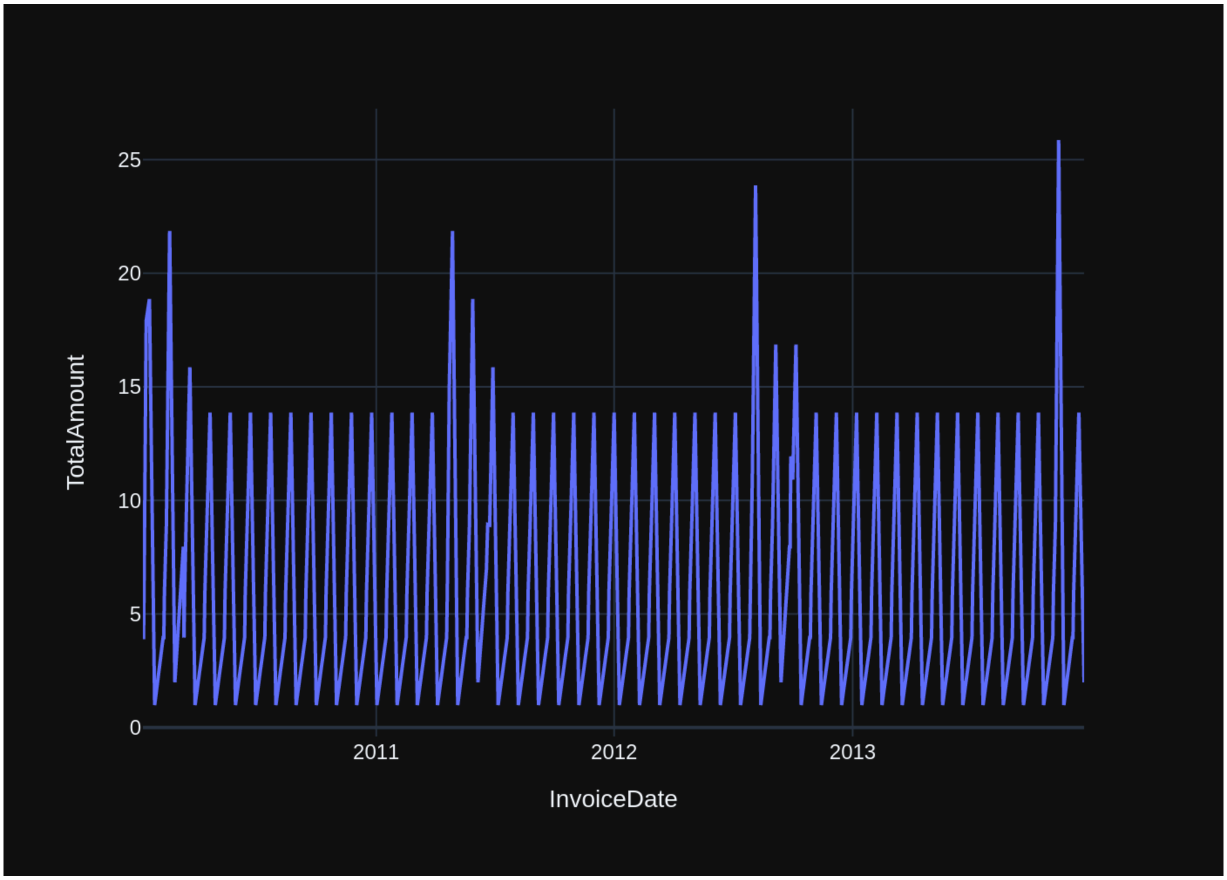
```
question = """
    Find all invoices since 2010 and the total amount invoiced:
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
7, updating n_results = 7
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE TABLE "invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId I
NTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity
INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (Inv
oiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON "invoice_items"
(InvoiceId)\n\nCREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)
\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nCREA
TE TABLE "employees"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMEN
T NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHA
R(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n
BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r
\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR
(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax
NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFE
RENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACT
ION\r\n)\n\nCREATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY
KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n
LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address
NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Co
untry NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(2
4),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    Sup
portRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees"
(EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE "tracks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    Media
TypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(2
20),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    Uni
tPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "alb
ums" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREI
GN KEY (GenreId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_type
s" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCRE
ATE TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "playlist_track"\r
\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r
\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n
FOREIGN KEY (PlaylistId) REFERENCES "playlists" (PlaylistId) \r\n\t\tON DELE
TE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "t
racks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n=
==Additional Context \n\nIn the chinook database invoice means order\n\n===R
esponse Guidelines \n1. If the provided context is sufficient, please genera
te a valid SQL query without any explanations for the question. \n2. If the
```

```
provided context is almost sufficient but requires knowledge of a specific s
tring in a particular column, please generate an intermediate SQL query to f
ind the distinct strings in that column. Prepend the query with a comment sa
ying intermediate_sql \n3. If the provided context is insufficient, please e
xplain why it can\'t be generated. \n4. Please use the most relevant table
(s). \n5. If the question has been asked and answered before, please repeat
the answer exactly as it was given before. \n'}, {'role': 'user', 'content':
'  \n    List all invoices with a total exceeding $10:\n'}, {'role': 'assist
ant', 'content': ' SELECT * FROM "invoices" WHERE Total > 10'}, {'role': 'us
er', 'content': '  \n    Get the total number of invoices for each customer
\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT(*) AS Total
Invoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'user', 'content':
'How many customers are there'}, {'role': 'assistant', 'content': 'SELECT CO
UNT(*) FROM "customers"'}, {'role': 'user', 'content': 'what are the top 5 c
ountries that customers come from?'}, {'role': 'assistant', 'content': 'SELE
CT Country, COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDE
R BY CustomerCount DESC LIMIT 5'}, {'role': 'user', 'content': '  \n    List
all albums and their corresponding artist names  \n'}, {'role': 'assistant',
'content': 'SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM "album
s" a JOIN "artists" ar ON a.ArtistId = ar.ArtistId'}, {'role': 'user', 'cont
ent': '  \n    Find all tracks with a name containing "What" (case-insensiti
ve)\n'}, {'role': 'assistant', 'content': "SELECT * FROM tracks WHERE Name L
IKE '%What%'"}, {'role': 'user', 'content': 'Can you list all tables in the
SQLite database catalog?'}, {'role': 'assistant', 'content': "SELECT name FR
OM sqlite_master WHERE type='table'"}, {'role': 'user', 'content': '  \n
Find all invoices since 2010 and the total amount invoiced:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE \"invoice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER
NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER
NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON \"invoice_items\" (I
nvoiceId)\n\nCREATE INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerId)
\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)\n\nCR
EATE TABLE \"employees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVA
RCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r
\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR
(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NV
ARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo)
REFERENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION\r\n)\n\nCREATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NUL
L,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n
Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r
\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVA
RCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n
SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employe
es\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCR
EATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT
NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n
MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARC
HAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES
\"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n
FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"med
ia_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOI
NCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INT
EGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (Artist
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"p
laylist_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INT
EGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId,
TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlists\" (Playlist
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Tra
ckId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION\r\n)\n\n\n===Additional Context \n\nIn the chinook database invoic
e means order\n\n===Response Guidelines \n1. If the provided context is suff
icient, please generate a valid SQL query without any explanations for the q
uestion. \n2. If the provided context is almost sufficient but requires know
ledge of a specific string in a particular column, please generate an interm
ediate SQL query to find the distinct strings in that column. Prepend the qu
ery with a comment saying intermediate_sql \n3. If the provided context is i
nsufficient, please explain why it can't be generated. \n4. Please use the m
ost relevant table(s). \n5. If the question has been asked and answered befo
re, please repeat the answer exactly as it was given before. \n"}, {"role":
"user", "content": "  \n    List all invoices with a total exceeding $1
0:\n"}, {"role": "assistant", "content": " SELECT * FROM \"invoices\" WHERE
Total > 10"}, {"role": "user", "content": "  \n    Get the total number of i
nvoices for each customer\n"}, {"role": "assistant", "content": "SELECT Cust
omerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY CustomerId"},
{"role": "user", "content": "How many customers are there"}, {"role": "assis
tant", "content": "SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "c
ontent": "what are the top 5 countries that customers come from?"}, {"role":
"assistant", "content": "SELECT Country, COUNT(*) AS CustomerCount FROM \"cu
stomers\" GROUP BY Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role":
"user", "content": "  \n    List all albums and their corresponding artist n
ames  \n"}, {"role": "assistant", "content": "SELECT a.Title AS AlbumTitle,
ar.Name AS ArtistName FROM \"albums\" a JOIN \"artists\" ar ON a.ArtistId =
ar.ArtistId"}, {"role": "user", "content": "  \n    Find all tracks with a n
ame containing \"What\" (case-insensitive)\n"}, {"role": "assistant", "conte
nt": "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {"role": "user", "con
tent": "Can you list all tables in the SQLite database catalog?"}, {"role":
"assistant", "content": "SELECT name FROM sqlite_master WHERE type='tabl
```

```
e'"}, {"role": "user", "content": "  \n    Find all invoices since 2010 and
the total amount invoiced:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:28:32.71412549
6Z', 'message': {'role': 'assistant', 'content': 'SELECT InvoiceDate, SUM(To
tal) AS TotalAmount FROM "invoices" WHERE strftime(\'%Y\', InvoiceDate) >=
\'2010\' GROUP BY InvoiceDate'}, 'done_reason': 'stop', 'done': True, 'total
_duration': 103021003021, 'load_duration': 14524891, 'prompt_eval_count': 16
43, 'prompt_eval_duration': 91888350000, 'eval_count': 37, 'eval_duration':
9993860000}
LLM Response: SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices"
WHERE strftime('%Y', InvoiceDate) >= '2010' GROUP BY InvoiceDate
SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHERE strftime
('%Y', InvoiceDate) >= '2010' GROUP BY InvoiceDate
             InvoiceDate  TotalAmount
0    2010-01-08 00:00:00         3.96
1    2010-01-09 00:00:00         3.96
2    2010-01-10 00:00:00         6.94
3    2010-01-13 00:00:00        17.91
4    2010-01-18 00:00:00        18.86
..                   ...          ...
277  2013-12-05 00:00:00         3.96
278  2013-12-06 00:00:00         5.94
279  2013-12-09 00:00:00         8.91
280  2013-12-14 00:00:00        13.86
281  2013-12-22 00:00:00         1.99

[282 rows x 2 columns]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    Find all invoices since 2010 and the total amount invoiced:\n'\n\nThe
DataFrame was produced using this query: SELECT InvoiceDate, SUM(Total) AS T
otalAmount FROM \"invoices\" WHERE strftime('%Y', InvoiceDate) >= '2010' GRO
UP BY InvoiceDate\n\nThe following is information about the resulting pandas
DataFrame 'df': \nRunning df.dtypes gives:\n InvoiceDate     object\nTotalAm
ount    float64\ndtype: object"}, {"role": "user", "content": "Can you gener
ate the Python plotly code to chart the results of the dataframe? Assume the
data is in a pandas dataframe called 'df'. If there is only one value in the
dataframe, use an Indicator. Respond with only Python code. Do not answer wi
th any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:28:51.05714618
9Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nfig = px.line(df, x='InvoiceDate', y='TotalAmount')\nfig.sho
w()\n```"}, 'done_reason': 'stop', 'done': True, 'total_duration': 183151075
85, 'load_duration': 14003349, 'prompt_eval_count': 191, 'prompt_eval_durati
on': 9951108000, 'eval_count': 32, 'eval_duration': 8306431000}
```


TotalAmount
25
20
15
10
5
0
2011
2012
2013
InvoiceDate

```
Out[25]: ('SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHERE strft
         ime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDate',
                       InvoiceDate  TotalAmount
          0    2010-01-08 00:00:00         3.96
          1    2010-01-09 00:00:00         3.96
          2    2010-01-10 00:00:00         6.94
          3    2010-01-13 00:00:00        17.91
          4    2010-01-18 00:00:00        18.86
          ..                   ...          ...
          277  2013-12-05 00:00:00         3.96
          278  2013-12-06 00:00:00         5.94
          279  2013-12-09 00:00:00         8.91
          280  2013-12-14 00:00:00        13.86
          281  2013-12-22 00:00:00         1.99

          [282 rows x 2 columns],
          Figure({
              'data': [{'hovertemplate': 'InvoiceDate=%{x}<br>TotalAmount=%{y}<extra
         ></extra>',
                        'legendgroup': '',
                        'line': {'color': '#636efa', 'dash': 'solid'},
                        'marker': {'symbol': 'circle'},
                        'mode': 'lines',
                        'name': '',
                        'orientation': 'v',
                        'showlegend': False,
                        'type': 'scatter',
                        'x': array(['2010-01-08 00:00:00', '2010-01-09 00:00:00', '2
         010-01-10 00:00:00',
                                    ..., '2013-12-09 00:00:00', '2013-12-14 00:00:0
         0',
                                    '2013-12-22 00:00:00'], dtype=object),
                        'xaxis': 'x',
                        'y': array([ 3.96,  3.96,  6.94, ...,  8.91, 13.86,  1.99]),
                        'yaxis': 'y'}],
              'layout': {'legend': {'tracegroupgap': 0},
                         'margin': {'t': 60},
                         'template': '...',
                         'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'InvoiceDate'}},
                         'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'TotalAmount'}}}
          }))
```

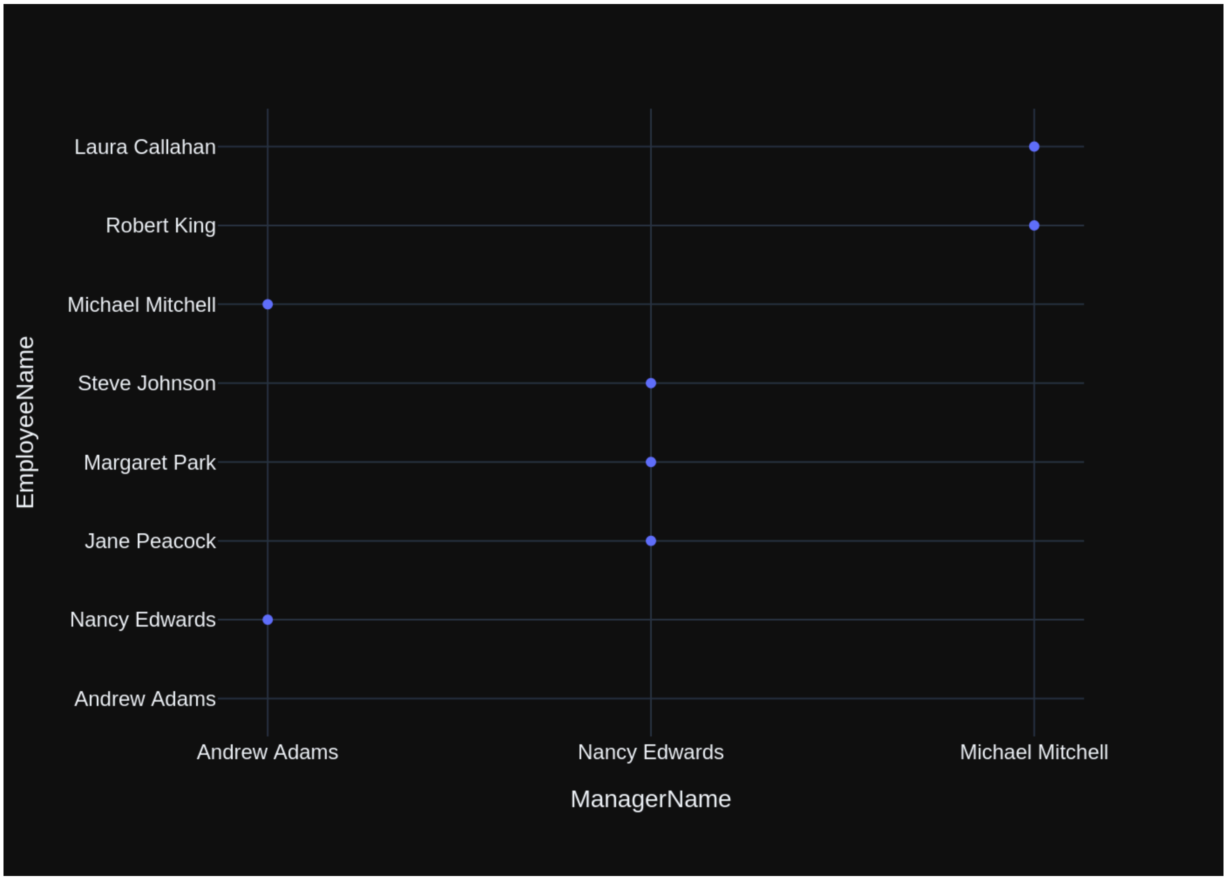
```
In [26]: question = """
             List all employees and their reporting manager's name (if any):
         """

         vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
8, updating n_results = 8
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE INDEX IFK_EmployeeReportsTo ON "employ
ees" (ReportsTo)\n\nCREATE TABLE "employees"\r\n(\r\n    EmployeeId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NUL
L,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n
ReportsTo INTEGER,\r\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n
Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r
\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVA
RCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIG
N KEY (ReportsTo) REFERENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "customers"\r\n(\r\n    Custo
merId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR
(40)  NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARC
HAR(80),\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State
NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r
\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)
NOT NULL,\r\n    SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REF
ERENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO AC
TION\r\n)\n\nCREATE INDEX IFK_CustomerSupportRepId ON "customers" (SupportRe
pId)\n\nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId INTEGER PRIMARY KEY AU
TOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    InvoiceDat
e DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    BillingCity
NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry NVARCH
AR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(10,2)  N
OT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "customers" (CustomerId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "invoic
e_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n
FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t\tON DELETE
NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "trac
ks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE "artists"\r\n(\r\n    ArtistId INTEGER PRIMARY KEY AUTOINCREMENT NOT N
ULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE "tracks"\r\n(\r\n    Tra
ckId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)
NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n
GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER
NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r
\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE
NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genr
es" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIG
N KEY (MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE
NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "albums"\r\n(\r\n    Albu
mId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)
NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) R
EFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTI
ON\r\n)\n\nCREATE TABLE sqlite_stat1(tbl,idx,stat)\n\n\n===Additional Contex
t \n\nIn the chinook database invoice means order\n\n===Response Guidelines
\n1. If the provided context is sufficient, please generate a valid SQL quer
y without any explanations for the question. \n2. If the provided context is
almost sufficient but requires knowledge of a specific string in a particula
r column, please generate an intermediate SQL query to find the distinct str
ings in that column. Prepend the query with a comment saying intermediate_sq
l \n3. If the provided context is insufficient, please explain why it can\'t
```

```
be generated. \n4. Please use the most relevant table(s). \n5. If the questi
on has been asked and answered before, please repeat the answer exactly as i
t was given before. \n'}, {'role': 'user', 'content': '  \n    Find all invo
ices since 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'c
ontent': 'SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHER
E strftime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDate'}, {'role':
'user', 'content': '  \n    Get the total number of invoices for each custom
er\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT(*) AS Tot
alInvoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'user', 'conten
t': '  \n    List all albums and their corresponding artist names  \n'}, {'r
ole': 'assistant', 'content': 'SELECT a.Title AS AlbumTitle, ar.Name AS Arti
stName FROM "albums" a JOIN "artists" ar ON a.ArtistId = ar.ArtistId'}, {'ro
le': 'user', 'content': 'what are the top 5 countries that customers come fr
om?'}, {'role': 'assistant', 'content': 'SELECT Country, COUNT(*) AS Custome
rCount FROM "customers" GROUP BY Country ORDER BY CustomerCount DESC LIMIT
5'}, {'role': 'user', 'content': '  \n    List all invoices with a total exc
eeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "invoices"
WHERE Total > 10'}, {'role': 'user', 'content': 'How many customers are ther
e'}, {'role': 'assistant', 'content': 'SELECT COUNT(*) FROM "customers"'},
{'role': 'user', 'content': 'Can you list all tables in the SQLite database
catalog?'}, {'role': 'assistant', 'content': "SELECT name FROM sqlite_master
WHERE type='table'"}, {'role': 'user', 'content': '  \n    Find all tracks w
ith a name containing "What" (case-insensitive)\n'}, {'role': 'assistant',
'content': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role': 'use
r', 'content': "  \n    List all employees and their reporting manager's nam
e (if any):\n"}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE INDEX IFK_EmployeeReportsTo ON \"employees\" (Repo
rtsTo)\n\nCREATE TABLE \"employees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY
KEY AUTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    F
irstName NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo
INTEGER,\r\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address
NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Co
untry NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(2
4),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY
(ReportsTo) REFERENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"customers\"\r\n(\r\n    Custome
rId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(4
0)  NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHA
R(80),\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State N
VARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r
\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)
NOT NULL,\r\n    SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REF
ERENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE INDEX IFK_CustomerSupportRepId ON \"customers\" (Suppo
rtRepId)\n\nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER PRIMARY
KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    Invo
iceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    Billi
ngCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry
NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(1
0,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\" (Cu
stomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TAB
LE \"invoice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCRE
MENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  N
OT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  
NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO 
ACTION\r\n)\n\nCREATE TABLE \"artists\"\r\n(\r\n    ArtistId INTEGER PRIMARY
KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE 
\"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r
\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaType
Id INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(22
0),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    Unit
Price NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES \"alb
ums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FORE
IGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"media_t
ypes\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREM
ENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER 
NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE sqlite_st
at1(tbl,idx,stat)\n\n\n===Additional Context \n\nIn the chinook database inv
oice means order\n\n===Response Guidelines \n1. If the provided context is s
ufficient, please generate a valid SQL query without any explanations for th
e question. \n2. If the provided context is almost sufficient but requires k
nowledge of a specific string in a particular column, please generate an int
ermediate SQL query to find the distinct strings in that column. Prepend the
query with a comment saying intermediate_sql \n3. If the provided context is
insufficient, please explain why it can't be generated. \n4. Please use the 
most relevant table(s). \n5. If the question has been asked and answered bef
ore, please repeat the answer exactly as it was given before. \n"}, {"role":
"user", "content": "  \n    Find all invoices since 2010 and the total amoun
t invoiced:\n"}, {"role": "assistant", "content": "SELECT InvoiceDate, SUM(T
otal) AS TotalAmount FROM \"invoices\" WHERE strftime('%Y', InvoiceDate) >= 
'2010' GROUP BY InvoiceDate"}, {"role": "user", "content": "  \n    Get the 
total number of invoices for each customer\n"}, {"role": "assistant", "conte
nt": "SELECT CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP B
Y CustomerId"}, {"role": "user", "content": "  \n    List all albums and the
ir corresponding artist names  \n"}, {"role": "assistant", "content": "SELEC
T a.Title AS AlbumTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"arti
sts\" ar ON a.ArtistId = ar.ArtistId"}, {"role": "user", "content": "what ar
e the top 5 countries that customers come from?"}, {"role": "assistant", "co
ntent": "SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP 
BY Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "conten
t": "  \n    List all invoices with a total exceeding $10:\n"}, {"role": "as
sistant", "content": " SELECT * FROM \"invoices\" WHERE Total > 10"}, {"rol
e": "user", "content": "How many customers are there"}, {"role": "assistan
t", "content": "SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "cont
ent": "Can you list all tables in the SQLite database catalog?"}, {"role": 
"assistant", "content": "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {"role": "user", "content": "  \n    Find all tracks with a name conta
ining \"What\" (case-insensitive)\n"}, {"role": "assistant", "content": "SEL
ECT * FROM tracks WHERE Name LIKE '%What%'"}, {"role": "user", "content": "
```

```
\n    List all employees and their reporting manager's name (if any):\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:30:40.99489945
7Z', 'message': {'role': 'assistant', 'content': ' SELECT e1.FirstName || \'
\' || e1.LastName AS EmployeeName,\n       e2.FirstName || \' \' || e2.LastN
ame AS ManagerName\nFROM "employees" e1\nLEFT JOIN "employees" e2 ON e1.Repo
rtsTo = e2.EmployeeId'}, 'done_reason': 'stop', 'done': True, 'total_duratio
n': 109816151963, 'load_duration': 11412604, 'prompt_eval_count': 1604, 'pro
mpt_eval_duration': 92183077000, 'eval_count': 61, 'eval_duration': 16362312
000}
LLM Response:  SELECT e1.FirstName || ' ' || e1.LastName AS EmployeeName,
       e2.FirstName || ' ' || e2.LastName AS ManagerName
FROM "employees" e1
LEFT JOIN "employees" e2 ON e1.ReportsTo = e2.EmployeeId
 SELECT e1.FirstName || ' ' || e1.LastName AS EmployeeName,
       e2.FirstName || ' ' || e2.LastName AS ManagerName
FROM "employees" e1
LEFT JOIN "employees" e2 ON e1.ReportsTo = e2.EmployeeId
       EmployeeName       ManagerName
0      Andrew Adams              None
1     Nancy Edwards      Andrew Adams
2      Jane Peacock     Nancy Edwards
3     Margaret Park     Nancy Edwards
4     Steve Johnson     Nancy Edwards
5  Michael Mitchell      Andrew Adams
6       Robert King  Michael Mitchell
7    Laura Callahan  Michael Mitchell
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    List all employees and their reporting manager's name (if any):\n'\n\n
The DataFrame was produced using this query:  SELECT e1.FirstName || ' ' ||
e1.LastName AS EmployeeName,\n       e2.FirstName || ' ' || e2.LastName AS M
anagerName\nFROM \"employees\" e1\nLEFT JOIN \"employees\" e2 ON e1.ReportsT
o = e2.EmployeeId\n\nThe following is information about the resulting pandas
DataFrame 'df': \nRunning df.dtypes gives:\n EmployeeName    object\nManager
Name     object\ndtype: object"}, {"role": "user", "content": "Can you gener
ate the Python plotly code to chart the results of the dataframe? Assume the
data is in a pandas dataframe called 'df'. If there is only one value in the
dataframe, use an Indicator. Respond with only Python code. Do not answer wi
th any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:31:12.87026523
5Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nif len(df) == 1:\n    fig = px.indicator(df, title='Employee
Manager', mode='markers')\nelse:\n    fig = px.scatter(df, x='ManagerName',
y='EmployeeName', hover_name='EmployeeName', size_max=60)\n\nfig.show()\n``
`"}, 'done_reason': 'stop', 'done': True, 'total_duration': 31847949564, 'lo
ad_duration': 52648137, 'prompt_eval_count': 210, 'prompt_eval_duration': 11
920584000, 'eval_count': 74, 'eval_duration': 19817439000}
```


Laura Callahan
Robert King
Michael Mitchell
Steve Johnson
Margaret Park
Jane Peacock
Nancy Edwards
Andrew Adams
EmployeeName
Andrew Adams
Nancy Edwards
Michael Mitchell
ManagerName

Out[26]:

```
(' SELECT e1.FirstName || \' \' || e1.LastName AS EmployeeName,\n       e2.
FirstName || \' \' || e2.LastName AS ManagerName\nFROM "employees" e1\nLEFT
JOIN "employees" e2 ON e1.ReportsTo = e2.EmployeeId',
        EmployeeName       ManagerName
 0      Andrew Adams              None
 1     Nancy Edwards      Andrew Adams
 2      Jane Peacock     Nancy Edwards
 3     Margaret Park     Nancy Edwards
 4     Steve Johnson     Nancy Edwards
 5  Michael Mitchell      Andrew Adams
 6       Robert King  Michael Mitchell
 7    Laura Callahan  Michael Mitchell,
 Figure({
     'data': [{'hovertemplate': '<b>%{hovertext}</b><br><br>ManagerName=%
{x}<br>EmployeeName=%{y}<extra></extra>',
               'hovertext': array(['Andrew Adams', 'Nancy Edwards', 'Jane P
eacock', 'Margaret Park',
                                   'Steve Johnson', 'Michael Mitchell', 'Ro
bert King', 'Laura Callahan'],
                                  dtype=object),
               'legendgroup': '',
               'marker': {'color': '#636efa', 'symbol': 'circle'},
               'mode': 'markers',
               'name': '',
               'orientation': 'v',
               'showlegend': False,
               'type': 'scatter',
               'x': array([None, 'Andrew Adams', 'Nancy Edwards', 'Nancy Ed
wards', 'Nancy Edwards',
                           'Andrew Adams', 'Michael Mitchell', 'Michael Mit
chell'], dtype=object),
               'xaxis': 'x',
               'y': array(['Andrew Adams', 'Nancy Edwards', 'Jane Peacock',
'Margaret Park',
                           'Steve Johnson', 'Michael Mitchell', 'Robert Kin
g', 'Laura Callahan'],
                          dtype=object),
               'yaxis': 'y'}],
     'layout': {'legend': {'tracegroupgap': 0},
                'margin': {'t': 60},
                'template': '...',
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'ManagerName'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'EmployeeName'}}}
 }))
```

In [27]:

```
question = """
    Get the average invoice total for each customer:
"""

vn.ask(question=question)
```

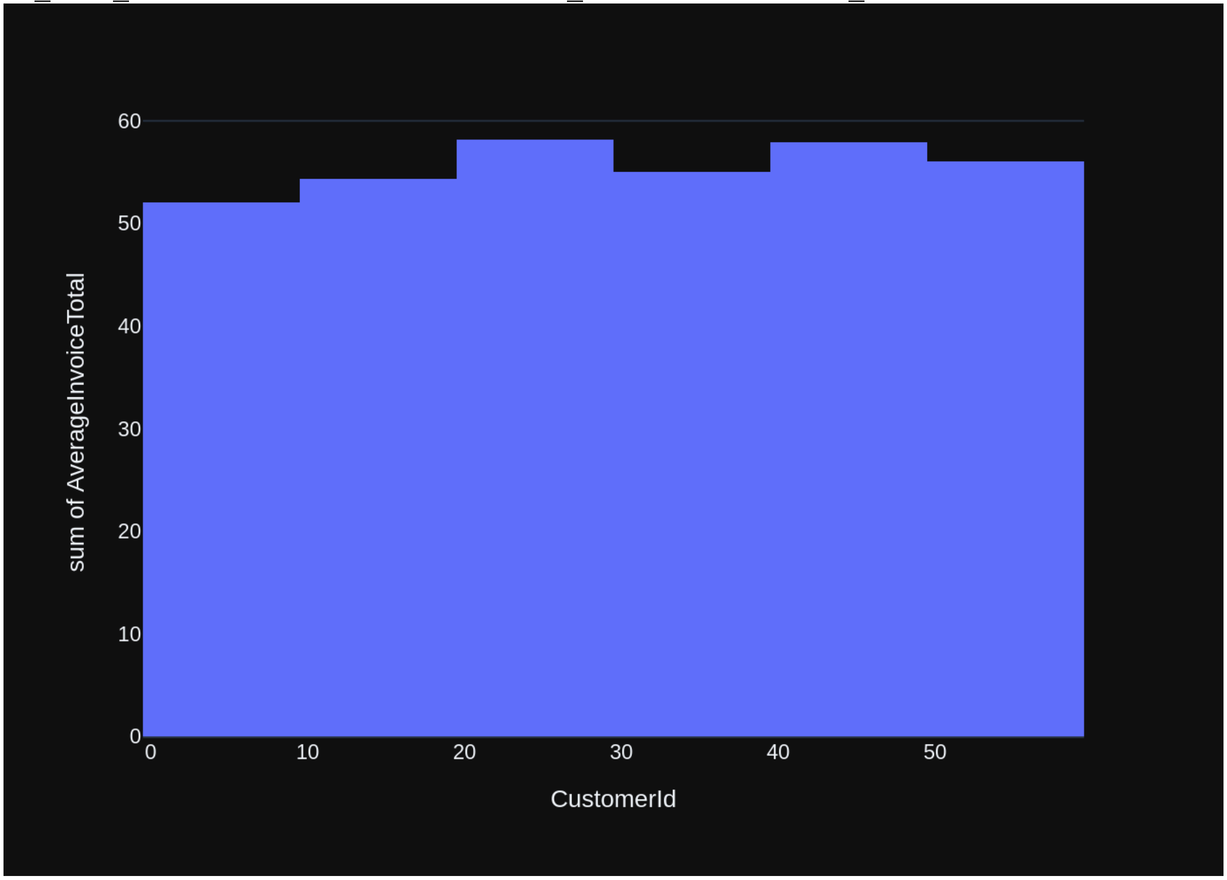
```
Number of requested results 10 is greater than number of elements in index
9, updating n_results = 9
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)\n\nCREATE IN
DEX IFK_InvoiceLineInvoiceId ON "invoice_items" (InvoiceId)\n\nCREATE TABLE
"invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT
NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NU
LL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT N
ULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nC
REATE TABLE sqlite_stat1(tbl,idx,stat)\n\nCREATE INDEX IFK_CustomerSupportRe
pId ON "customers" (SupportRepId)\n\nCREATE TABLE "customers"\r\n(\r\n    Cu
stomerId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCH
AR(40)  NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVA
RCHAR(80),\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    Sta
te NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(1
0),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHA
R(60)  NOT NULL,\r\n    SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRep
Id) REFERENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeReportsTo ON "employees" (Repor
tsTo)\n\nCREATE TABLE "employees"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    First
Name NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INT
EGER,\r\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NV
ARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Coun
try NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(2
4),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY
(ReportsTo) REFERENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION
ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nIn the chinook datab
ase invoice means order\n\n===Response Guidelines \n1. If the provided conte
xt is sufficient, please generate a valid SQL query without any explanations
for the question. \n2. If the provided context is almost sufficient but requ
ires knowledge of a specific string in a particular column, please generate
an intermediate SQL query to find the distinct strings in that column. Prepe
nd the query with a comment saying intermediate_sql \n3. If the provided con
text is insufficient, please explain why it can\'t be generated. \n4. Please
use the most relevant table(s). \n5. If the question has been asked and answ
ered before, please repeat the answer exactly as it was given before. \n'},
{'role': 'user', 'content': '  \n    Get the total number of invoices for ea
ch customer\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT
(*) AS TotalInvoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'user',
'content': '  \n    Find all invoices since 2010 and the total amount invoic
ed:\n'}, {'role': 'assistant', 'content': 'SELECT InvoiceDate, SUM(Total) AS
TotalAmount FROM "invoices" WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\'
GROUP BY InvoiceDate'}, {'role': 'user', 'content': '  \n    List all invoic
es with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELEC
T * FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': 'How man
```

```
y customers are there'}, {'role': 'assistant', 'content': 'SELECT COUNT(*) F
ROM "customers"'}, {'role': 'user', 'content': 'what are the top 5 countries
that customers come from?'}, {'role': 'assistant', 'content': 'SELECT Countr
y, COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY Cust
omerCount DESC LIMIT 5'}, {'role': 'user', 'content': "  \n    List all empl
oyees and their reporting manager's name (if any):\n"}, {'role': 'assistan
t', 'content': ' SELECT e1.FirstName || \' \' || e1.LastName AS EmployeeNam
e,\n       e2.FirstName || \' \' || e2.LastName AS ManagerName\nFROM "employ
ees" e1\nLEFT JOIN "employees" e2 ON e1.ReportsTo = e2.EmployeeId'}, {'rol
e': 'user', 'content': '  \n    List all albums and their corresponding arti
st names  \n'}, {'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTit
le, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId =
ar.ArtistId'}, {'role': 'user', 'content': '  \n    Find all tracks with a n
ame containing "What" (case-insensitive)\n'}, {'role': 'assistant', 'conten
t': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role': 'user', 'cont
ent': 'Can you list all tables in the SQLite database catalog?'}, {'role':
'assistant', 'content': "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {'role': 'user', 'content': '  \n    Get the average invoice total for
each customer:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerId)\n\nCREATE INDEX IFK
_InvoiceLineInvoiceId ON \"invoice_items\" (InvoiceId)\n\nCREATE TABLE \"inv
oice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NUL
L,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NU
LL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId) \r\n
\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) RE
FERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)
\n\nCREATE TABLE sqlite_stat1(tbl,idx,stat)\n\nCREATE INDEX IFK_CustomerSupp
ortRepId ON \"customers\" (SupportRepId)\n\nCREATE TABLE \"customers\"\r\n
(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    First
Name NVARCHAR(40)  NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n
Company NVARCHAR(80),\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(4
0),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCod
e NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    E
mail NVARCHAR(60)  NOT NULL,\r\n    SupportRepId INTEGER,\r\n    FOREIGN KEY
(SupportRepId) REFERENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeReportsTo ON \"emp
loyees\" (ReportsTo)\n\nCREATE TABLE \"employees\"\r\n(\r\n    EmployeeId IN
TEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT
NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r
\n    ReportsTo INTEGER,\r\n    BirthDate DATETIME,\r\n    HireDate DATETIM
E,\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARC
HAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    
Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    
FOREIGN KEY (ReportsTo) REFERENCES \"employees\" (EmployeeId) \r\n\t\tON DEL
ETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nIn the 
chinook database invoice means order\n\n===Response Guidelines \n1. If the p
rovided context is sufficient, please generate a valid SQL query without any 
explanations for the question. \n2. If the provided context is almost suffic
ient but requires knowledge of a specific string in a particular column, ple
ase generate an intermediate SQL query to find the distinct strings in that 
column. Prepend the query with a comment saying intermediate_sql \n3. If the 
provided context is insufficient, please explain why it can't be generated. 
\n4. Please use the most relevant table(s). \n5. If the question has been as
ked and answered before, please repeat the answer exactly as it was given be
fore. \n"}, {"role": "user", "content": "  \n    Get the total number of inv
oices for each customer\n"}, {"role": "assistant", "content": "SELECT Custom
erId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY CustomerId"}, {"r
ole": "user", "content": "  \n    Find all invoices since 2010 and the total 
amount invoiced:\n"}, {"role": "assistant", "content": "SELECT InvoiceDate, 
SUM(Total) AS TotalAmount FROM \"invoices\" WHERE strftime('%Y', InvoiceDat
e) >= '2010' GROUP BY InvoiceDate"}, {"role": "user", "content": "  \n    Li
st all invoices with a total exceeding $10:\n"}, {"role": "assistant", "cont
ent": " SELECT * FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "con
tent": "How many customers are there"}, {"role": "assistant", "content": "SE
LECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "what are th
e top 5 countries that customers come from?"}, {"role": "assistant", "conten
t": "SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY C
ountry ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": " 
\n    List all employees and their reporting manager's name (if any):\n"}, 
{"role": "assistant", "content": " SELECT e1.FirstName || ' ' || e1.LastName 
AS EmployeeName,\n       e2.FirstName || ' ' || e2.LastName AS ManagerName\n
FROM \"employees\" e1\nLEFT JOIN \"employees\" e2 ON e1.ReportsTo = e2.Emplo
yeeId"}, {"role": "user", "content": "  \n    List all albums and their corr
esponding artist names  \n"}, {"role": "assistant", "content": "SELECT a.Tit
le AS AlbumTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artists\" a
r ON a.ArtistId = ar.ArtistId"}, {"role": "user", "content": "  \n    Find a
ll tracks with a name containing \"What\" (case-insensitive)\n"}, {"role": 
"assistant", "content": "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, 
{"role": "user", "content": "Can you list all tables in the SQLite database 
catalog?"}, {"role": "assistant", "content": "SELECT name FROM sqlite_master 
WHERE type='table'"}, {"role": "user", "content": "  \n    Get the average i
nvoice total for each customer:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:32:36.21282923
5Z', 'message': {'role': 'assistant', 'content': 'SELECT CustomerId, AVG(Tot
al) AS AverageInvoiceTotal FROM "invoices" GROUP BY CustomerId'}, 'done_reas
on': 'stop', 'done': True, 'total_duration': 83245500804, 'load_duration': 1
5917778, 'prompt_eval_count': 1386, 'prompt_eval_duration': 75873128000, 'ev
al_count': 23, 'eval_duration': 6031934000}
LLM Response: SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM "inv
oices" GROUP BY CustomerId
SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM "invoices" GROUP B
Y CustomerId
    CustomerId  AverageInvoiceTotal
0            1             5.660000
```

```
1            2              5.374286
2            3              5.660000
3            4              5.660000
4            5              5.802857
5            6              7.088571
6            7              6.088571
7            8              5.374286
8            9              5.374286
9           10              5.374286
10          11              5.374286
11          12              5.374286
12          13              5.374286
13          14              5.374286
14          15              5.517143
15          16              5.374286
16          17              5.660000
17          18              5.374286
18          19              5.517143
19          20              5.660000
20          21              5.374286
21          22              5.660000
22          23              5.374286
23          24              6.231429
24          25              6.088571
25          26              6.802857
26          27              5.374286
27          28              6.231429
28          29              5.374286
29          30              5.374286
30          31              5.374286
31          32              5.374286
32          33              5.374286
33          34              5.660000
34          35              5.374286
35          36              5.374286
36          37              6.231429
37          38              5.374286
38          39              5.517143
39          40              5.517143
40          41              5.374286
41          42              5.660000
42          43              5.802857
43          44              5.945714
44          45              6.517143
45          46              6.517143
46          47              5.374286
47          48              5.802857
48          49              5.374286
49          50              5.374286
50          51              5.517143
51          52              5.374286
52          53              5.374286
53          54              5.374286
54          55              5.374286
55          56              5.374286
56          57              6.660000
```

```
57          58            5.517143
58          59            6.106667
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    Get the average invoice total for each customer:\n'\n\nThe DataFrame w
as produced using this query: SELECT CustomerId, AVG(Total) AS AverageInvoic
eTotal FROM \"invoices\" GROUP BY CustomerId\n\nThe following is information
about the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n Cust
omerId               int64\nAverageInvoiceTotal    float64\ndtype: object"},
{"role": "user", "content": "Can you generate the Python plotly code to char
t the results of the dataframe? Assume the data is in a pandas dataframe cal
led 'df'. If there is only one value in the dataframe, use an Indicator. Res
pond with only Python code. Do not answer with any explanations -- just the
code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:32:54.66603268
3Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nfig = px.histogram(df, x='CustomerId', y='AverageInvoiceTota
l')\nfig.show()\n```"}, 'done_reason': 'stop', 'done': True, 'total_duratio
n': 18427445664, 'load_duration': 13618818, 'prompt_eval_count': 172, 'promp
t_eval_duration': 9475125000, 'eval_count': 35, 'eval_duration': 8895303000}
```



```
Out[27]: ('SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM "invoices" GROU
         P BY CustomerId',
              CustomerId  AverageInvoiceTotal
          0            1             5.660000
          1            2             5.374286
          2            3             5.660000
          3            4             5.660000
          4            5             5.802857
          5            6             7.088571
          6            7             6.088571
          7            8             5.374286
          8            9             5.374286
          9           10             5.374286
          10          11             5.374286
          11          12             5.374286
          12          13             5.374286
          13          14             5.374286
          14          15             5.517143
          15          16             5.374286
          16          17             5.660000
          17          18             5.374286
          18          19             5.517143
          19          20             5.660000
          20          21             5.374286
          21          22             5.660000
          22          23             5.374286
          23          24             6.231429
          24          25             6.088571
          25          26             6.802857
          26          27             5.374286
          27          28             6.231429
          28          29             5.374286
          29          30             5.374286
          30          31             5.374286
          31          32             5.374286
          32          33             5.374286
          33          34             5.660000
          34          35             5.374286
          35          36             5.374286
          36          37             6.231429
          37          38             5.374286
          38          39             5.517143
          39          40             5.517143
          40          41             5.374286
          41          42             5.660000
          42          43             5.802857
          43          44             5.945714
          44          45             6.517143
          45          46             6.517143
          46          47             5.374286
          47          48             5.802857
          48          49             5.374286
          49          50             5.374286
          50          51             5.517143
          51          52             5.374286
          52          53             5.374286
```

```
 53          54             5.374286
 54          55             5.374286
 55          56             5.374286
 56          57             6.660000
 57          58             5.517143
 58          59             6.106667,
 Figure({
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               'bingroup': 'x',
               'histfunc': 'sum',
               'hovertemplate': 'CustomerId=%{x}<br>sum of AverageInvoiceTo
tal=%{y}<extra></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
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13, 14, 15, 16, 17, 18,
                           19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30,
31, 32, 33, 34, 35, 36,
                           37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48,
49, 50, 51, 52, 53, 54,
                           55, 56, 57, 58, 59]),
               'xaxis': 'x',
               'y': array([5.66      , 5.37428571, 5.66      , 5.66      ,
5.80285714, 7.08857143,
                           6.08857143, 5.37428571, 5.37428571, 5.37428571,
5.37428571, 5.37428571,
                           5.37428571, 5.37428571, 5.51714286, 5.37428571,
5.66      , 5.37428571,
                           5.51714286, 5.66      , 5.37428571, 5.66      ,
5.37428571, 6.23142857,
                           6.08857143, 6.80285714, 5.37428571, 6.23142857,
5.37428571, 5.37428571,
                           5.37428571, 5.37428571, 5.37428571, 5.66      ,
5.37428571, 5.37428571,
                           6.23142857, 5.37428571, 5.51714286, 5.51714286,
5.37428571, 5.66      ,
                           5.80285714, 5.94571429, 6.51714286, 6.51714286,
5.37428571, 5.80285714,
                           5.37428571, 5.37428571, 5.51714286, 5.37428571,
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                           5.37428571, 5.37428571, 6.66      , 5.51714286,
6.10666667]),
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                'margin': {'t': 60},
                'template': '...',
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'CustomerId'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'sum of AverageInvoiceTotal'}}}
 }))
```

In [28]:

```
question = """
    Find the top 5 most expensive tracks (based on unit price):
"""

vn.ask(question=question)
```

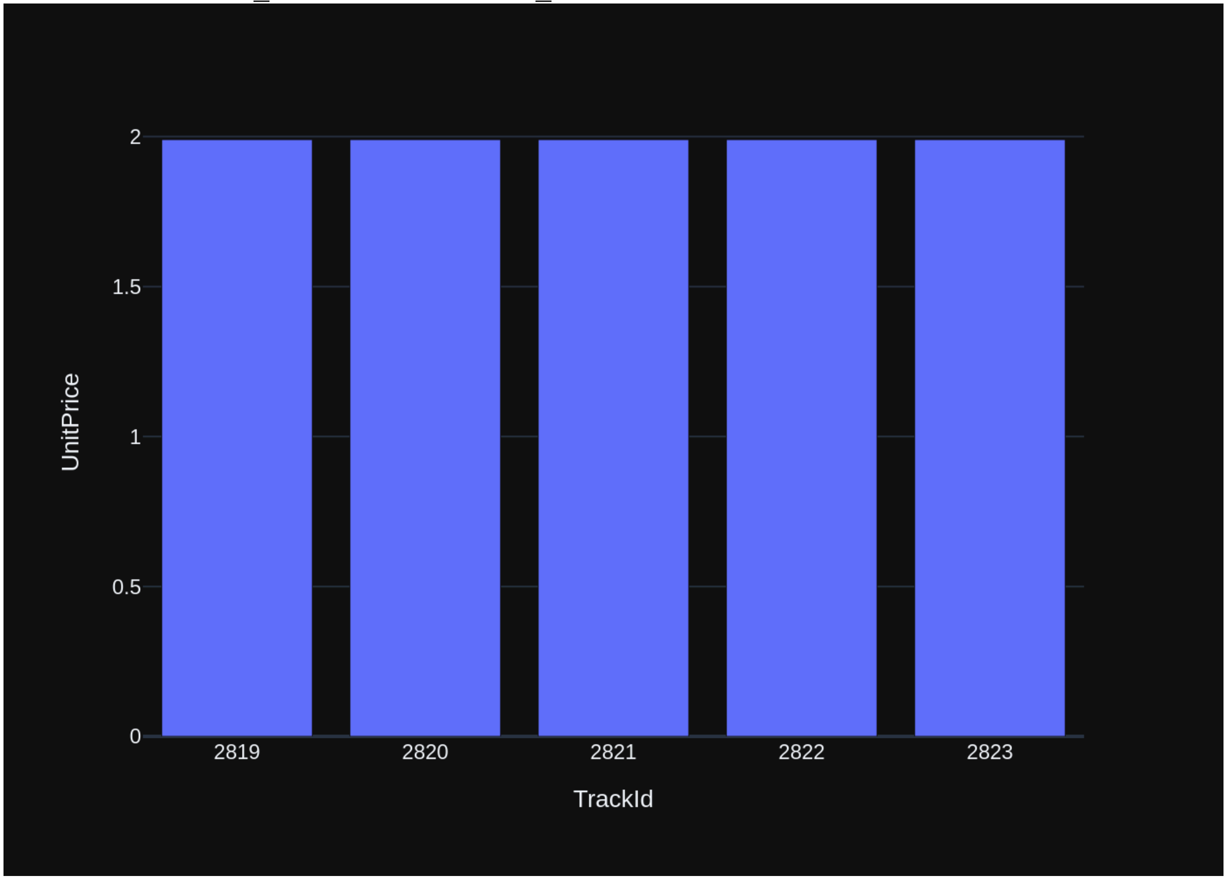
```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "tracks"\r\n(\r\n    TrackId INT
EGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NUL
L,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    Genr
eId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT
NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n
FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACT
ION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (G
enreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackAlbumId ON "tracks"
(AlbumId)\n\nCREATE INDEX IFK_TrackGenreId ON "tracks" (GenreId)\n\nCREATE I
NDEX IFK_PlaylistTrackTrackId ON "playlist_track" (TrackId)\n\nCREATE INDEX
IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nCREATE INDEX IFK_Trac
kMediaTypeId ON "tracks" (MediaTypeId)\n\nCREATE TABLE "invoice_items"\r\n
(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    In
voiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPric
e NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN
KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (Tra
ckId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE
"playlist_track"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId IN
TEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistI
d, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES "playlists" (Playlis
tId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Tr
ackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE N
O ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON "albums" (ArtistId)\n\nCR
EATE TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NO
T NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT N
ULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tO
N DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nI
n the chinook database invoice means order\n\n===Response Guidelines \n1. If
the provided context is sufficient, please generate a valid SQL query withou
t any explanations for the question. \n2. If the provided context is almost
sufficient but requires knowledge of a specific string in a particular colum
n, please generate an intermediate SQL query to find the distinct strings in
that column. Prepend the query with a comment saying intermediate_sql \n3. I
f the provided context is insufficient, please explain why it can\'t be gene
rated. \n4. Please use the most relevant table(s). \n5. If the question has
been asked and answered before, please repeat the answer exactly as it was g
iven before. \n'}, {'role': 'user', 'content': '  \n    Find all tracks with
a name containing "What" (case-insensitive)\n'}, {'role': 'assistant', 'cont
ent': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role': 'user', 'co
ntent': '  \n    List all invoices with a total exceeding $10:\n'}, {'role':
'assistant', 'content': ' SELECT * FROM "invoices" WHERE Total > 10'}, {'rol
e': 'user', 'content': '  \n    List all albums and their corresponding arti
st names  \n'}, {'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTit
le, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId =
ar.ArtistId'}, {'role': 'user', 'content': 'what are the top 5 countries tha
t customers come from?'}, {'role': 'assistant', 'content': 'SELECT Country,
COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY Custome
rCount DESC LIMIT 5'}, {'role': 'user', 'content': '  \n    Get the average
invoice total for each customer:\n'}, {'role': 'assistant', 'content': 'SELE
CT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM "invoices" GROUP BY Cu
```

```
stomerId'}, {'role': 'user', 'content': '  \n    Find all invoices since 201
0 and the total amount invoiced:\n'}, {'role': 'assistant', 'content': 'SELE
CT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHERE strftime(\'%
Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDate'}, {'role': 'user', 'cont
ent': 'Can you list all tables in the SQLite database catalog?'}, {'role':
'assistant', 'content': "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {'role': 'user', 'content': '  \n    Get the total number of invoices
for each customer\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId,
COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'u
ser', 'content': 'How many customers are there'}, {'role': 'assistant', 'con
tent': 'SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'content': "
\n    List all employees and their reporting manager's name (if any):\n"},
{'role': 'assistant', 'content': ' SELECT e1.FirstName || \' \' || e1.LastNa
me AS EmployeeName,\n       e2.FirstName || \' \' || e2.LastName AS ManagerN
ame\nFROM "employees" e1\nLEFT JOIN "employees" e2 ON e1.ReportsTo = e2.Empl
oyeeId'}, {'role': 'user', 'content': '  \n    Find the top 5 most expensive
tracks (based on unit price):\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMA
RY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    A
lbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGE
R,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n
Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY
(AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTy
peId) REFERENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackAlbumId ON \"tracks\" (Albu
mId)\n\nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (GenreId)\n\nCREATE INDE
X IFK_PlaylistTrackTrackId ON \"playlist_track\" (TrackId)\n\nCREATE INDEX I
FK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)\n\nCREATE INDEX IFK_Tra
ckMediaTypeId ON \"tracks\" (MediaTypeId)\n\nCREATE TABLE \"invoice_items
\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPr
ice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREI
GN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId) \r\n\t\tON DELETE NO
ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks
\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE \"playlist_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    Tr
ackId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (Pl
aylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlists\"
(PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN
KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON
UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums\" (Artis
tId)\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTO
INCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId IN
TEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (Artis
tId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional
Context \n\nIn the chinook database invoice means order\n\n===Response Guide
```

```
lines \n1. If the provided context is sufficient, please generate a valid SQ
L query without any explanations for the question. \n2. If the provided cont
ext is almost sufficient but requires knowledge of a specific string in a pa
rticular column, please generate an intermediate SQL query to find the disti
nct strings in that column. Prepend the query with a comment saying intermed
iate_sql \n3. If the provided context is insufficient, please explain why it
can't be generated. \n4. Please use the most relevant table(s). \n5. If the
question has been asked and answered before, please repeat the answer exactl
y as it was given before. \n"}, {"role": "user", "content": "  \n    Find al
l tracks with a name containing \"What\" (case-insensitive)\n"}, {"role": "a
ssistant", "content": "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {"ro
le": "user", "content": "  \n    List all invoices with a total exceeding $1
0:\n"}, {"role": "assistant", "content": " SELECT * FROM \"invoices\" WHERE
Total > 10"}, {"role": "user", "content": "  \n    List all albums and their
corresponding artist names  \n"}, {"role": "assistant", "content": "SELECT
a.Title AS AlbumTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artist
s\" ar ON a.ArtistId = ar.ArtistId"}, {"role": "user", "content": "what are
the top 5 countries that customers come from?"}, {"role": "assistant", "cont
ent": "SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY
Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "
\n    Get the average invoice total for each customer:\n"}, {"role": "assist
ant", "content": "SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM
\"invoices\" GROUP BY CustomerId"}, {"role": "user", "content": "  \n    Fin
d all invoices since 2010 and the total amount invoiced:\n"}, {"role": "assi
stant", "content": "SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM \"inv
oices\" WHERE strftime('%Y', InvoiceDate) >= '2010' GROUP BY InvoiceDate"},
{"role": "user", "content": "Can you list all tables in the SQLite database
catalog?"}, {"role": "assistant", "content": "SELECT name FROM sqlite_master
WHERE type='table'"}, {"role": "user", "content": "  \n    Get the total num
ber of invoices for each customer\n"}, {"role": "assistant", "content": "SEL
ECT CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY Custome
rId"}, {"role": "user", "content": "How many customers are there"}, {"role":
"assistant", "content": "SELECT COUNT(*) FROM \"customers\""}, {"role": "use
r", "content": "  \n    List all employees and their reporting manager's nam
e (if any):\n"}, {"role": "assistant", "content": " SELECT e1.FirstName || '
' || e1.LastName AS EmployeeName,\n       e2.FirstName || ' ' || e2.LastName
AS ManagerName\nFROM \"employees\" e1\nLEFT JOIN \"employees\" e2 ON e1.Repo
rtsTo = e2.EmployeeId"}, {"role": "user", "content": "  \n    Find the top 5
most expensive tracks (based on unit price):\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:34:11.09545904
Z', 'message': {'role': 'assistant', 'content': 'SELECT TrackId, Name, UnitP
rice FROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, 'done_reason': 'stop',
'done': True, 'total_duration': 76332552889, 'load_duration': 15142146, 'pro
mpt_eval_count': 1299, 'prompt_eval_duration': 69526890000, 'eval_count': 2
1, 'eval_duration': 5304432000}
LLM Response: SELECT TrackId, Name, UnitPrice FROM "tracks" ORDER BY UnitPri
ce DESC LIMIT 5
SELECT TrackId, Name, UnitPrice FROM "tracks" ORDER BY UnitPrice DESC LIMIT
5
   TrackId                                     Name  UnitPrice
0     2819  Battlestar Galactica: The Story So Far       1.99
1     2820                  Occupation / Precipice       1.99
2     2821                           Exodus, Pt. 1       1.99
3     2822                           Exodus, Pt. 2       1.99
4     2823                           Collaborators       1.99
```

```
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    Find the top 5 most expensive tracks (based on unit price):\n'\n\nThe
DataFrame was produced using this query: SELECT TrackId, Name, UnitPrice FRO
M \"tracks\" ORDER BY UnitPrice DESC LIMIT 5\n\nThe following is information
about the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n Trac
kId        int64\nName          object\nUnitPrice    float64\ndtype: objec
t"}, {"role": "user", "content": "Can you generate the Python plotly code to
chart the results of the dataframe? Assume the data is in a pandas dataframe
called 'df'. If there is only one value in the dataframe, use an Indicator.
Respond with only Python code. Do not answer with any explanations -- just t
he code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:34:28.29281771
7Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nfig = px.bar(df, x='TrackId', y='UnitPrice')\nfig.show()\n``
`"}, 'done_reason': 'stop', 'done': True, 'total_duration': 17177219215, 'lo
ad_duration': 55278587, 'prompt_eval_count': 178, 'prompt_eval_duration': 88
99825000, 'eval_count': 32, 'eval_duration': 8177320000}
```



```
Out[28]: ('SELECT TrackId, Name, UnitPrice FROM "tracks" ORDER BY UnitPrice DESC LIM
         IT 5',
             TrackId                                        Name  UnitPrice
          0     2819  Battlestar Galactica: The Story So Far       1.99
          1     2820                   Occupation / Precipice       1.99
          2     2821                            Exodus, Pt. 1       1.99
          3     2822                            Exodus, Pt. 2       1.99
          4     2823                            Collaborators       1.99,
          Figure({
              'data': [{'alignmentgroup': 'True',
                        'hovertemplate': 'TrackId=%{x}<br>UnitPrice=%{y}<extra></ext
         ra>',
                        'legendgroup': '',
                        'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
                        'name': '',
                        'offsetgroup': '',
                        'orientation': 'v',
                        'showlegend': False,
                        'textposition': 'auto',
                        'type': 'bar',
                        'x': array([2819, 2820, 2821, 2822, 2823]),
                        'xaxis': 'x',
                        'y': array([1.99, 1.99, 1.99, 1.99, 1.99]),
                        'yaxis': 'y'}],
              'layout': {'barmode': 'relative',
                         'legend': {'tracegroupgap': 0},
                         'margin': {'t': 60},
                         'template': '...',
                         'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'TrackId'}},
                         'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'UnitPrice'}}}
          }))
```

```
In [29]: question = """
             List all genres and the number of tracks in each genre:
         """

         vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "tracks"\r\n(\r\n    TrackId INT
EGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NUL
L,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    Genr
eId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT
NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n
FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACT
ION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (G
enreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackGenreId ON "tracks"
(GenreId)\n\nCREATE TABLE "genres"\r\n(\r\n    GenreId INTEGER PRIMARY KEY A
UTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_Pl
aylistTrackTrackId ON "playlist_track" (TrackId)\n\nCREATE INDEX IFK_TrackAl
bumId ON "tracks" (AlbumId)\n\nCREATE TABLE "playlists"\r\n(\r\n    Playlist
Id INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r
\n)\n\nCREATE INDEX IFK_TrackMediaTypeId ON "tracks" (MediaTypeId)\n\nCREATE
TABLE "playlist_track"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    Trac
kId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (Play
listId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES "playlists" (Pl
aylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KE
Y (TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION\r\n)\n\nCREATE TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIM
ARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n
ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artist
s" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
INDEX IFK_AlbumArtistId ON "albums" (ArtistId)\n\n\n===Additional Context \n
\nIn the chinook database invoice means order\n\n===Response Guidelines \n1.
If the provided context is sufficient, please generate a valid SQL query wit
hout any explanations for the question. \n2. If the provided context is almo
st sufficient but requires knowledge of a specific string in a particular co
lumn, please generate an intermediate SQL query to find the distinct strings
in that column. Prepend the query with a comment saying intermediate_sql \n
3. If the provided context is insufficient, please explain why it can\'t be
generated. \n4. Please use the most relevant table(s). \n5. If the question
has been asked and answered before, please repeat the answer exactly as it w
as given before. \n'}, {'role': 'user', 'content': '  \n    Find the top 5 m
ost expensive tracks (based on unit price):\n'}, {'role': 'assistant', 'cont
ent': 'SELECT TrackId, Name, UnitPrice FROM "tracks" ORDER BY UnitPrice DESC
LIMIT 5'}, {'role': 'user', 'content': '  \n    List all albums and their co
rresponding artist names  \n'}, {'role': 'assistant', 'content': 'SELECT a.T
itle AS AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar
ON a.ArtistId = ar.ArtistId'}, {'role': 'user', 'content': '  \n    Find all
tracks with a name containing "What" (case-insensitive)\n'}, {'role': 'assis
tant', 'content': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role':
'user', 'content': 'Can you list all tables in the SQLite database catalo
g?'}, {'role': 'assistant', 'content': "SELECT name FROM sqlite_master WHERE
type='table'"}, {'role': 'user', 'content': 'what are the top 5 countries th
at customers come from?'}, {'role': 'assistant', 'content': 'SELECT Country,
COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY Custome
rCount DESC LIMIT 5'}, {'role': 'user', 'content': '  \n    List all invoice
s with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT
* FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': '  \n    F
ind all invoices since 2010 and the total amount invoiced:\n'}, {'role': 'as
```

```
sistant', 'content': 'SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "in
voices" WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDat
e'}, {'role': 'user', 'content': '  \n    Get the total number of invoices f
or each customer\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, C
OUNT(*) AS TotalInvoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'us
er', 'content': '  \n    Get the average invoice total for each custome
r:\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, AVG(Total) AS A
verageInvoiceTotal FROM "invoices" GROUP BY CustomerId'}, {'role': 'user',
'content': 'How many customers are there'}, {'role': 'assistant', 'content':
'SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'content': '  \n    Li
st all genres and the number of tracks in each genre:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMA
RY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    A
lbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGE
R,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n
Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY
(AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTy
peId) REFERENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (Genr
eId)\n\nCREATE TABLE \"genres\"\r\n(\r\n    GenreId INTEGER PRIMARY KEY AUTO
INCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_Playl
istTrackTrackId ON \"playlist_track\" (TrackId)\n\nCREATE INDEX IFK_TrackAlb
umId ON \"tracks\" (AlbumId)\n\nCREATE TABLE \"playlists\"\r\n(\r\n    Playl
istId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)
\r\n)\n\nCREATE INDEX IFK_TrackMediaTypeId ON \"tracks\" (MediaTypeId)\n\nCR
EATE TABLE \"playlist_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n
TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY
(PlaylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlist
s\" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOR
EIGN KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTI
ON ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId I
NTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT N
ULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERE
NCES \"artists\" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION
\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums\" (ArtistId)\n\n\n===Add
itional Context \n\nIn the chinook database invoice means order\n\n===Respon
se Guidelines \n1. If the provided context is sufficient, please generate a
valid SQL query without any explanations for the question. \n2. If the provi
ded context is almost sufficient but requires knowledge of a specific string
in a particular column, please generate an intermediate SQL query to find th
e distinct strings in that column. Prepend the query with a comment saying i
ntermediate_sql \n3. If the provided context is insufficient, please explain
why it can't be generated. \n4. Please use the most relevant table(s). \n5.
If the question has been asked and answered before, please repeat the answer
exactly as it was given before. \n"}, {"role": "user", "content": "  \n    F
ind the top 5 most expensive tracks (based on unit price):\n"}, {"role": "as
```

```
sistant", "content": "SELECT TrackId, Name, UnitPrice FROM \"tracks\" ORDER
BY UnitPrice DESC LIMIT 5"}, {"role": "user", "content": "  \n    List all a
lbums and their corresponding artist names  \n"}, {"role": "assistant", "con
tent": "SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM \"albums\"
a JOIN \"artists\" ar ON a.ArtistId = ar.ArtistId"}, {"role": "user", "conte
nt": "  \n    Find all tracks with a name containing \"What\" (case-insensit
ive)\n"}, {"role": "assistant", "content": "SELECT * FROM tracks WHERE Name
LIKE '%What%'"}, {"role": "user", "content": "Can you list all tables in the
SQLite database catalog?"}, {"role": "assistant", "content": "SELECT name FR
OM sqlite_master WHERE type='table'"}, {"role": "user", "content": "what are
the top 5 countries that customers come from?"}, {"role": "assistant", "cont
ent": "SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY
Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "
\n    List all invoices with a total exceeding $10:\n"}, {"role": "assistan
t", "content": " SELECT * FROM \"invoices\" WHERE Total > 10"}, {"role": "us
er", "content": "  \n    Find all invoices since 2010 and the total amount i
nvoiced:\n"}, {"role": "assistant", "content": "SELECT InvoiceDate, SUM(Tota
l) AS TotalAmount FROM \"invoices\" WHERE strftime('%Y', InvoiceDate) >= '20
10' GROUP BY InvoiceDate"}, {"role": "user", "content": "  \n    Get the tot
al number of invoices for each customer\n"}, {"role": "assistant", "conten
t": "SELECT CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY
CustomerId"}, {"role": "user", "content": "  \n    Get the average invoice t
otal for each customer:\n"}, {"role": "assistant", "content": "SELECT Custom
erId, AVG(Total) AS AverageInvoiceTotal FROM \"invoices\" GROUP BY CustomerI
d"}, {"role": "user", "content": "How many customers are there"}, {"role":
"assistant", "content": "SELECT COUNT(*) FROM \"customers\""}, {"role": "use
r", "content": "  \n    List all genres and the number of tracks in each gen
re:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:35:46.02519938
4Z', 'message': {'role': 'assistant', 'content': 'SELECT g.Name AS GenreNam
e, COUNT(t.TrackId) AS TrackCount FROM "genres" g LEFT JOIN "tracks" t ON g.
GenreId = t.GenereId GROUP BY g.GenreId'}, 'done_reason': 'stop', 'done': Tr
ue, 'total_duration': 77643485847, 'load_duration': 13647595, 'prompt_eval_c
ount': 1168, 'prompt_eval_duration': 63390379000, 'eval_count': 48, 'eval_du
ration': 12750809000}
LLM Response: SELECT g.Name AS GenreName, COUNT(t.TrackId) AS TrackCount FRO
M "genres" g LEFT JOIN "tracks" t ON g.GenreId = t.GenereId GROUP BY g.Genre
Id
SELECT g.Name AS GenreName, COUNT(t.TrackId) AS TrackCount FROM "genres" g L
EFT JOIN "tracks" t ON g.GenreId = t.GenereId GROUP BY g.GenreId
Couldn't run sql:  Execution failed on sql 'SELECT g.Name AS GenreName, COUN
T(t.TrackId) AS TrackCount FROM "genres" g LEFT JOIN "tracks" t ON g.GenreId
= t.GenereId GROUP BY g.GenreId': no such column: t.GenereId
```

In [30]:

```
question = """
    Get all genres that do not have any tracks associated with them:
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE INDEX IFK_TrackGenreId ON "tracks" (Ge
nreId)\n\nCREATE TABLE "tracks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTO
INCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTE
GER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Co
mposer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes IN
TEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumI
d) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO AC
TION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (GenreId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFER
ENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO A
CTION\r\n)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON "playlist_track" (Tra
ckId)\n\nCREATE INDEX IFK_TrackMediaTypeId ON "tracks" (MediaTypeId)\n\nCREA
TE INDEX IFK_TrackAlbumId ON "tracks" (AlbumId)\n\nCREATE TABLE "genres"\r\n
(\r\n    GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVA
RCHAR(120)\r\n)\n\nCREATE TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY
KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    Art
istId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists"
(ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TA
BLE "playlist_track"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackI
d INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (Playli
stId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES "playlists" (Play
listId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON "albums" (ArtistId)\n
\nCREATE TABLE "playlists"\r\n(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===Additional Context
\n\nIn the chinook database invoice means order\n\n===Response Guidelines \n
1. If the provided context is sufficient, please generate a valid SQL query
without any explanations for the question. \n2. If the provided context is a
lmost sufficient but requires knowledge of a specific string in a particular
column, please generate an intermediate SQL query to find the distinct strin
gs in that column. Prepend the query with a comment saying intermediate_sql
\n3. If the provided context is insufficient, please explain why it can\'t b
e generated. \n4. Please use the most relevant table(s). \n5. If the questio
n has been asked and answered before, please repeat the answer exactly as it
was given before. \n'}, {'role': 'user', 'content': '  \n    Find all tracks
with a name containing "What" (case-insensitive)\n'}, {'role': 'assistant',
'content': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role': 'use
r', 'content': '  \n    List all albums and their corresponding artist names
\n'}, {'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTitle, ar.Nam
e AS ArtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId = ar.ArtistI
d'}, {'role': 'user', 'content': '  \n    Find the top 5 most expensive trac
ks (based on unit price):\n'}, {'role': 'assistant', 'content': 'SELECT Trac
kId, Name, UnitPrice FROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, {'rol
e': 'user', 'content': 'Can you list all tables in the SQLite database catal
og?'}, {'role': 'assistant', 'content': "SELECT name FROM sqlite_master WHER
E type='table'"}, {'role': 'user', 'content': '  \n    Find all invoices sin
ce 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'content':
'SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHERE strftim
e(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDate'}, {'role': 'user',
'content': '  \n    List all invoices with a total exceeding $10:\n'}, {'rol
e': 'assistant', 'content': ' SELECT * FROM "invoices" WHERE Total > 10'},
{'role': 'user', 'content': 'what are the top 5 countries that customers com
```

```
e from?'}, {'role': 'assistant', 'content': 'SELECT Country, COUNT(*) AS Cus
tomerCount FROM "customers" GROUP BY Country ORDER BY CustomerCount DESC LIM
IT 5'}, {'role': 'user', 'content': "  \n    List all employees and their re
porting manager's name (if any):\n"}, {'role': 'assistant', 'content': ' SEL
ECT e1.FirstName || \' \' || e1.LastName AS EmployeeName,\n       e2.FirstNa
me || \' \' || e2.LastName AS ManagerName\nFROM "employees" e1\nLEFT JOIN "e
mployees" e2 ON e1.ReportsTo = e2.EmployeeId'}, {'role': 'user', 'content':
'How many customers are there'}, {'role': 'assistant', 'content': 'SELECT CO
UNT(*) FROM "customers"'}, {'role': 'user', 'content': '  \n    Get the aver
age invoice total for each customer:\n'}, {'role': 'assistant', 'content':
'SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM "invoices" GROUP
BY CustomerId'}, {'role': 'user', 'content': '  \n    Get all genres that do
not have any tracks associated with them:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (GenreId)\n\n
CREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMEN
T NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n
MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARC
HAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES
\"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n
FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"med
ia_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON \"playlist_track\" (TrackId)
\n\nCREATE INDEX IFK_TrackMediaTypeId ON \"tracks\" (MediaTypeId)\n\nCREATE
INDEX IFK_TrackAlbumId ON \"tracks\" (AlbumId)\n\nCREATE TABLE \"genres\"\r
\n(\r\n    GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name N
VARCHAR(120)\r\n)\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRI
MARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n
ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artis
ts\" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREA
TE TABLE \"playlist_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n
TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY
(PlaylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlist
s\" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOR
EIGN KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTI
ON ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums\"
(ArtistId)\n\nCREATE TABLE \"playlists\"\r\n(\r\n    PlaylistId INTEGER PRIM
ARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===Addit
ional Context \n\nIn the chinook database invoice means order\n\n===Response
Guidelines \n1. If the provided context is sufficient, please generate a val
id SQL query without any explanations for the question. \n2. If the provided
context is almost sufficient but requires knowledge of a specific string in
a particular column, please generate an intermediate SQL query to find the d
istinct strings in that column. Prepend the query with a comment saying inte
rmediate_sql \n3. If the provided context is insufficient, please explain wh
y it can't be generated. \n4. Please use the most relevant table(s). \n5. If
the question has been asked and answered before, please repeat the answer ex
```

```
actly as it was given before. \n"}, {"role": "user", "content": "  \n    Fin
d all tracks with a name containing \"What\" (case-insensitive)\n"}, {"rol
e": "assistant", "content": "SELECT * FROM tracks WHERE Name LIKE '%Wha
t%'"}, {"role": "user", "content": "  \n    List all albums and their corres
ponding artist names  \n"}, {"role": "assistant", "content": "SELECT a.Title
AS AlbumTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artists\" ar O
N a.ArtistId = ar.ArtistId"}, {"role": "user", "content": "  \n    Find the
top 5 most expensive tracks (based on unit price):\n"}, {"role": "assistan
t", "content": "SELECT TrackId, Name, UnitPrice FROM \"tracks\" ORDER BY Uni
tPrice DESC LIMIT 5"}, {"role": "user", "content": "Can you list all tables
in the SQLite database catalog?"}, {"role": "assistant", "content": "SELECT
name FROM sqlite_master WHERE type='table'"}, {"role": "user", "content": "
\n    Find all invoices since 2010 and the total amount invoiced:\n"}, {"rol
e": "assistant", "content": "SELECT InvoiceDate, SUM(Total) AS TotalAmount F
ROM \"invoices\" WHERE strftime('%Y', InvoiceDate) >= '2010' GROUP BY Invoic
eDate"}, {"role": "user", "content": "  \n    List all invoices with a total
exceeding $10:\n"}, {"role": "assistant", "content": " SELECT * FROM \"invoi
ces\" WHERE Total > 10"}, {"role": "user", "content": "what are the top 5 co
untries that customers come from?"}, {"role": "assistant", "content": "SELEC
T Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY Country ORD
ER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "  \n    Lis
t all employees and their reporting manager's name (if any):\n"}, {"role":
"assistant", "content": " SELECT e1.FirstName || ' ' || e1.LastName AS Emplo
yeeName,\n       e2.FirstName || ' ' || e2.LastName AS ManagerName\nFROM \"e
mployees\" e1\nLEFT JOIN \"employees\" e2 ON e1.ReportsTo = e2.EmployeeId"},
{"role": "user", "content": "How many customers are there"}, {"role": "assis
tant", "content": "SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "c
ontent": "  \n    Get the average invoice total for each customer:\n"}, {"ro
le": "assistant", "content": "SELECT CustomerId, AVG(Total) AS AverageInvoic
eTotal FROM \"invoices\" GROUP BY CustomerId"}, {"role": "user", "content":
"  \n    Get all genres that do not have any tracks associated with the
m:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:37:06.15807058
Z', 'message': {'role': 'assistant', 'content': 'SELECT g.Name FROM "genres"
g LEFT JOIN "tracks" t ON g.GenreId = t.GenereId WHERE t.TrackId IS NULL'},
'done_reason': 'stop', 'done': True, 'total_duration': 80090823393, 'load_du
ration': 13848230, 'prompt_eval_count': 1213, 'prompt_eval_duration': 690876
33000, 'eval_count': 35, 'eval_duration': 9534663000}
LLM Response: SELECT g.Name FROM "genres" g LEFT JOIN "tracks" t ON g.GenreI
d = t.GenereId WHERE t.TrackId IS NULL
SELECT g.Name FROM "genres" g LEFT JOIN "tracks" t ON g.GenreId = t.GenereId
WHERE t.TrackId IS NULL
Couldn't run sql:  Execution failed on sql 'SELECT g.Name FROM "genres" g LE
FT JOIN "tracks" t ON g.GenreId = t.GenereId WHERE t.TrackId IS NULL': no su
ch column: t.GenereId
```

In [31]:

```
question = """
    List all customers who have not placed any orders:
"""


vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName N
VARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR
(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NV
ARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "inv
oice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NUL
L,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NU
LL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE "employees"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY A
UTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstN
ame NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTE
GER,\r\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVA
RCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Count
ry NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(2
4),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY
(ReportsTo) REFERENCES "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION
ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "playlist_track"\r\n(\r\n    Playli
stId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT
PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KEY (Pla
ylistId) REFERENCES "playlists" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON
UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "album
s"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Ti
tle NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREI
GN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_CustomerSupportRepId ON "cust
omers" (SupportRepId)\n\nCREATE TABLE "playlists"\r\n(\r\n    PlaylistId INT
EGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nC
REATE TABLE "tracks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT N
OT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n
MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARC
HAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES
"albums" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    F
OREIGN KEY (GenreId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTI
ON ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_t
ypes" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n
CREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)\n\n\n===Additi
onal Context \n\nIn the chinook database invoice means order\n\n===Response
Guidelines \n1. If the provided context is sufficient, please generate a val
```

```
id SQL query without any explanations for the question. \n2. If the provided
context is almost sufficient but requires knowledge of a specific string in
a particular column, please generate an intermediate SQL query to find the d
istinct strings in that column. Prepend the query with a comment saying inte
rmediate_sql \n3. If the provided context is insufficient, please explain wh
y it can\'t be generated. \n4. Please use the most relevant table(s). \n5. I
f the question has been asked and answered before, please repeat the answer
exactly as it was given before. \n'}, {'role': 'user', 'content': 'what are
the top 5 countries that customers come from?'}, {'role': 'assistant', 'cont
ent': 'SELECT Country, COUNT(*) AS CustomerCount FROM "customers" GROUP BY C
ountry ORDER BY CustomerCount DESC LIMIT 5'}, {'role': 'user', 'content': 'H
ow many customers are there'}, {'role': 'assistant', 'content': 'SELECT COUN
T(*) FROM "customers"'}, {'role': 'user', 'content': '  \n    Get the total
number of invoices for each customer\n'}, {'role': 'assistant', 'content':
'SELECT CustomerId, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY Custo
merId'}, {'role': 'user', 'content': '  \n    List all invoices with a total
exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "invoic
es" WHERE Total > 10'}, {'role': 'user', 'content': '  \n    Find all invoic
es since 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'con
tent': 'SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHERE
strftime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDate'}, {'role':
'user', 'content': '  \n    Get the average invoice total for each custome
r:\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, AVG(Total) AS A
verageInvoiceTotal FROM "invoices" GROUP BY CustomerId'}, {'role': 'user',
'content': "  \n    List all employees and their reporting manager's name (i
f any):\n"}, {'role': 'assistant', 'content': ' SELECT e1.FirstName || \' \'
|| e1.LastName AS EmployeeName,\n       e2.FirstName || \' \' || e2.LastName
AS ManagerName\nFROM "employees" e1\nLEFT JOIN "employees" e2 ON e1.ReportsT
o = e2.EmployeeId'}, {'role': 'user', 'content': '  \n    List all albums an
d their corresponding artist names  \n'}, {'role': 'assistant', 'content':
'SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN "a
rtists" ar ON a.ArtistId = ar.ArtistId'}, {'role': 'user', 'content': '  \n
Find the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'a
ssistant', 'content': 'SELECT TrackId, Name, UnitPrice FROM "tracks" ORDER B
Y UnitPrice DESC LIMIT 5'}, {'role': 'user', 'content': 'Can you list all ta
bles in the SQLite database catalog?'}, {'role': 'assistant', 'content': "SE
LECT name FROM sqlite_master WHERE type='table'"}, {'role': 'user', 'conten
t': '  \n    List all customers who have not placed any orders:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCREMENT
NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVARCHAR
(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(70),\r
\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR
(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax
NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId INTEG
ER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employees\" (EmployeeId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"invoi
ce_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT N
ULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r
\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION
\r\n)\n\nCREATE TABLE \"employees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY K
EY AUTOINCREMENT NOT NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Fi
rstName NVARCHAR(20)  NOT NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo
INTEGER,\r\n    BirthDate DATETIME,\r\n    HireDate DATETIME,\r\n    Address
NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Co
untry NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(2
4),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY
(ReportsTo) REFERENCES \"employees\" (EmployeeId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"playlist_track\"\r\n(\r\n    Pl
aylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONSTRA
INT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KEY
(PlaylistId) REFERENCES \"playlists\" (PlaylistId) \r\n\t\tON DELETE NO ACTI
ON ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\"
(TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TAB
LE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId) \r\n\t\tO
N DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_CustomerSupp
ortRepId ON \"customers\" (SupportRepId)\n\nCREATE TABLE \"playlists\"\r\n
(\r\n    PlaylistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name
NVARCHAR(120)\r\n)\n\nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PR
IMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n
AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGE
R,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n
Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY
(AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTy
peId) REFERENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceCustomerId ON \"invoices
\" (CustomerId)\n\n\n===Additional Context \n\nIn the chinook database invoi
ce means order\n\n===Response Guidelines \n1. If the provided context is suf
ficient, please generate a valid SQL query without any explanations for the
question. \n2. If the provided context is almost sufficient but requires kno
wledge of a specific string in a particular column, please generate an inter
mediate SQL query to find the distinct strings in that column. Prepend the q
uery with a comment saying intermediate_sql \n3. If the provided context is
insufficient, please explain why it can't be generated. \n4. Please use the
most relevant table(s). \n5. If the question has been asked and answered bef
ore, please repeat the answer exactly as it was given before. \n"}, {"role":
"user", "content": "what are the top 5 countries that customers come fro
m?"}, {"role": "assistant", "content": "SELECT Country, COUNT(*) AS Customer
Count FROM \"customers\" GROUP BY Country ORDER BY CustomerCount DESC LIMIT
5"}, {"role": "user", "content": "How many customers are there"}, {"role":
"assistant", "content": "SELECT COUNT(*) FROM \"customers\""}, {"role": "use
```

```
r", "content": "  \n    Get the total number of invoices for each customer
\n"}, {"role": "assistant", "content": "SELECT CustomerId, COUNT(*) AS Total
Invoices FROM \"invoices\" GROUP BY CustomerId"}, {"role": "user", "conten
t": "  \n    List all invoices with a total exceeding $10:\n"}, {"role": "as
sistant", "content": " SELECT * FROM \"invoices\" WHERE Total > 10"}, {"rol
e": "user", "content": "  \n    Find all invoices since 2010 and the total a
mount invoiced:\n"}, {"role": "assistant", "content": "SELECT InvoiceDate, S
UM(Total) AS TotalAmount FROM \"invoices\" WHERE strftime('%Y', InvoiceDate)
>= '2010' GROUP BY InvoiceDate"}, {"role": "user", "content": "  \n    Get t
he average invoice total for each customer:\n"}, {"role": "assistant", "cont
ent": "SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM \"invoices
\" GROUP BY CustomerId"}, {"role": "user", "content": "  \n    List all empl
oyees and their reporting manager's name (if any):\n"}, {"role": "assistan
t", "content": " SELECT e1.FirstName || ' ' || e1.LastName AS EmployeeNam
e,\n       e2.FirstName || ' ' || e2.LastName AS ManagerName\nFROM \"employe
es\" e1\nLEFT JOIN \"employees\" e2 ON e1.ReportsTo = e2.EmployeeId"}, {"rol
e": "user", "content": "  \n    List all albums and their corresponding arti
st names  \n"}, {"role": "assistant", "content": "SELECT a.Title AS AlbumTit
le, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artists\" ar ON a.ArtistI
d = ar.ArtistId"}, {"role": "user", "content": "  \n    Find the top 5 most
expensive tracks (based on unit price):\n"}, {"role": "assistant", "conten
t": "SELECT TrackId, Name, UnitPrice FROM \"tracks\" ORDER BY UnitPrice DESC
LIMIT 5"}, {"role": "user", "content": "Can you list all tables in the SQLit
e database catalog?"}, {"role": "assistant", "content": "SELECT name FROM sq
lite_master WHERE type='table'"}, {"role": "user", "content": "  \n    List
all customers who have not placed any orders:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:39:03.00158408
5Z', 'message': {'role': 'assistant', 'content': 'intermediate_sql\n-- Find
distinct customer IDs that have no invoices\nSELECT DISTINCT CustomerId FROM
"customers" WHERE CustomerId NOT IN (SELECT DISTINCT CustomerId FROM "invoic
es")'}, 'done_reason': 'stop', 'done': True, 'total_duration': 116801154598,
'load_duration': 15761929, 'prompt_eval_count': 1842, 'prompt_eval_duratio
n': 103951780000, 'eval_count': 42, 'eval_duration': 11301014000}
LLM Response: intermediate_sql
-- Find distinct customer IDs that have no invoices
SELECT DISTINCT CustomerId FROM "customers" WHERE CustomerId NOT IN (SELECT
DISTINCT CustomerId FROM "invoices")
The LLM is not allowed to see the data in your database. Your question requi
res database introspection to generate the necessary SQL. Please set allow_l
lm_to_see_data=True to enable this.
Couldn't run sql:  Execution failed on sql 'The LLM is not allowed to see th
e data in your database. Your question requires database introspection to ge
nerate the necessary SQL. Please set allow_llm_to_see_data=True to enable th
is.': near "The": syntax error
```

In [32]:

```
question = """
    There are 3 tables: artists, albums and tracks, where albums and artists
    Can you find the top 10 most popular artists based on the number of trac
"""

vn.ask(question=question)
```

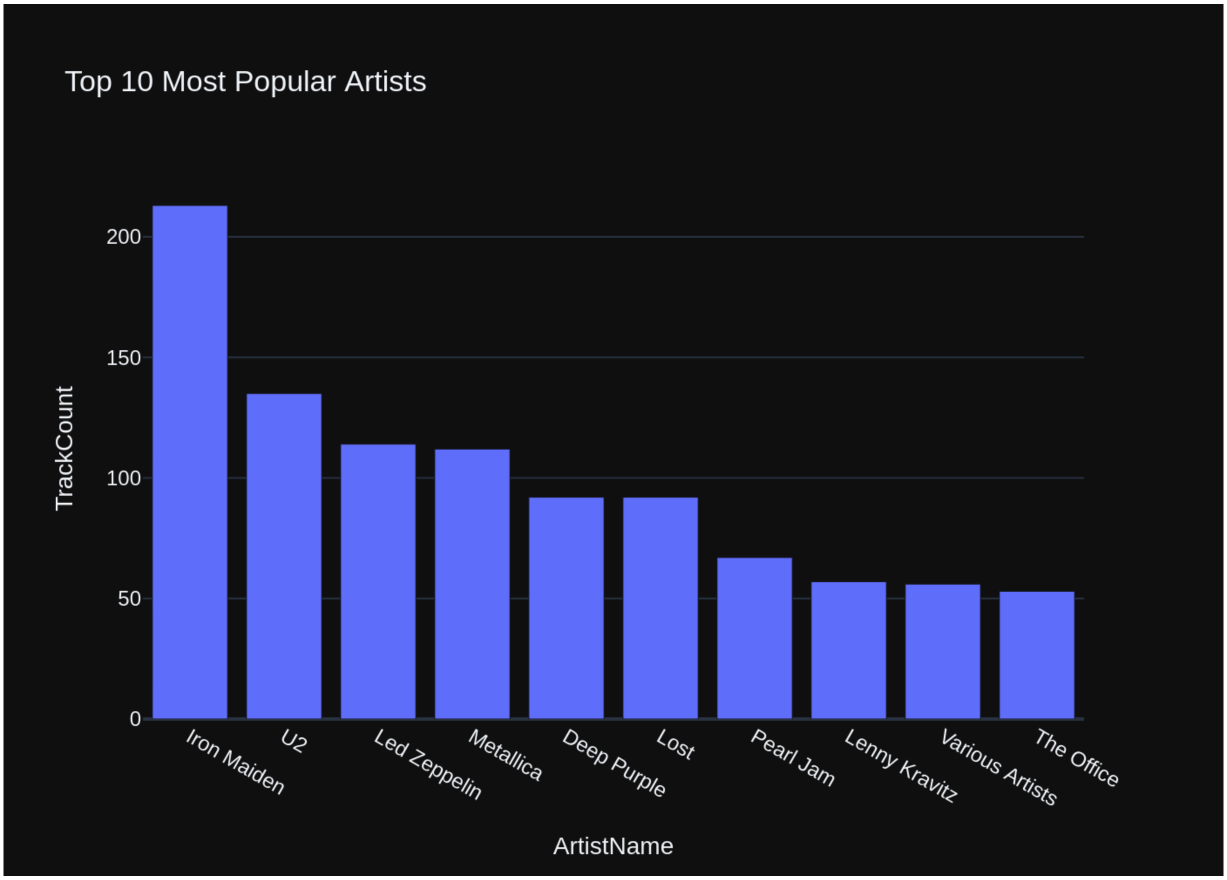
```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "tracks"\r\n(\r\n    TrackId INT
EGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NUL
L,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    Genr
eId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT
NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n
FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACT
ION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (G
enreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "albums"\r\n(\r\n    AlbumId I
NTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT N
ULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERE
NCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE "artists"\r\n(\r\n    ArtistId INTEGER PRIMARY KEY AUTOI
NCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_AlbumA
rtistId ON "albums" (ArtistId)\n\nCREATE INDEX IFK_TrackAlbumId ON "tracks"
(AlbumId)\n\nCREATE TABLE "playlists"\r\n(\r\n    PlaylistId INTEGER PRIMARY
KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE
"genres"\r\n(\r\n    GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Name NVARCHAR(120)\r\n)\n\nCREATE TABLE "playlist_track"\r\n(\r\n    Playlis
tId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT P
K_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KEY (Play
listId) REFERENCES "playlists" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON U
PDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_Tra
ckGenreId ON "tracks" (GenreId)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON
"playlist_track" (TrackId)\n\n\n===Additional Context \n\nIn the chinook dat
abase invoice means order\n\n===Response Guidelines \n1. If the provided con
text is sufficient, please generate a valid SQL query without any explanatio
ns for the question. \n2. If the provided context is almost sufficient but r
equires knowledge of a specific string in a particular column, please genera
te an intermediate SQL query to find the distinct strings in that column. Pr
epend the query with a comment saying intermediate_sql \n3. If the provided
context is insufficient, please explain why it can\'t be generated. \n4. Ple
ase use the most relevant table(s). \n5. If the question has been asked and
answered before, please repeat the answer exactly as it was given before.
\n'}, {'role': 'user', 'content': '  \n    Find the top 5 most expensive tra
cks (based on unit price):\n'}, {'role': 'assistant', 'content': 'SELECT Tra
ckId, Name, UnitPrice FROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, {'rol
e': 'user', 'content': '  \n    List all albums and their corresponding arti
st names  \n'}, {'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTit
le, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId =
ar.ArtistId'}, {'role': 'user', 'content': 'what are the top 5 countries tha
t customers come from?'}, {'role': 'assistant', 'content': 'SELECT Country,
COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY Custome
rCount DESC LIMIT 5'}, {'role': 'user', 'content': '  \n    Find all tracks
with a name containing "What" (case-insensitive)\n'}, {'role': 'assistant',
'content': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role': 'use
r', 'content': 'Can you list all tables in the SQLite database catalog?'},
{'role': 'assistant', 'content': "SELECT name FROM sqlite_master WHERE type
='table'"}, {'role': 'user', 'content': '  \n    List all invoices with a to
tal exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "in
voices" WHERE Total > 10'}, {'role': 'user', 'content': '  \n    Get the ave
```

```
rage invoice total for each customer:\n'}, {'role': 'assistant', 'content':
'SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM "invoices" GROUP
BY CustomerId'}, {'role': 'user', 'content': '  \n    Get the total number o
f invoices for each customer\n'}, {'role': 'assistant', 'content': 'SELECT C
ustomerId, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY CustomerId'},
{'role': 'user', 'content': '  \n    Find all invoices since 2010 and the to
tal amount invoiced:\n'}, {'role': 'assistant', 'content': 'SELECT InvoiceDa
te, SUM(Total) AS TotalAmount FROM "invoices" WHERE strftime(\'%Y\', Invoice
Date) >= \'2010\' GROUP BY InvoiceDate'}, {'role': 'user', 'content': 'How m
any customers are there'}, {'role': 'assistant', 'content': 'SELECT COUNT(*)
FROM "customers"'}, {'role': 'user', 'content': ' \n    There are 3 tables:
artists, albums and tracks, where albums and artists are linked by ArtistId,
albums and tracks are linked by AlbumId,\n    Can you find the top 10 most p
opular artists based on the number of tracks\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMA
RY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    A
lbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGE
R,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n
Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY
(AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTy
peId) REFERENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEG
ER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NUL
L,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENC
ES \"artists\" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE \"artists\"\r\n(\r\n    ArtistId INTEGER PRIMARY KEY AUT
OINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_Albu
mArtistId ON \"albums\" (ArtistId)\n\nCREATE INDEX IFK_TrackAlbumId ON \"tra
cks\" (AlbumId)\n\nCREATE TABLE \"playlists\"\r\n(\r\n    PlaylistId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE
TABLE \"genres\"\r\n(\r\n    GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT N
ULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE TABLE \"playlist_track\"\r\n
(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n
CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREI
GN KEY (PlaylistId) REFERENCES \"playlists\" (PlaylistId) \r\n\t\tON DELETE
NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tra
cks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREA
TE INDEX IFK_TrackGenreId ON \"tracks\" (GenreId)\n\nCREATE INDEX IFK_Playli
stTrackTrackId ON \"playlist_track\" (TrackId)\n\n\n===Additional Context \n
\nIn the chinook database invoice means order\n\n===Response Guidelines \n1.
If the provided context is sufficient, please generate a valid SQL query wit
hout any explanations for the question. \n2. If the provided context is almo
st sufficient but requires knowledge of a specific string in a particular co
lumn, please generate an intermediate SQL query to find the distinct strings
in that column. Prepend the query with a comment saying intermediate_sql \n
3. If the provided context is insufficient, please explain why it can't be g
```

```
enerated. \n4. Please use the most relevant table(s). \n5. If the question h
as been asked and answered before, please repeat the answer exactly as it wa
s given before. \n"}, {"role": "user", "content": "  \n    Find the top 5 mo
st expensive tracks (based on unit price):\n"}, {"role": "assistant", "conte
nt": "SELECT TrackId, Name, UnitPrice FROM \"tracks\" ORDER BY UnitPrice DES
C LIMIT 5"}, {"role": "user", "content": "  \n    List all albums and their 
corresponding artist names  \n"}, {"role": "assistant", "content": "SELECT 
a.Title AS AlbumTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artist
s\" ar ON a.ArtistId = ar.ArtistId"}, {"role": "user", "content": "what are 
the top 5 countries that customers come from?"}, {"role": "assistant", "cont
ent": "SELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY
Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "
\n    Find all tracks with a name containing \"What\" (case-insensitive) 
\n"}, {"role": "assistant", "content": "SELECT * FROM tracks WHERE Name LIKE
'%What%'"}, {"role": "user", "content": "Can you list all tables in the SQLi
te database catalog?"}, {"role": "assistant", "content": "SELECT name FROM s
qlite_master WHERE type='table'"}, {"role": "user", "content": "  \n    List
all invoices with a total exceeding $10:\n"}, {"role": "assistant", "conten
t": " SELECT * FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "conte
nt": "  \n    Get the average invoice total for each customer:\n"}, {"role":
"assistant", "content": "SELECT CustomerId, AVG(Total) AS AverageInvoiceTota
l FROM \"invoices\" GROUP BY CustomerId"}, {"role": "user", "content": "  \n
Get the total number of invoices for each customer\n"}, {"role": "assistan
t", "content": "SELECT CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices
\" GROUP BY CustomerId"}, {"role": "user", "content": "  \n    Find all invo
ices since 2010 and the total amount invoiced:\n"}, {"role": "assistant", "c
ontent": "SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM \"invoices\" WH
ERE strftime('%Y', InvoiceDate) >= '2010' GROUP BY InvoiceDate"}, {"role":
"user", "content": "How many customers are there"}, {"role": "assistant", "c
ontent": "SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content":
" \n    There are 3 tables: artists, albums and tracks, where albums and art
ists are linked by ArtistId, albums and tracks are linked by AlbumId,\n    C
an you find the top 10 most popular artists based on the number of tracks
\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:40:29.72196842
2Z', 'message': {'role': 'assistant', 'content': 'SELECT a.Name AS ArtistNam
e, COUNT(t.TrackId) AS TrackCount FROM artists a LEFT JOIN albums alb ON a.A
rtistId = alb.ArtistId LEFT JOIN tracks t ON alb.AlbumId = t.AlbumId GROUP B
Y a.ArtistId ORDER BY TrackCount DESC LIMIT 10'}, 'done_reason': 'stop', 'do
ne': True, 'total_duration': 86669421859, 'load_duration': 16094356, 'prompt
_eval_count': 1225, 'prompt_eval_duration': 68318539000, 'eval_count': 63,
'eval_duration': 16871540000}
LLM Response: SELECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FR
OM artists a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tra
cks t ON alb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DES
C LIMIT 10
SELECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FROM artists a L
EFT JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tracks t ON alb.A
lbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DESC LIMIT 10
        ArtistName  TrackCount
0      Iron Maiden         213
1               U2         135
2     Led Zeppelin         114
3        Metallica         112
4      Deep Purple          92
```

```
5             Lost          92
6        Pearl Jam          67
7    Lenny Kravitz          57
8  Various Artists          56
9       The Office          53
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    There are 3 tables: artists, albums and tracks, where albums and artis
ts are linked by ArtistId, albums and tracks are linked by AlbumId,\n    Can
you find the top 10 most popular artists based on the number of tracks\n'\n
\nThe DataFrame was produced using this query: SELECT a.Name AS ArtistName,
COUNT(t.TrackId) AS TrackCount FROM artists a LEFT JOIN albums alb ON a.Arti
stId = alb.ArtistId LEFT JOIN tracks t ON alb.AlbumId = t.AlbumId GROUP BY
a.ArtistId ORDER BY TrackCount DESC LIMIT 10\n\nThe following is information
about the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n Arti
stName    object\nTrackCount     int64\ndtype: object"}, {"role": "user", "c
ontent": "Can you generate the Python plotly code to chart the results of th
e dataframe? Assume the data is in a pandas dataframe called 'df'. If there
is only one value in the dataframe, use an Indicator. Respond with only Pyth
on code. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:41:02.15755766
5Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nif len(df) == 1:\n    fig = px.indicator(title=df['ArtistNam
e'][0], value=df['TrackCount'][0])\nelse:\n    fig = px.bar(df, x='ArtistNam
e', y='TrackCount', title='Top 10 Most Popular Artists')\n\nfig.show()\n``
`"}, 'done_reason': 'stop', 'done': True, 'total_duration': 32415781472, 'lo
ad_duration': 57091229, 'prompt_eval_count': 250, 'prompt_eval_duration': 12
646099000, 'eval_count': 76, 'eval_duration': 19663143000}
```


Top 10 Most Popular Artists
TrackCount
0
50
100
150
200
Iron Maiden
U2
Led Zeppelin
Metallica
Deep Purple
Lost
Pearl Jam
Lenny Kravitz
Various Artists
The Office
ArtistName

Out[32]:

```
('SELECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FROM artists
a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tracks t ON a
lb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DESC LIMIT 1
0',
         ArtistName  TrackCount
 0      Iron Maiden         213
 1               U2         135
 2     Led Zeppelin         114
 3        Metallica         112
 4      Deep Purple          92
 5             Lost          92
 6        Pearl Jam          67
 7    Lenny Kravitz          57
 8  Various Artists          56
 9       The Office          53,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'ArtistName=%{x}<br>TrackCount=%{y}<extra>
</extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array(['Iron Maiden', 'U2', 'Led Zeppelin', 'Metallic
a', 'Deep Purple', 'Lost',
                           'Pearl Jam', 'Lenny Kravitz', 'Various Artists',
'The Office'],
                          dtype=object),
               'xaxis': 'x',
               'y': array([213, 135, 114, 112,  92,  92,  67,  57,  56,  5
3]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'template': '...',
                'title': {'text': 'Top 10 Most Popular Artists'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'ArtistName'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'TrackCount'}}}
 }))
```

In [33]:

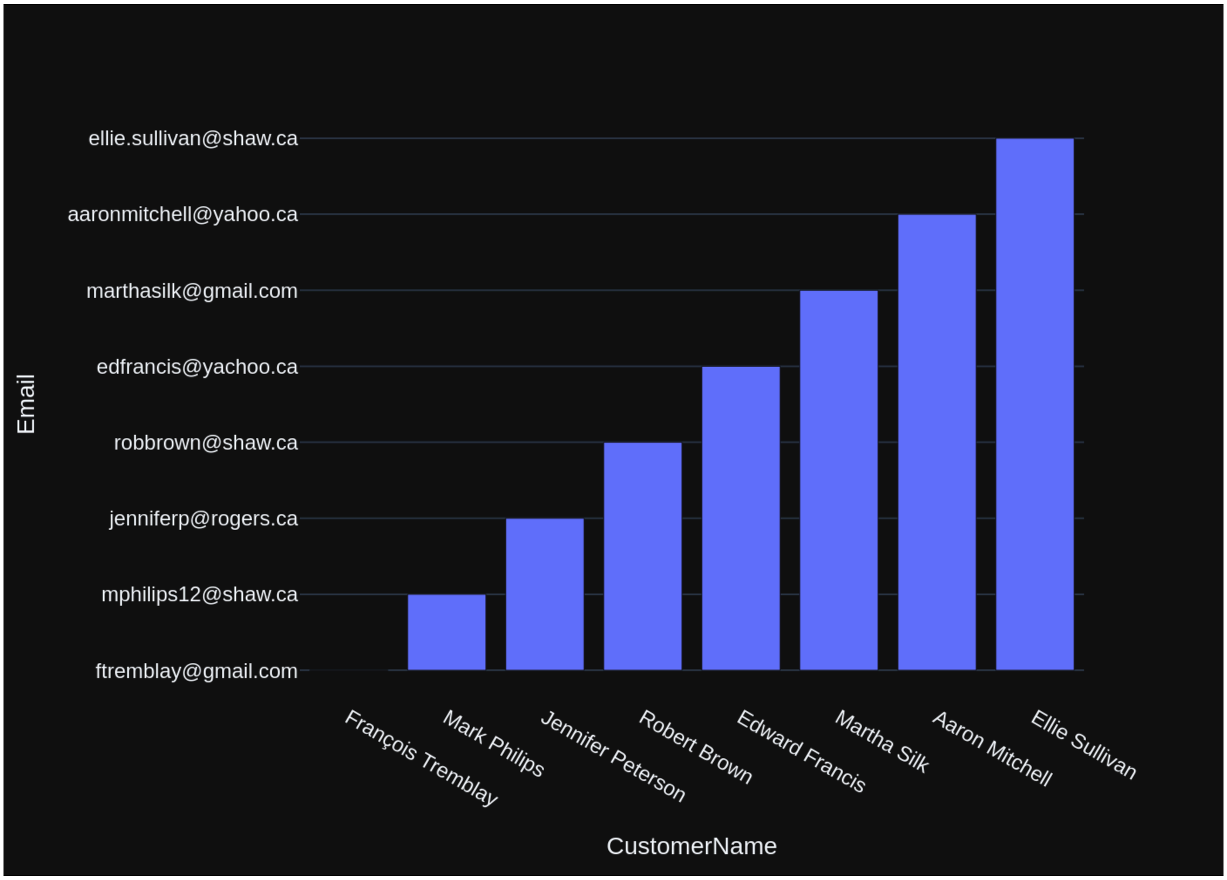
```
question = """
     List all customers from Canada and their email addresses:
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE INDEX IFK_CustomerSupportRepId ON "cus
tomers" (SupportRepId)\n\nCREATE TABLE "customers"\r\n(\r\n    CustomerId IN
TEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT
NULL,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r
\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR
(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Ph
one NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NU
LL,\r\n    SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCE
S "employees" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId INTEGER PRIMARY KEY AUT
OINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    InvoiceDate
DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    BillingCity N
VARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry NVARCHA
R(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(10,2)  NO
T NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "customers" (CustomerId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_Inv
oiceCustomerId ON "invoices" (CustomerId)\n\nCREATE TABLE "employees"\r\n(\r
\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    LastName
NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r\n    Titl
e NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIME,\r\n
HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r
\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVA
RCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email
NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES "employees" (Employe
eId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "i
nvoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NO
T NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NUL
L,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NU
LL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE sqlite_sequence(name,seq)\n\nCREATE TABLE "playlist_trac
k"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NUL
L,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r
\n    FOREIGN KEY (PlaylistId) REFERENCES "playlists" (PlaylistId) \r\n\t\tO
N DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFEREN
CES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)
\n\nCREATE INDEX IFK_EmployeeReportsTo ON "employees" (ReportsTo)\n\nCREATE
TABLE "albums"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NUL
L,\r\n    FOREIGN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nIn
the chinook database invoice means order\n\n===Response Guidelines \n1. If t
he provided context is sufficient, please generate a valid SQL query without
any explanations for the question. \n2. If the provided context is almost su
fficient but requires knowledge of a specific string in a particular column,
please generate an intermediate SQL query to find the distinct strings in th
at column. Prepend the query with a comment saying intermediate_sql \n3. If
the provided context is insufficient, please explain why it can\'t be genera
ted. \n4. Please use the most relevant table(s). \n5. If the question has be
en asked and answered before, please repeat the answer exactly as it was giv
en before. \n'}, {'role': 'user', 'content': 'what are the top 5 countries t
hat customers come from?'}, {'role': 'assistant', 'content': 'SELECT Countr
```

```
y, COUNT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY Cust
omerCount DESC LIMIT 5'}, {'role': 'user', 'content': 'How many customers ar
e there'}, {'role': 'assistant', 'content': 'SELECT COUNT(*) FROM "customer
s"'}, {'role': 'user', 'content': '  \n    Get the total number of invoices
for each customer\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId,
COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'u
ser', 'content': "  \n    List all employees and their reporting manager's n
ame (if any):\n"}, {'role': 'assistant', 'content': ' SELECT e1.FirstName ||
\' \' || e1.LastName AS EmployeeName,\n       e2.FirstName || \' \' || e2.La
stName AS ManagerName\nFROM "employees" e1\nLEFT JOIN "employees" e2 ON e1.R
eportsTo = e2.EmployeeId'}, {'role': 'user', 'content': '  \n    List all in
voices with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' S
ELECT * FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': '
\n    Get the average invoice total for each customer:\n'}, {'role': 'assist
ant', 'content': 'SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM
"invoices" GROUP BY CustomerId'}, {'role': 'user', 'content': 'Can you list
all tables in the SQLite database catalog?'}, {'role': 'assistant', 'conten
t': "SELECT name FROM sqlite_master WHERE type='table'"}, {'role': 'user',
'content': '  \n    Find the top 5 most expensive tracks (based on unit pric
e):\n'}, {'role': 'assistant', 'content': 'SELECT TrackId, Name, UnitPrice F
ROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, {'role': 'user', 'content':
'  \n    Find all invoices since 2010 and the total amount invoiced:\n'},
{'role': 'assistant', 'content': 'SELECT InvoiceDate, SUM(Total) AS TotalAmo
unt FROM "invoices" WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY
InvoiceDate'}, {'role': 'user', 'content': '  \n    List all albums and thei
r corresponding artist names  \n'}, {'role': 'assistant', 'content': 'SELECT
a.Title AS AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN "artists"
ar ON a.ArtistId = ar.ArtistId'}, {'role': 'user', 'content': '  \n     List
all customers from Canada and their email addresses:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE INDEX IFK_CustomerSupportRepId ON \"customers\" (S
upportRepId)\n\nCREATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PR
IMARY KEY AUTOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r
\n    LastName NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    A
ddress NVARCHAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r
\n    Country NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVA
RCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n
SupportRepId INTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employe
es\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCR
EATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER PRIMARY KEY AUTOINCREM
ENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    InvoiceDate DATETI
ME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    BillingCity NVARCHA
R(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry NVARCHAR(4
0),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(10,2)  NOT N
ULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\" (CustomerId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_Inv
oiceCustomerId ON \"invoices\" (CustomerId)\n\nCREATE TABLE \"employees\"\r
\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Las
tName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r\n
Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIME,\r\n
HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCHAR(40),\r
\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    PostalCode NVA
RCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    Email 
NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES \"employees\" (Emplo
yeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE 
\"invoice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMEN
T NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT 
NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT 
NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) 
REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACT
ION\r\n)\n\nCREATE TABLE sqlite_sequence(name,seq)\n\nCREATE TABLE \"playlis
t_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    TrackId INTEGER  
NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (PlaylistId, Track
Id),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlists\" (PlaylistId) 
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO 
ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeReportsTo ON \"employees\" (ReportsT
o)\n\nCREATE TABLE \"albums\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTE
GER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERENCES \"artists\" (ArtistI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional C
ontext \n\nIn the chinook database invoice means order\n\n===Response Guidel
ines \n1. If the provided context is sufficient, please generate a valid SQL 
query without any explanations for the question. \n2. If the provided contex
t is almost sufficient but requires knowledge of a specific string in a part
icular column, please generate an intermediate SQL query to find the distinc
t strings in that column. Prepend the query with a comment saying intermedia
te_sql \n3. If the provided context is insufficient, please explain why it c
an't be generated. \n4. Please use the most relevant table(s). \n5. If the q
uestion has been asked and answered before, please repeat the answer exactly 
as it was given before. \n"}, {"role": "user", "content": "what are the top 
5 countries that customers come from?"}, {"role": "assistant", "content": "S
ELECT Country, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY Country 
ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "How many 
customers are there"}, {"role": "assistant", "content": "SELECT COUNT(*) FRO
M \"customers\""}, {"role": "user", "content": "  \n    Get the total number 
of invoices for each customer\n"}, {"role": "assistant", "content": "SELECT 
CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY CustomerI
d"}, {"role": "user", "content": "  \n    List all employees and their repor
ting manager's name (if any):\n"}, {"role": "assistant", "content": " SELECT 
e1.FirstName || ' ' || e1.LastName AS EmployeeName,\n       e2.FirstName || 
' ' || e2.LastName AS ManagerName\nFROM \"employees\" e1\nLEFT JOIN \"employ
ees\" e2 ON e1.ReportsTo = e2.EmployeeId"}, {"role": "user", "content": "  
\n    List all invoices with a total exceeding $10:\n"}, {"role": "assistan
t", "content": " SELECT * FROM \"invoices\" WHERE Total > 10"}, {"role": "us
er", "content": "  \n    Get the average invoice total for each custome
r:\n"}, {"role": "assistant", "content": "SELECT CustomerId, AVG(Total) AS A
verageInvoiceTotal FROM \"invoices\" GROUP BY CustomerId"}, {"role": "user", 
"content": "Can you list all tables in the SQLite database catalog?"}, {"rol
e": "assistant", "content": "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {"role": "user", "content": "  \n    Find the top 5 most expensive tra
cks (based on unit price):\n"}, {"role": "assistant", "content": "SELECT Tra
ckId, Name, UnitPrice FROM \"tracks\" ORDER BY UnitPrice DESC LIMIT 5"}, {"r
ole": "user", "content": "  \n    Find all invoices since 2010 and the total
```

```
amount invoiced:\n"}, {"role": "assistant", "content": "SELECT InvoiceDate,
SUM(Total) AS TotalAmount FROM \"invoices\" WHERE strftime('%Y', InvoiceDat
e) >= '2010' GROUP BY InvoiceDate"}, {"role": "user", "content": "  \n    Li
st all albums and their corresponding artist names  \n"}, {"role": "assistan
t", "content": "SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM \"a
lbums\" a JOIN \"artists\" ar ON a.ArtistId = ar.ArtistId"}, {"role": "use
r", "content": "  \n     List all customers from Canada and their email addr
esses:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:42:37.76397519
Z', 'message': {'role': 'assistant', 'content': 'SELECT FirstName || \' \' |
| LastName AS CustomerName, Email FROM "customers" WHERE Country = \'Canada
\''}, 'done_reason': 'stop', 'done': True, 'total_duration': 95462267890, 'l
oad_duration': 11897981, 'prompt_eval_count': 1605, 'prompt_eval_duration':
87157402000, 'eval_count': 26, 'eval_duration': 6759339000}
LLM Response: SELECT FirstName || ' ' || LastName AS CustomerName, Email FRO
M "customers" WHERE Country = 'Canada'
SELECT FirstName || ' ' || LastName AS CustomerName, Email FROM "customers"
WHERE Country = 'Canada'
        CustomerName                   Email
0  François Tremblay     ftremblay@gmail.com
1       Mark Philips      mphilips12@shaw.ca
2  Jennifer Peterson     jenniferp@rogers.ca
3       Robert Brown        robbrown@shaw.ca
4     Edward Francis     edfrancis@yachoo.ca
5        Martha Silk    marthasilk@gmail.com
6     Aaron Mitchell  aaronmitchell@yahoo.ca
7     Ellie Sullivan  ellie.sullivan@shaw.ca
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n     List all customers from Canada and their email addresses:\n'\n\nThe D
ataFrame was produced using this query: SELECT FirstName || ' ' || LastName
AS CustomerName, Email FROM \"customers\" WHERE Country = 'Canada'\n\nThe fo
llowing is information about the resulting pandas DataFrame 'df': \nRunning
df.dtypes gives:\n CustomerName    object\nEmail           object\ndtype: ob
ject"}, {"role": "user", "content": "Can you generate the Python plotly code
to chart the results of the dataframe? Assume the data is in a pandas datafr
ame called 'df'. If there is only one value in the dataframe, use an Indicat
or. Respond with only Python code. Do not answer with any explanations -- ju
st the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:43:03.40277062
Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.ex
press as px\n\nif df.shape[0] > 1:\n    fig = px.bar(df, x='CustomerName', y
='Email')\n    fig.show()\nelse:\n    fig = px.indicator(df, title='Customer
Name', measure='Email')\n    fig.show()\n```"}, 'done_reason': 'stop', 'don
e': True, 'total_duration': 25611574589, 'load_duration': 13662336, 'prompt_
eval_count': 169, 'prompt_eval_duration': 8380669000, 'eval_count': 67, 'eva
l_duration': 17169789000}
```


ellie.sullivan@shaw.ca
aaronmitchell@yahoo.ca
marthasilk@gmail.com
edfrancis@yachoo.ca
robbrown@shaw.ca
jenniferp@rogers.ca
mphilips12@shaw.ca
ftremblay@gmail.com
Email
François Tremblay
Mark Philips
Jennifer Peterson
Robert Brown
Edward Francis
Martha Silk
Aaron Mitchell
Ellie Sullivan
CustomerName

Out[33]:

```
('SELECT FirstName || \' \' || LastName AS CustomerName, Email FROM "custom
ers" WHERE Country = \'Canada\'',
          CustomerName                     Email
 0  François Tremblay     ftremblay@gmail.com
 1       Mark Philips      mphilips12@shaw.ca
 2  Jennifer Peterson     jenniferp@rogers.ca
 3       Robert Brown        robbrown@shaw.ca
 4     Edward Francis     edfrancis@yachoo.ca
 5        Martha Silk    marthasilk@gmail.com
 6     Aaron Mitchell  aaronmitchell@yahoo.ca
 7     Ellie Sullivan  ellie.sullivan@shaw.ca,
 Figure({
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               'hovertemplate': 'CustomerName=%{x}<br>Email=%{y}<extra></ex
tra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
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               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
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eterson',
                           'Robert Brown', 'Edward Francis', 'Martha Silk',
'Aaron Mitchell',
                           'Ellie Sullivan'], dtype=object),
               'xaxis': 'x',
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nniferp@rogers.ca',
                           'robbrown@shaw.ca', 'edfrancis@yachoo.ca', 'mart
hasilk@gmail.com',
                           'aaronmitchell@yahoo.ca', 'ellie.sullivan@shaw.c
a'], dtype=object),
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                'margin': {'t': 60},
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                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'CustomerName'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'Email'}}}
 }))
```

In [34]:

```python
question = """
     Find the customer with the most invoices
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please 
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n  
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)\n\nCREATE IN
DEX IFK_InvoiceLineInvoiceId ON "invoice_items" (InvoiceId)\n\nCREATE TABLE 
"invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT 
NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NU
LL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT N
ULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (InvoiceId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFE
RENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nC
REATE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCRE
MENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVAR
CHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(7
0),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVAR
CHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_
CustomerSupportRepId ON "customers" (SupportRepId)\n\nCREATE TABLE "employee
s"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   
LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r
\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIM
E,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCH
AR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    Posta
lCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n 
Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES "employees" (E
mployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE IN
DEX IFK_EmployeeReportsTo ON "employees" (ReportsTo)\n\nCREATE TABLE "track
s"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Na
me NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEG
ER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    
Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumI
d) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (Genr
eId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO 
ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_types" (MediaType
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional 
Context \n\nIn the chinook database invoice means order\n\n===Response Guide
lines \n1. If the provided context is sufficient, please generate a valid SQ
L query without any explanations for the question. \n2. If the provided cont
ext is almost sufficient but requires knowledge of a specific string in a pa
rticular column, please generate an intermediate SQL query to find the disti
nct strings in that column. Prepend the query with a comment saying intermed
iate_sql \n3. If the provided context is insufficient, please explain why it
can\'t be generated. \n4. Please use the most relevant table(s). \n5. If the
question has been asked and answered before, please repeat the answer exactl
y as it was given before. \n'}, {'role': 'user', 'content': '  \n    Get the
```

```
total number of invoices for each customer\n'}, {'role': 'assistant', 'conte
nt': 'SELECT CustomerId, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY
CustomerId'}, {'role': 'user', 'content': '  \n    List all invoices with a
total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT * FROM
"invoices" WHERE Total > 10'}, {'role': 'user', 'content': '  \n    Get the
average invoice total for each customer:\n'}, {'role': 'assistant', 'conten
t': 'SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM "invoices" GR
OUP BY CustomerId'}, {'role': 'user', 'content': '  \n    Find all invoices
since 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'conten
t': 'SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHERE str
ftime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDate'}, {'role': 'use
r', 'content': '  \n    Find the top 5 most expensive tracks (based on unit
price):\n'}, {'role': 'assistant', 'content': 'SELECT TrackId, Name, UnitPri
ce FROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, {'role': 'user', 'conten
t': 'what are the top 5 countries that customers come from?'}, {'role': 'ass
istant', 'content': 'SELECT Country, COUNT(*) AS CustomerCount FROM "custome
rs" GROUP BY Country ORDER BY CustomerCount DESC LIMIT 5'}, {'role': 'user',
'content': 'How many customers are there'}, {'role': 'assistant', 'content':
'SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'content': '  \n     L
ist all customers from Canada and their email addresses:\n'}, {'role': 'assi
stant', 'content': 'SELECT FirstName || \' \' || LastName AS CustomerName, E
mail FROM "customers" WHERE Country = \'Canada\''}, {'role': 'user', 'conten
t': ' \n    There are 3 tables: artists, albums and tracks, where albums and
artists are linked by ArtistId, albums and tracks are linked by AlbumId,\n
Can you find the top 10 most popular artists based on the number of tracks
\n'}, {'role': 'assistant', 'content': 'SELECT a.Name AS ArtistName, COUNT
(t.TrackId) AS TrackCount FROM artists a LEFT JOIN albums alb ON a.ArtistId
= alb.ArtistId LEFT JOIN tracks t ON alb.AlbumId = t.AlbumId GROUP BY a.Arti
stId ORDER BY TrackCount DESC LIMIT 10'}, {'role': 'user', 'content': "  \n
List all employees and their reporting manager's name (if any):\n"}, {'rol
e': 'assistant', 'content': ' SELECT e1.FirstName || \' \' || e1.LastName AS
EmployeeName,\n       e2.FirstName || \' \' || e2.LastName AS ManagerName\nF
ROM "employees" e1\nLEFT JOIN "employees" e2 ON e1.ReportsTo = e2.EmployeeI
d'}, {'role': 'user', 'content': '  \n     Find the customer with the most i
nvoices \n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerId)\n\nCREATE INDEX IFK
_InvoiceLineInvoiceId ON \"invoice_items\" (InvoiceId)\n\nCREATE TABLE \"inv
oice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NUL
L,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NU
LL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId) \r\n
\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) RE
FERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N\r\n)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)
\n\nCREATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AU
TOINCREMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastNa
me NVARCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARC
HAR(70),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country
NVARCHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employees\" (Employee
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK
_CustomerSupportRepId ON \"customers\" (SupportRepId)\n\nCREATE TABLE \"empl
oyees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r
\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NU
LL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DA
TETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City N
VARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    
PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(2
4),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES \"e
mployees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)
\n\nCREATE INDEX IFK_EmployeeReportsTo ON \"employees\" (ReportsTo)\n\nCREAT
E TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT
NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    Me
diaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHA
R(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    
UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES 
\"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n   
FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO A
CTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"med
ia_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\n\n===Additional Context \n\nIn the chinook database invoice means ord
er\n\n===Response Guidelines \n1. If the provided context is sufficient, ple
ase generate a valid SQL query without any explanations for the question. \n
2. If the provided context is almost sufficient but requires knowledge of a
specific string in a particular column, please generate an intermediate SQL
query to find the distinct strings in that column. Prepend the query with a
comment saying intermediate_sql \n3. If the provided context is insufficien
t, please explain why it can't be generated. \n4. Please use the most releva
nt table(s). \n5. If the question has been asked and answered before, please
repeat the answer exactly as it was given before. \n"}, {"role": "user", "co
ntent": "  \n    Get the total number of invoices for each customer\n"}, {"r
ole": "assistant", "content": "SELECT CustomerId, COUNT(*) AS TotalInvoices
FROM \"invoices\" GROUP BY CustomerId"}, {"role": "user", "content": "  \n  
List all invoices with a total exceeding $10:\n"}, {"role": "assistant", "co
ntent": " SELECT * FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "c
ontent": "  \n    Get the average invoice total for each customer:\n"}, {"ro
le": "assistant", "content": "SELECT CustomerId, AVG(Total) AS AverageInvoic
eTotal FROM \"invoices\" GROUP BY CustomerId"}, {"role": "user", "content": 
"  \n    Find all invoices since 2010 and the total amount invoiced:\n"}, 
{"role": "assistant", "content": "SELECT InvoiceDate, SUM(Total) AS TotalAmo
unt FROM \"invoices\" WHERE strftime('%Y', InvoiceDate) >= '2010' GROUP BY I
nvoiceDate"}, {"role": "user", "content": "  \n    Find the top 5 most expen
sive tracks (based on unit price):\n"}, {"role": "assistant", "content": "SE
LECT TrackId, Name, UnitPrice FROM \"tracks\" ORDER BY UnitPrice DESC LIMIT 
5"}, {"role": "user", "content": "what are the top 5 countries that customer
s come from?"}, {"role": "assistant", "content": "SELECT Country, COUNT(*) A
```

```
S CustomerCount FROM \"customers\" GROUP BY Country ORDER BY CustomerCount D
ESC LIMIT 5"}, {"role": "user", "content": "How many customers are there"},
{"role": "assistant", "content": "SELECT COUNT(*) FROM \"customers\""}, {"ro
le": "user", "content": "  \n     List all customers from Canada and their e
mail addresses:\n"}, {"role": "assistant", "content": "SELECT FirstName || '
' || LastName AS CustomerName, Email FROM \"customers\" WHERE Country = 'Can
ada'"}, {"role": "user", "content": " \n    There are 3 tables: artists, alb
ums and tracks, where albums and artists are linked by ArtistId, albums and
tracks are linked by AlbumId,\n    Can you find the top 10 most popular arti
sts based on the number of tracks\n"}, {"role": "assistant", "content": "SEL
ECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FROM artists a LEFT
JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tracks t ON alb.Album
Id = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DESC LIMIT 10"}, {"ro
le": "user", "content": "  \n    List all employees and their reporting mana
ger's name (if any):\n"}, {"role": "assistant", "content": " SELECT e1.First
Name || ' ' || e1.LastName AS EmployeeName,\n       e2.FirstName || ' ' || e
2.LastName AS ManagerName\nFROM \"employees\" e1\nLEFT JOIN \"employees\" e2
ON e1.ReportsTo = e2.EmployeeId"}, {"role": "user", "content": "  \n     Fin
d the customer with the most invoices \n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:44:49.90663292
5Z', 'message': {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT
(*) AS InvoiceCount FROM "invoices" GROUP BY CustomerId ORDER BY InvoiceCoun
t DESC LIMIT 1'}, 'done_reason': 'stop', 'done': True, 'total_duration': 106
406999871, 'load_duration': 14861202, 'prompt_eval_count': 1729, 'prompt_eva
l_duration': 97663028000, 'eval_count': 27, 'eval_duration': 7223820000}
LLM Response: SELECT CustomerId, COUNT(*) AS InvoiceCount FROM "invoices" GR
OUP BY CustomerId ORDER BY InvoiceCount DESC LIMIT 1
SELECT CustomerId, COUNT(*) AS InvoiceCount FROM "invoices" GROUP BY Custome
rId ORDER BY InvoiceCount DESC LIMIT 1
   CustomerId  InvoiceCount
0           1             7
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n     Find the customer with the most invoices \n'\n\nThe DataFrame was pro
duced using this query: SELECT CustomerId, COUNT(*) AS InvoiceCount FROM \"i
nvoices\" GROUP BY CustomerId ORDER BY InvoiceCount DESC LIMIT 1\n\nThe foll
owing is information about the resulting pandas DataFrame 'df': \nRunning d
f.dtypes gives:\n CustomerId      int64\nInvoiceCount    int64\ndtype: objec
t"}, {"role": "user", "content": "Can you generate the Python plotly code to
chart the results of the dataframe? Assume the data is in a pandas dataframe
called 'df'. If there is only one value in the dataframe, use an Indicator.
Respond with only Python code. Do not answer with any explanations -- just t
he code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:45:23.77892993
1Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.g
raph_objects as go\n\nif len(df) == 1:\n    fig = go.Figure(go.Indicator(\n
mode='number+gauge',\n        value=df['InvoiceCount'].iloc[0],\n        tit
le={'text': 'Invoices<br>by Customer'}\n    ))\nelse:\n    fig = go.Figure(d
ata=[go.Bar(x=df['CustomerId'], y=df['InvoiceCount'])])\nfig.show()\n```"},
```

```
'done_reason': 'stop', 'done': True, 'total_duration': 33845235743, 'load_du
ration': 12988401, 'prompt_eval_count': 176, 'prompt_eval_duration': 8790374
000, 'eval_count': 95, 'eval_duration': 24992919000}
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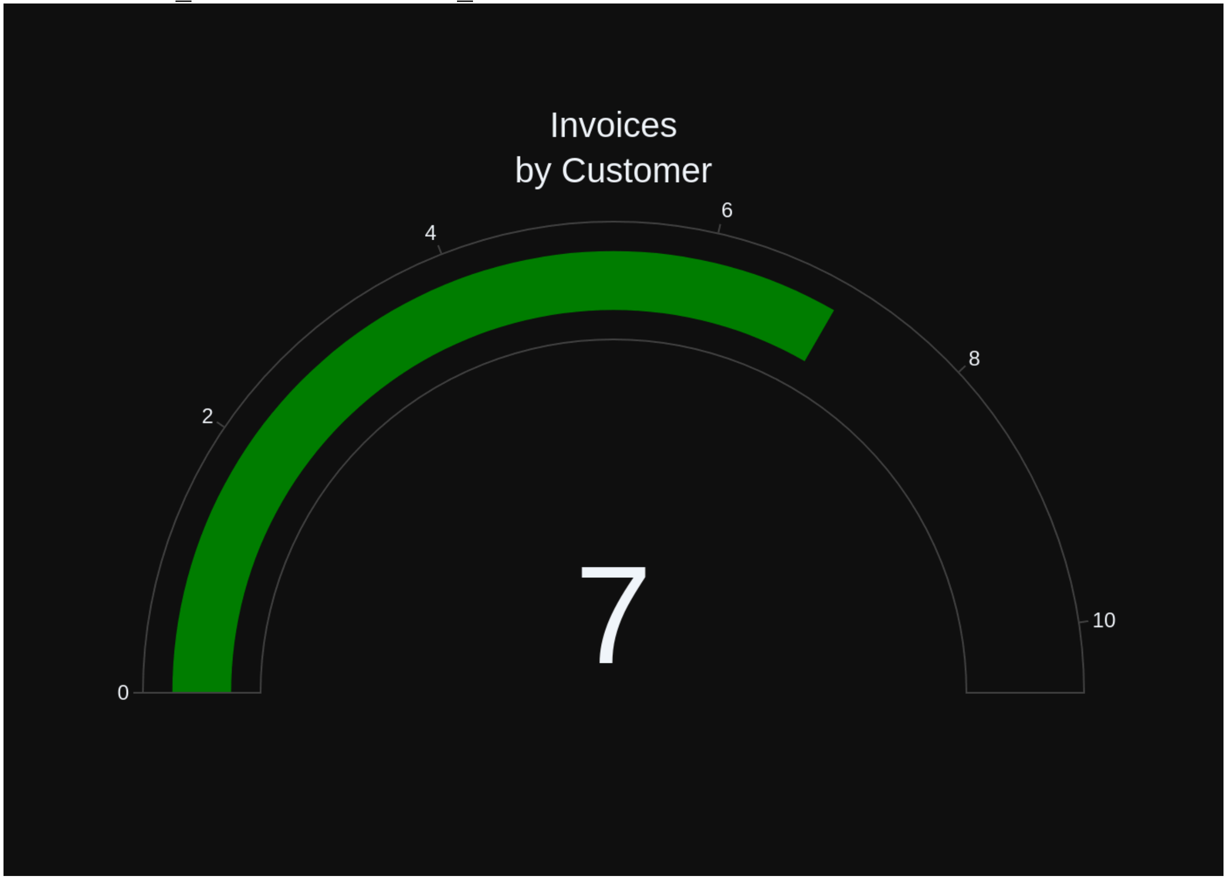


```
Out[34]: ('SELECT CustomerId, COUNT(*) AS InvoiceCount FROM "invoices" GROUP BY Cust
omerId ORDER BY InvoiceCount DESC LIMIT 1',
    CustomerId  InvoiceCount
 0           1             7,
 Figure({
     'data': [{'mode': 'number+gauge', 'title': {'text': 'Invoices<br>by Cu
stomer'}, 'type': 'indicator', 'value': 7}],
     'layout': {'template': '...'}
 }))
```

```
In [ ]:
```

Advanced SQL questions

```
In [35]: question = """
             Find the customer who bought the most albums in total quantity (across
         """

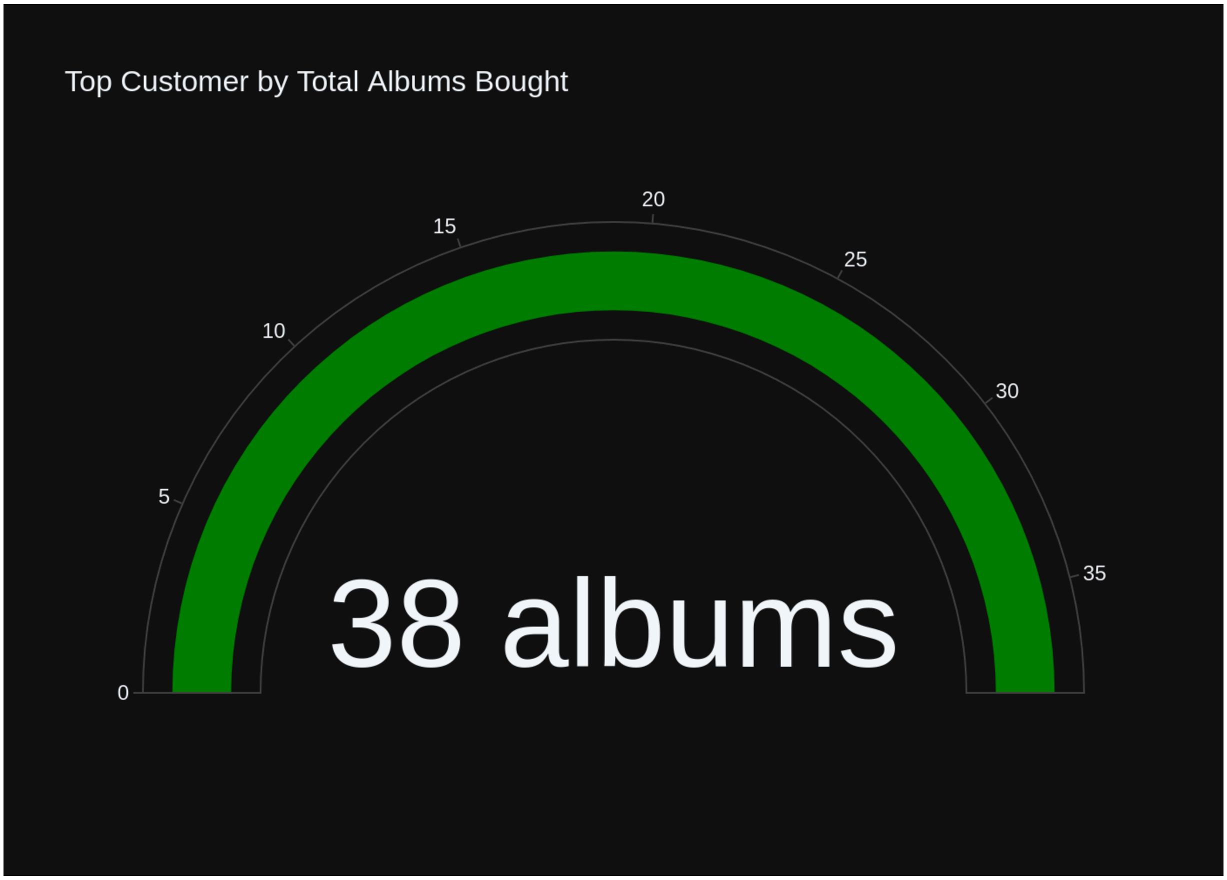
         vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "tracks"\r\n(\r\n    TrackId INT
EGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NUL
L,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    Genr
eId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT
NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n
FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACT
ION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (G
enreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "invoice_items"\r\n(\r\n    In
voiceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INT
EGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(1
0,2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (Invoi
ceId) REFERENCES "invoices" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId) \r\n
\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "albums"\r
\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title
NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN K
EY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTION ON
UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON "albums" (ArtistI
d)\n\nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId INTEGER PRIMARY KEY AUTO
INCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    InvoiceDate
DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    BillingCity N
VARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry NVARCHA
R(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(10,2)  NO
T NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "customers" (CustomerId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_Inv
oiceLineTrackId ON "invoice_items" (TrackId)\n\nCREATE INDEX IFK_InvoiceLine
InvoiceId ON "invoice_items" (InvoiceId)\n\nCREATE INDEX IFK_InvoiceCustomer
Id ON "invoices" (CustomerId)\n\nCREATE INDEX IFK_TrackAlbumId ON "tracks"
(AlbumId)\n\nCREATE TABLE "artists"\r\n(\r\n    ArtistId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===Additional Co
ntext \n\nIn the chinook database invoice means order\n\n===Response Guideli
nes \n1. If the provided context is sufficient, please generate a valid SQL
query without any explanations for the question. \n2. If the provided contex
t is almost sufficient but requires knowledge of a specific string in a part
icular column, please generate an intermediate SQL query to find the distinc
t strings in that column. Prepend the query with a comment saying intermedia
te_sql \n3. If the provided context is insufficient, please explain why it c
an\'t be generated. \n4. Please use the most relevant table(s). \n5. If the
question has been asked and answered before, please repeat the answer exactl
y as it was given before. \n'}, {'role': 'user', 'content': '  \n     Find t
he customer with the most invoices \n'}, {'role': 'assistant', 'content': 'S
ELECT CustomerId, COUNT(*) AS InvoiceCount FROM "invoices" GROUP BY Customer
Id ORDER BY InvoiceCount DESC LIMIT 1'}, {'role': 'user', 'content': ' \n
There are 3 tables: artists, albums and tracks, where albums and artists are
linked by ArtistId, albums and tracks are linked by AlbumId,\n    Can you fi
nd the top 10 most popular artists based on the number of tracks\n'}, {'rol
e': 'assistant', 'content': 'SELECT a.Name AS ArtistName, COUNT(t.TrackId) A
S TrackCount FROM artists a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistI
d LEFT JOIN tracks t ON alb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY
TrackCount DESC LIMIT 10'}, {'role': 'user', 'content': '  \n    Get the tot
al number of invoices for each customer\n'}, {'role': 'assistant', 'conten
```

```
t': 'SELECT CustomerId, COUNT(*) AS TotalInvoices FROM "invoices" GROUP BY C
ustomerId'}, {'role': 'user', 'content': '  \n    Find the top 5 most expens
ive tracks (based on unit price):\n'}, {'role': 'assistant', 'content': 'SEL
ECT TrackId, Name, UnitPrice FROM "tracks" ORDER BY UnitPrice DESC LIMIT
5'}, {'role': 'user', 'content': '  \n    List all invoices with a total exc
eeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "invoices"
WHERE Total > 10'}, {'role': 'user', 'content': '  \n    Find all invoices s
ince 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'conten
t': 'SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM "invoices" WHERE str
ftime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY InvoiceDate'}, {'role': 'use
r', 'content': '  \n    Get the average invoice total for each custome
r:\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, AVG(Total) AS A
verageInvoiceTotal FROM "invoices" GROUP BY CustomerId'}, {'role': 'user',
'content': '  \n    List all albums and their corresponding artist names
\n'}, {'role': 'assistant', 'content': 'SELECT a.Title AS AlbumTitle, ar.Nam
e AS ArtistName FROM "albums" a JOIN "artists" ar ON a.ArtistId = ar.ArtistI
d'}, {'role': 'user', 'content': 'what are the top 5 countries that customer
s come from?'}, {'role': 'assistant', 'content': 'SELECT Country, COUNT(*) A
S CustomerCount FROM "customers" GROUP BY Country ORDER BY CustomerCount DES
C LIMIT 5'}, {'role': 'user', 'content': 'How many customers are there'},
{'role': 'assistant', 'content': 'SELECT COUNT(*) FROM "customers"'}, {'rol
e': 'user', 'content': '  \n     Find the customer who bought the most album
s in total quantity (across all invoices): \n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMA
RY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    A
lbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGE
R,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n
Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY
(AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTy
peId) REFERENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"invoice_items\"\r\n(\r\n    Invoic
eLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER
NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)
NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId)
REFERENCES \"invoices\" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"albums\"\r
\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title
NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN K
EY (ArtistId) REFERENCES \"artists\" (ArtistId) \r\n\t\tON DELETE NO ACTION
ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums\" (Ar
tistId)\n\nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER PRIMARY K
EY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    Invoi
ceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    Billin
gCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry
NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(1
0,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\" (Cu
stomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE IND
EX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)\n\nCREATE INDEX IFK
_InvoiceLineInvoiceId ON \"invoice_items\" (InvoiceId)\n\nCREATE INDEX IFK_I
nvoiceCustomerId ON \"invoices\" (CustomerId)\n\nCREATE INDEX IFK_TrackAlbum
Id ON \"tracks\" (AlbumId)\n\nCREATE TABLE \"artists\"\r\n(\r\n    ArtistId 
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n
\n\n===Additional Context \n\nIn the chinook database invoice means order\n
\n===Response Guidelines \n1. If the provided context is sufficient, please 
generate a valid SQL query without any explanations for the question. \n2. I
f the provided context is almost sufficient but requires knowledge of a spec
ific string in a particular column, please generate an intermediate SQL quer
y to find the distinct strings in that column. Prepend the query with a comm
ent saying intermediate_sql \n3. If the provided context is insufficient, pl
ease explain why it can't be generated. \n4. Please use the most relevant ta
ble(s). \n5. If the question has been asked and answered before, please repe
at the answer exactly as it was given before. \n"}, {"role": "user", "conten
t": "  \n     Find the customer with the most invoices \n"}, {"role": "assis
tant", "content": "SELECT CustomerId, COUNT(*) AS InvoiceCount FROM \"invoic
es\" GROUP BY CustomerId ORDER BY InvoiceCount DESC LIMIT 1"}, {"role": "use
r", "content": " \n    There are 3 tables: artists, albums and tracks, where
albums and artists are linked by ArtistId, albums and tracks are linked by A
lbumId,\n    Can you find the top 10 most popular artists based on the numbe
r of tracks\n"}, {"role": "assistant", "content": "SELECT a.Name AS ArtistNa
me, COUNT(t.TrackId) AS TrackCount FROM artists a LEFT JOIN albums alb ON a.
ArtistId = alb.ArtistId LEFT JOIN tracks t ON alb.AlbumId = t.AlbumId GROUP 
BY a.ArtistId ORDER BY TrackCount DESC LIMIT 10"}, {"role": "user", "conten
t": "  \n    Get the total number of invoices for each customer\n"}, {"rol
e": "assistant", "content": "SELECT CustomerId, COUNT(*) AS TotalInvoices FR
OM \"invoices\" GROUP BY CustomerId"}, {"role": "user", "content": "  \n    
Find the top 5 most expensive tracks (based on unit price):\n"}, {"role": "a
ssistant", "content": "SELECT TrackId, Name, UnitPrice FROM \"tracks\" ORDER
BY UnitPrice DESC LIMIT 5"}, {"role": "user", "content": "  \n    List all i
nvoices with a total exceeding $10:\n"}, {"role": "assistant", "content": "
SELECT * FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": "
\n    Find all invoices since 2010 and the total amount invoiced:\n"}, {"rol
e": "assistant", "content": "SELECT InvoiceDate, SUM(Total) AS TotalAmount F
ROM \"invoices\" WHERE strftime('%Y', InvoiceDate) >= '2010' GROUP BY Invoic
eDate"}, {"role": "user", "content": "  \n    Get the average invoice total 
for each customer:\n"}, {"role": "assistant", "content": "SELECT CustomerId,
AVG(Total) AS AverageInvoiceTotal FROM \"invoices\" GROUP BY CustomerId"},
{"role": "user", "content": "  \n    List all albums and their corresponding
artist names  \n"}, {"role": "assistant", "content": "SELECT a.Title AS Albu
mTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artists\" ar ON a.Art
istId = ar.ArtistId"}, {"role": "user", "content": "what are the top 5 count
ries that customers come from?"}, {"role": "assistant", "content": "SELECT C
ountry, COUNT(*) AS CustomerCount FROM \"customers\" GROUP BY Country ORDER 
BY CustomerCount DESC LIMIT 5"}, {"role": "user", "content": "How many custo
mers are there"}, {"role": "assistant", "content": "SELECT COUNT(*) FROM \"c
ustomers\""}, {"role": "user", "content": "  \n     Find the customer who bo
ught the most albums in total quantity (across all invoices): \n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:47:11.34409759
9Z', 'message': {'role': 'assistant', 'content': 'SELECT i.CustomerId, SUM(i
i.Quantity) AS TotalAlbumsBought\nFROM "invoices" i\nJOIN "invoice_items" ii
ON i.InvoiceId = ii.InvoiceId\nJOIN "tracks" t ON ii.TrackId = t.TrackId\nWH
```

```
ERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 represents albums\nGROUP BY
i.CustomerId\nORDER BY TotalAlbumsBought DESC\nLIMIT 1'}, 'done_reason': 'st
op', 'done': True, 'total_duration': 107480869169, 'load_duration': 1498152
0, 'prompt_eval_count': 1428, 'prompt_eval_duration': 79512679000, 'eval_cou
nt': 97, 'eval_duration': 26491481000}
LLM Response: SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought
FROM "invoices" i
JOIN "invoice_items" ii ON i.InvoiceId = ii.InvoiceId
JOIN "tracks" t ON ii.TrackId = t.TrackId
WHERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 represents albums
GROUP BY i.CustomerId
ORDER BY TotalAlbumsBought DESC
LIMIT 1
SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought
FROM "invoices" i
JOIN "invoice_items" ii ON i.InvoiceId = ii.InvoiceId
JOIN "tracks" t ON ii.TrackId = t.TrackId
WHERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 represents albums
GROUP BY i.CustomerId
ORDER BY TotalAlbumsBought DESC
LIMIT 1
   CustomerId  TotalAlbumsBought
0           8                 38
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n     Find the customer who bought the most albums in total quantity (acros
s all invoices): \n'\n\nThe DataFrame was produced using this query: SELECT
i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought\nFROM \"invoices\" i\nJO
IN \"invoice_items\" ii ON i.InvoiceId = ii.InvoiceId\nJOIN \"tracks\" t ON
ii.TrackId = t.TrackId\nWHERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 re
presents albums\nGROUP BY i.CustomerId\nORDER BY TotalAlbumsBought DESC\nLIM
IT 1\n\nThe following is information about the resulting pandas DataFrame 'd
f': \nRunning df.dtypes gives:\n CustomerId           int64\nTotalAlbumsBoug
ht    int64\ndtype: object"}, {"role": "user", "content": "Can you generate
the Python plotly code to chart the results of the dataframe? Assume the dat
a is in a pandas dataframe called 'df'. If there is only one value in the da
taframe, use an Indicator. Respond with only Python code. Do not answer with
any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:48:01.97747122
Z', 'message': {'role': 'assistant', 'content': '```python\nimport plotly.gr
aph_objects as go\n\nif df.shape[0] == 1:\n    fig = go.Figure(go.Indicator
(\n        mode="gauge+number",\n        value=df[\'TotalAlbumsBought\'].ilo
c[0],\n        number={\'suffix\': " albums"},\n        gauge={\n
\'axis\': {\'range\': [None, max(df[\'TotalAlbumsBought\'])]}\n        }\n
))\nelse:\n    fig = go.Figure(data=[go.Bar(x=df[\'CustomerId\'], y=df[\'Tot
alAlbumsBought\'])])\nfig.update_layout(title=\'Top Customer by Total Albums
Bought\')\nfig.show()\n```'}, 'done_reason': 'stop', 'done': True, 'total_du
ration': 50603915275, 'load_duration': 16186851, 'prompt_eval_count': 259,
'prompt_eval_duration': 14028273000, 'eval_count': 138, 'eval_duration': 365
13480000}
```



```
Out[35]: ('SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought\nFROM "invoice
         s" i\nJOIN "invoice_items" ii ON i.InvoiceId = ii.InvoiceId\nJOIN "tracks"
         t ON ii.TrackId = t.TrackId\nWHERE t.MediaTypeId = 1 -- Assuming MediaTypeI
         d 1 represents albums\nGROUP BY i.CustomerId\nORDER BY TotalAlbumsBought DE
         SC\nLIMIT 1',
             CustomerId  TotalAlbumsBought
          0           8                 38,
          Figure({
              'data': [{'gauge': {'axis': {'range': [None, 38]}},
                        'mode': 'gauge+number',
                        'number': {'suffix': ' albums'},
                        'type': 'indicator',
                        'value': 38}],
              'layout': {'template': '...', 'title': {'text': 'Top Customer by Total
         Albums Bought'}}
          }))
```

```
In [36]: question = """
             Hint: album quantity is found in invoice_items,

             Find the top 5 customers who bought the most albums in total quantity (a
         """

         vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

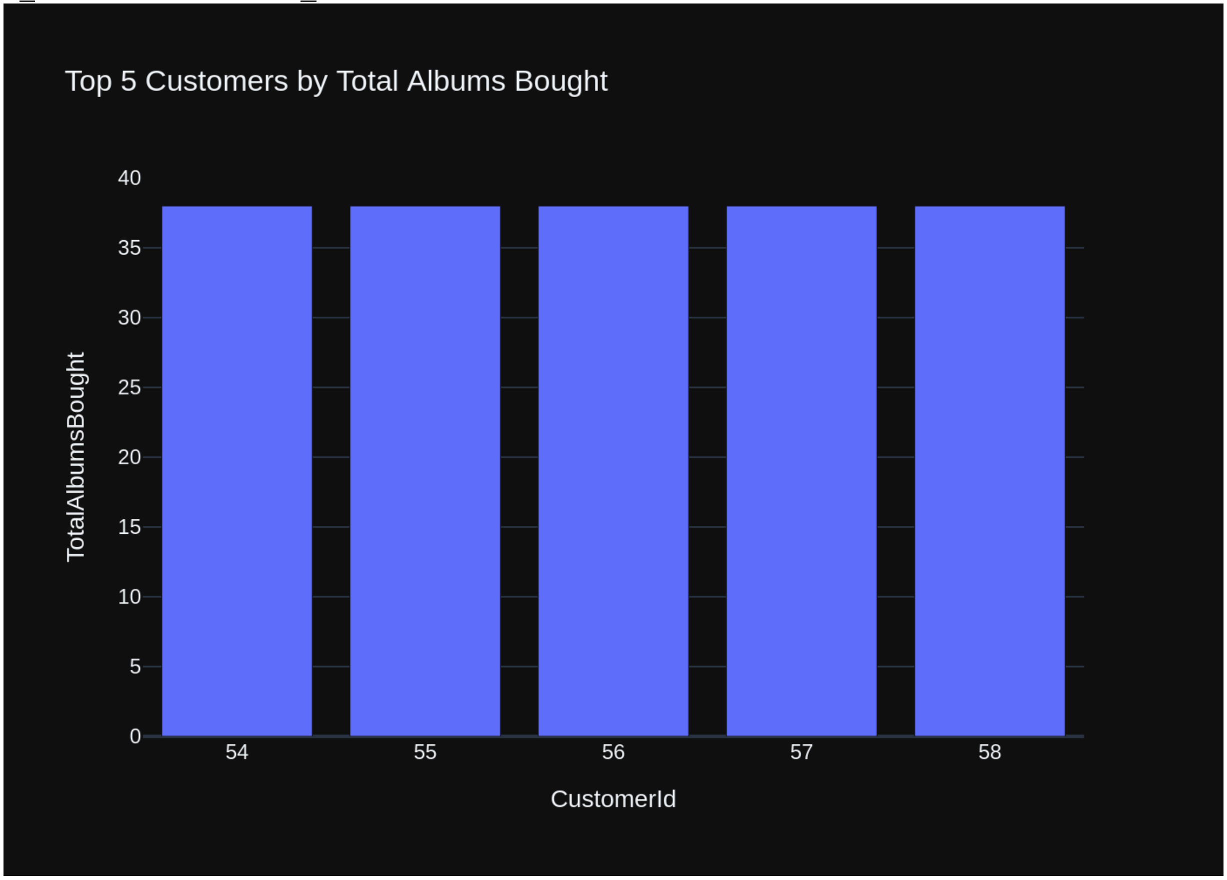
```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoice_items"\r\n(\r\n    Invo
iceLineId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEG
ER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,
2)  NOT NULL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (Invoice
Id) REFERENCES "invoices" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE
NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "tracks"\r\n
(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVA
RCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NO
T NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Millis
econds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,
2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId)
REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_types" (MediaTypeId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "album
s"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Ti
tle NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREI
GN KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON "albums" (Ar
tistId)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON "invoice_items" (Invoice
Id)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nC
REATE TABLE "invoices"\r\n(\r\n    InvoiceId INTEGER PRIMARY KEY AUTOINCREME
NT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    InvoiceDate DATETIM
E  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    BillingCity NVARCHAR
(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry NVARCHAR(4
0),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(10,2)  NOT N
ULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "customers" (CustomerId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_Invoi
ceCustomerId ON "invoices" (CustomerId)\n\nCREATE INDEX IFK_TrackAlbumId ON
"tracks" (AlbumId)\n\nCREATE TABLE "artists"\r\n(\r\n    ArtistId INTEGER PR
IMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===Add
itional Context \n\nIn the chinook database invoice means order\n\n===Respon
se Guidelines \n1. If the provided context is sufficient, please generate a
valid SQL query without any explanations for the question. \n2. If the provi
ded context is almost sufficient but requires knowledge of a specific string
in a particular column, please generate an intermediate SQL query to find th
e distinct strings in that column. Prepend the query with a comment saying i
ntermediate_sql \n3. If the provided context is insufficient, please explain
why it can\'t be generated. \n4. Please use the most relevant table(s). \n5.
If the question has been asked and answered before, please repeat the answer
exactly as it was given before. \n'}, {'role': 'user', 'content': '  \n
Find the customer who bought the most albums in total quantity (across all i
nvoices): \n'}, {'role': 'assistant', 'content': 'SELECT i.CustomerId, SUM(i
i.Quantity) AS TotalAlbumsBought\nFROM "invoices" i\nJOIN "invoice_items" ii
ON i.InvoiceId = ii.InvoiceId\nJOIN "tracks" t ON ii.TrackId = t.TrackId\nWH
ERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 represents albums\nGROUP BY
i.CustomerId\nORDER BY TotalAlbumsBought DESC\nLIMIT 1'}, {'role': 'user',
'content': ' \n    There are 3 tables: artists, albums and tracks, where alb
ums and artists are linked by ArtistId, albums and tracks are linked by Albu
mId,\n    Can you find the top 10 most popular artists based on the number o
f tracks\n'}, {'role': 'assistant', 'content': 'SELECT a.Name AS ArtistName,
COUNT(t.TrackId) AS TrackCount FROM artists a LEFT JOIN albums alb ON a.Arti
```

```
stId = alb.ArtistId LEFT JOIN tracks t ON alb.AlbumId = t.AlbumId GROUP BY
a.ArtistId ORDER BY TrackCount DESC LIMIT 10'}, {'role': 'user', 'content':
'  \n     Find the customer with the most invoices \n'}, {'role': 'assistan
t', 'content': 'SELECT CustomerId, COUNT(*) AS InvoiceCount FROM "invoices"
GROUP BY CustomerId ORDER BY InvoiceCount DESC LIMIT 1'}, {'role': 'user',
'content': '  \n    Find the top 5 most expensive tracks (based on unit pric
e):\n'}, {'role': 'assistant', 'content': 'SELECT TrackId, Name, UnitPrice F
ROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, {'role': 'user', 'content':
'  \n    List all invoices with a total exceeding $10:\n'}, {'role': 'assist
ant', 'content': ' SELECT * FROM "invoices" WHERE Total > 10'}, {'role': 'us
er', 'content': '  \n    Get the total number of invoices for each customer
\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT(*) AS Total
Invoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'user', 'content':
'  \n    Get the average invoice total for each customer:\n'}, {'role': 'ass
istant', 'content': 'SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FR
OM "invoices" GROUP BY CustomerId'}, {'role': 'user', 'content': 'what are t
he top 5 countries that customers come from?'}, {'role': 'assistant', 'conte
nt': 'SELECT Country, COUNT(*) AS CustomerCount FROM "customers" GROUP BY Co
untry ORDER BY CustomerCount DESC LIMIT 5'}, {'role': 'user', 'content': '
\n    Find all invoices since 2010 and the total amount invoiced:\n'}, {'rol
e': 'assistant', 'content': 'SELECT InvoiceDate, SUM(Total) AS TotalAmount F
ROM "invoices" WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\' GROUP BY Invo
iceDate'}, {'role': 'user', 'content': '  \n    List all albums and their co
rresponding artist names  \n'}, {'role': 'assistant', 'content': 'SELECT a.T
itle AS AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar
ON a.ArtistId = ar.ArtistId'}, {'role': 'user', 'content': '  \n    Hint: al
bum quantity is found in invoice_items, \n    \n    Find the top 5 customers
who bought the most albums in total quantity (across all invoices):\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"invoice_items\"\r\n(\r\n    InvoiceLineId
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NU
LL,\r\n    TrackId INTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NU
LL,\r\n    Quantity INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERE
NCES \"invoices\" (InvoiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON D
ELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"tracks\"\r\n(\r\n
TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(20
0)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NUL
L,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Millisecond
s INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  N
OT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFE
RENCES \"genres\" (GenreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTIO
N,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES \"media_types\" (MediaTypeId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"album
s\"\r\n(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    T
itle NVARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FORE
IGN KEY (ArtistId) REFERENCES \"artists\" (ArtistId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums
```

```
\" (ArtistId)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON \"invoice_items\"
(InvoiceId)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (Tra
ckId)\n\nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n    InvoiceD
ate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    BillingCi
ty NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCountry NVA
RCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMERIC(10,2)
NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\" (Customer
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK
_InvoiceCustomerId ON \"invoices\" (CustomerId)\n\nCREATE INDEX IFK_TrackAlb
umId ON \"tracks\" (AlbumId)\n\nCREATE TABLE \"artists\"\r\n(\r\n    ArtistI
d INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)
\n\n\n===Additional Context \n\nIn the chinook database invoice means order
\n\n===Response Guidelines \n1. If the provided context is sufficient, pleas
e generate a valid SQL query without any explanations for the question. \n2.
If the provided context is almost sufficient but requires knowledge of a spe
cific string in a particular column, please generate an intermediate SQL que
ry to find the distinct strings in that column. Prepend the query with a com
ment saying intermediate_sql \n3. If the provided context is insufficient, p
lease explain why it can't be generated. \n4. Please use the most relevant t
able(s). \n5. If the question has been asked and answered before, please rep
eat the answer exactly as it was given before. \n"}, {"role": "user", "conte
nt": "  \n     Find the customer who bought the most albums in total quantit
y (across all invoices): \n"}, {"role": "assistant", "content": "SELECT i.Cu
stomerId, SUM(ii.Quantity) AS TotalAlbumsBought\nFROM \"invoices\" i\nJOIN
\"invoice_items\" ii ON i.InvoiceId = ii.InvoiceId\nJOIN \"tracks\" t ON ii.
TrackId = t.TrackId\nWHERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 repre
sents albums\nGROUP BY i.CustomerId\nORDER BY TotalAlbumsBought DESC\nLIMIT
1"}, {"role": "user", "content": " \n    There are 3 tables: artists, albums
and tracks, where albums and artists are linked by ArtistId, albums and trac
ks are linked by AlbumId,\n    Can you find the top 10 most popular artists
based on the number of tracks\n"}, {"role": "assistant", "content": "SELECT
a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FROM artists a LEFT JOI
N albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tracks t ON alb.AlbumId
= t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DESC LIMIT 10"}, {"rol
e": "user", "content": "  \n     Find the customer with the most invoices
\n"}, {"role": "assistant", "content": "SELECT CustomerId, COUNT(*) AS Invoi
ceCount FROM \"invoices\" GROUP BY CustomerId ORDER BY InvoiceCount DESC LIM
IT 1"}, {"role": "user", "content": "  \n    Find the top 5 most expensive t
racks (based on unit price):\n"}, {"role": "assistant", "content": "SELECT T
rackId, Name, UnitPrice FROM \"tracks\" ORDER BY UnitPrice DESC LIMIT 5"},
{"role": "user", "content": "  \n    List all invoices with a total exceedin
g $10:\n"}, {"role": "assistant", "content": " SELECT * FROM \"invoices\" WH
ERE Total > 10"}, {"role": "user", "content": "  \n    Get the total number
of invoices for each customer\n"}, {"role": "assistant", "content": "SELECT
CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY CustomerI
d"}, {"role": "user", "content": "  \n    Get the average invoice total for
each customer:\n"}, {"role": "assistant", "content": "SELECT CustomerId, AVG
(Total) AS AverageInvoiceTotal FROM \"invoices\" GROUP BY CustomerId"}, {"ro
le": "user", "content": "what are the top 5 countries that customers come fr
om?"}, {"role": "assistant", "content": "SELECT Country, COUNT(*) AS Custome
rCount FROM \"customers\" GROUP BY Country ORDER BY CustomerCount DESC LIMIT
5"}, {"role": "user", "content": "  \n    Find all invoices since 2010 and t
he total amount invoiced:\n"}, {"role": "assistant", "content": "SELECT Invo
iceDate, SUM(Total) AS TotalAmount FROM \"invoices\" WHERE strftime('%Y', In
voiceDate) >= '2010' GROUP BY InvoiceDate"}, {"role": "user", "content": "
```

```
\n    List all albums and their corresponding artist names  \n"}, {"role":
"assistant", "content": "SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName
FROM \"albums\" a JOIN \"artists\" ar ON a.ArtistId = ar.ArtistId"}, {"rol
e": "user", "content": "  \n    Hint: album quantity is found in invoice_ite
ms, \n    \n    Find the top 5 customers who bought the most albums in total
quantity (across all invoices):\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:49:51.28468510
9Z', 'message': {'role': 'assistant', 'content': 'SELECT i.CustomerId, SUM(i
i.Quantity) AS TotalAlbumsBought FROM "invoices" i JOIN "invoice_items" ii O
N i.InvoiceId = ii.InvoiceId WHERE ii.TrackId IN (SELECT t.TrackId FROM "tra
cks" t JOIN "albums" a ON t.AlbumId = a.AlbumId) GROUP BY i.CustomerId ORDER
BY TotalAlbumsBought DESC LIMIT 5'}, 'done_reason': 'stop', 'done': True, 't
otal_duration': 109194132451, 'load_duration': 14166735, 'prompt_eval_coun
t': 1550, 'prompt_eval_duration': 83458306000, 'eval_count': 89, 'eval_durat
ion': 24262312000}
LLM Response: SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FRO
M "invoices" i JOIN "invoice_items" ii ON i.InvoiceId = ii.InvoiceId WHERE i
i.TrackId IN (SELECT t.TrackId FROM "tracks" t JOIN "albums" a ON t.AlbumId
= a.AlbumId) GROUP BY i.CustomerId ORDER BY TotalAlbumsBought DESC LIMIT 5
SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FROM "invoices" i
JOIN "invoice_items" ii ON i.InvoiceId = ii.InvoiceId WHERE ii.TrackId IN (S
ELECT t.TrackId FROM "tracks" t JOIN "albums" a ON t.AlbumId = a.AlbumId) GR
OUP BY i.CustomerId ORDER BY TotalAlbumsBought DESC LIMIT 5
   CustomerId  TotalAlbumsBought
0          58                 38
1          57                 38
2          56                 38
3          55                 38
4          54                 38
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n    Hint: album quantity is found in invoice_items, \n    \n    Find the t
op 5 customers who bought the most albums in total quantity (across all invo
ices):\n'\n\nThe DataFrame was produced using this query: SELECT i.CustomerI
d, SUM(ii.Quantity) AS TotalAlbumsBought FROM \"invoices\" i JOIN \"invoice_
items\" ii ON i.InvoiceId = ii.InvoiceId WHERE ii.TrackId IN (SELECT t.Track
Id FROM \"tracks\" t JOIN \"albums\" a ON t.AlbumId = a.AlbumId) GROUP BY i.
CustomerId ORDER BY TotalAlbumsBought DESC LIMIT 5\n\nThe following is infor
mation about the resulting pandas DataFrame 'df': \nRunning df.dtypes give
s:\n CustomerId           int64\nTotalAlbumsBought    int64\ndtype: objec
t"}, {"role": "user", "content": "Can you generate the Python plotly code to
chart the results of the dataframe? Assume the data is in a pandas dataframe
called 'df'. If there is only one value in the dataframe, use an Indicator.
Respond with only Python code. Do not answer with any explanations -- just t
he code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:50:17.69530932
2Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nfig = px.bar(df, x='CustomerId', y='TotalAlbumsBought', titl
e='Top 5 Customers by Total Albums Bought')\nfig.show()\n```"}, 'done_reaso
```

```
n': 'stop', 'done': True, 'total_duration': 26384298766, 'load_duration': 14
426708, 'prompt_eval_count': 267, 'prompt_eval_duration': 14135908000, 'eval
_count': 47, 'eval_duration': 12187809000}
```



```
Out[36]: ('SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FROM "invoice
         s" i JOIN "invoice_items" ii ON i.InvoiceId = ii.InvoiceId WHERE ii.TrackId
         IN (SELECT t.TrackId FROM "tracks" t JOIN "albums" a ON t.AlbumId = a.Album
         Id) GROUP BY i.CustomerId ORDER BY TotalAlbumsBought DESC LIMIT 5',
             CustomerId  TotalAlbumsBought
          0          58                 38
          1          57                 38
          2          56                 38
          3          55                 38
          4          54                 38,
          Figure({
              'data': [{'alignmentgroup': 'True',
                        'hovertemplate': 'CustomerId=%{x}<br>TotalAlbumsBought=%{y}<
         extra></extra>',
                        'legendgroup': '',
                        'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
                        'name': '',
                        'offsetgroup': '',
                        'orientation': 'v',
                        'showlegend': False,
                        'textposition': 'auto',
                        'type': 'bar',
                        'x': array([58, 57, 56, 55, 54]),
                        'xaxis': 'x',
                        'y': array([38, 38, 38, 38, 38]),
                        'yaxis': 'y'}],
              'layout': {'barmode': 'relative',
                         'legend': {'tracegroupgap': 0},
                         'template': '...',
                         'title': {'text': 'Top 5 Customers by Total Albums Bough
         t'},
                         'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'CustomerId'}},
                         'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'TotalAlbumsBought'}}}
          }))
```

```sql
SELECT c.CustomerId, SUM(il.Quantity) AS TotalAlbums
FROM Customers c
JOIN invoices i  ON c.CustomerId = i.CustomerId
JOIN invoice_items il ON i.InvoiceId = il.InvoiceId
GROUP BY c.CustomerId
ORDER BY TotalAlbums DESC
LIMIT 5
```

```
In [37]: question = """
              Find the top 5 customers who spent the most money overall,

              Hint: order total can be found on invoices table, calculation using inv
         """

         vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

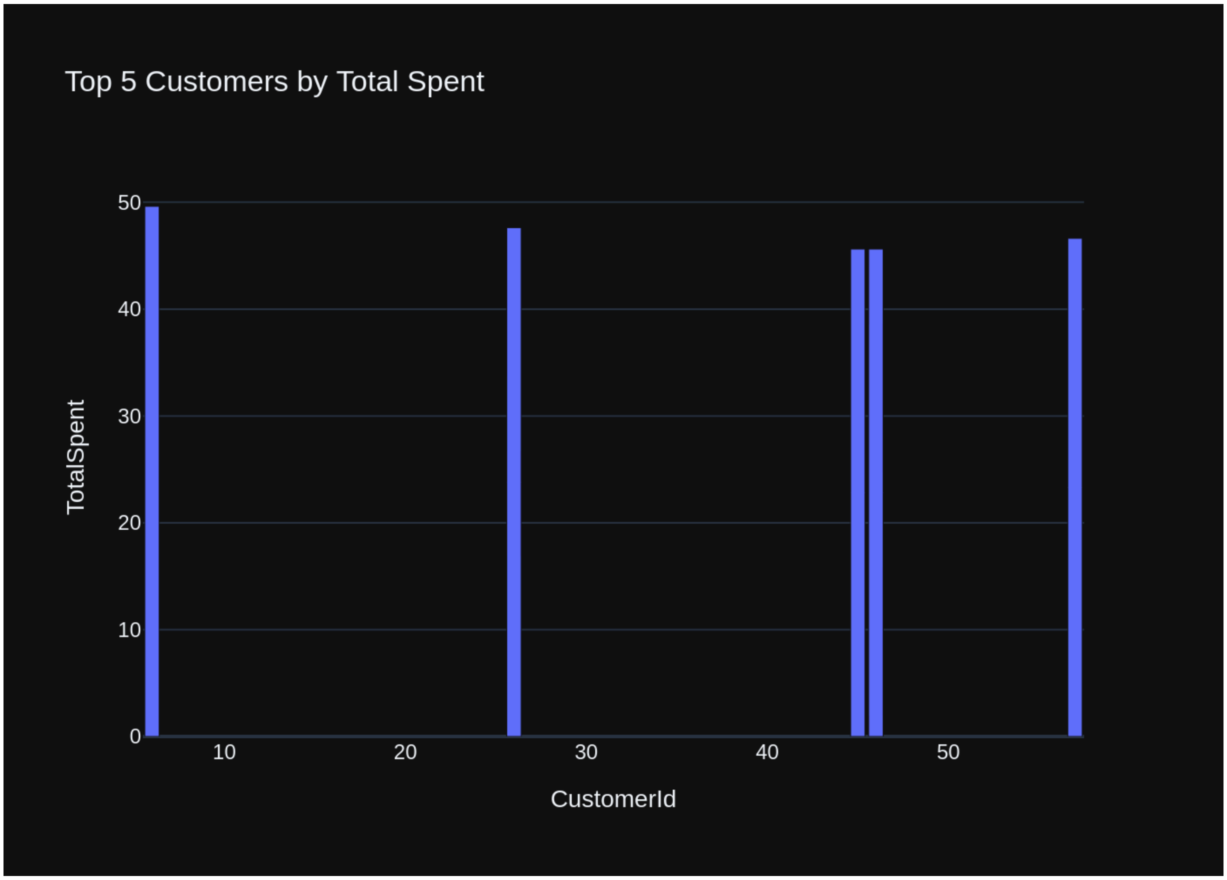
```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please 
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    InvoiceId 
INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT N
ULL,\r\n    InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(7
0),\r\n    BillingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    
BillingCountry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    T
otal NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES "cu
stomers" (CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n
\nCREATE TABLE "invoice_items"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY 
AUTOINCREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId I
NTEGER  NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity 
INTEGER  NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES "invoices" (Inv
oiceId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY 
(TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDAT
E NO ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON "invoice_items" 
(InvoiceId)\n\nCREATE INDEX IFK_InvoiceCustomerId ON "invoices" (CustomerId)
\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nCREA
TE TABLE "customers"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCREMEN
T NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVARCHA
R(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(70),\r
\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR
(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax 
NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId INTEG
ER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES "employees" (EmployeeId) \r
\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "employee
s"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    
LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NOT NULL,\r
\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDate DATETIM
E,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    City NVARCH
AR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n    Posta
lCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(24),\r\n    
Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES "employees" (E
mployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TA
BLE "tracks"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGER,\r\n    Media
TypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Composer NVARCHAR(2
20),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTEGER,\r\n    Uni
tPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId) REFERENCES "alb
ums" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREI
GN KEY (GenreId) REFERENCES "genres" (GenreId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFERENCES "media_type
s" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCRE
ATE TABLE "playlist_track"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    
TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY 
(PlaylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES "playlist
s" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FORE
IGN KEY (TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION 
ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeReportsTo ON "employee
s" (ReportsTo)\n\n\n===Additional Context \n\nIn the chinook database invoic
e means order\n\n===Response Guidelines \n1. If the provided context is suff
icient, please generate a valid SQL query without any explanations for the q
uestion. \n2. If the provided context is almost sufficient but requires know
ledge of a specific string in a particular column, please generate an interm
ediate SQL query to find the distinct strings in that column. Prepend the qu
```

```
ery with a comment saying intermediate_sql \n3. If the provided context is i
nsufficient, please explain why it can\'t be generated. \n4. Please use the
most relevant table(s). \n5. If the question has been asked and answered bef
ore, please repeat the answer exactly as it was given before. \n'}, {'role':
'user', 'content': '  \n    Hint: album quantity is found in invoice_items,
\n    \n    Find the top 5 customers who bought the most albums in total qua
ntity (across all invoices):\n'}, {'role': 'assistant', 'content': 'SELECT
i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FROM "invoices" i JOIN
"invoice_items" ii ON i.InvoiceId = ii.InvoiceId WHERE ii.TrackId IN (SELECT
t.TrackId FROM "tracks" t JOIN "albums" a ON t.AlbumId = a.AlbumId) GROUP BY
i.CustomerId ORDER BY TotalAlbumsBought DESC LIMIT 5'}, {'role': 'user', 'co
ntent': '  \n     Find the customer who bought the most albums in total quan
tity (across all invoices): \n'}, {'role': 'assistant', 'content': 'SELECT
i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought\nFROM "invoices" i\nJOIN
"invoice_items" ii ON i.InvoiceId = ii.InvoiceId\nJOIN "tracks" t ON ii.Trac
kId = t.TrackId\nWHERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 represent
s albums\nGROUP BY i.CustomerId\nORDER BY TotalAlbumsBought DESC\nLIMIT 1'},
{'role': 'user', 'content': '  \n     Find the customer with the most invoic
es \n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT(*) AS In
voiceCount FROM "invoices" GROUP BY CustomerId ORDER BY InvoiceCount DESC LI
MIT 1'}, {'role': 'user', 'content': '  \n    Get the average invoice total
for each customer:\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId,
AVG(Total) AS AverageInvoiceTotal FROM "invoices" GROUP BY CustomerId'}, {'r
ole': 'user', 'content': '  \n    Find the top 5 most expensive tracks (base
d on unit price):\n'}, {'role': 'assistant', 'content': 'SELECT TrackId, Nam
e, UnitPrice FROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, {'role': 'use
r', 'content': '  \n    Get the total number of invoices for each customer
\n'}, {'role': 'assistant', 'content': 'SELECT CustomerId, COUNT(*) AS Total
Invoices FROM "invoices" GROUP BY CustomerId'}, {'role': 'user', 'content':
'what are the top 5 countries that customers come from?'}, {'role': 'assista
nt', 'content': 'SELECT Country, COUNT(*) AS CustomerCount FROM "customers"
GROUP BY Country ORDER BY CustomerCount DESC LIMIT 5'}, {'role': 'user', 'co
ntent': '  \n    Find all invoices since 2010 and the total amount invoice
d:\n'}, {'role': 'assistant', 'content': 'SELECT InvoiceDate, SUM(Total) AS
TotalAmount FROM "invoices" WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\'
GROUP BY InvoiceDate'}, {'role': 'user', 'content': '  \n    List all invoic
es with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELEC
T * FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': ' \n
There are 3 tables: artists, albums and tracks, where albums and artists are
linked by ArtistId, albums and tracks are linked by AlbumId,\n    Can you fi
nd the top 10 most popular artists based on the number of tracks\n'}, {'rol
e': 'assistant', 'content': 'SELECT a.Name AS ArtistName, COUNT(t.TrackId) A
S TrackCount FROM artists a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistI
d LEFT JOIN tracks t ON alb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY
TrackCount DESC LIMIT 10'}, {'role': 'user', 'content': '  \n     Find the t
op 5 customers who spent the most money overall, \n     \n     Hint: order t
otal can be found on invoices table, calculation using invoice_items detail
table is unnecessary \n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
```

```
ons. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n    InvoiceId INTEGER P
RIMARY KEY AUTOINCREMENT NOT NULL,\r\n    CustomerId INTEGER  NOT NULL,\r\n
InvoiceDate DATETIME  NOT NULL,\r\n    BillingAddress NVARCHAR(70),\r\n    B
illingCity NVARCHAR(40),\r\n    BillingState NVARCHAR(40),\r\n    BillingCou
ntry NVARCHAR(40),\r\n    BillingPostalCode NVARCHAR(10),\r\n    Total NUMER
IC(10,2)  NOT NULL,\r\n    FOREIGN KEY (CustomerId) REFERENCES \"customers\"
(CustomerId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE
TABLE \"invoice_items\"\r\n(\r\n    InvoiceLineId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    InvoiceId INTEGER  NOT NULL,\r\n    TrackId INTEGER
NOT NULL,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    Quantity INTEGER
NOT NULL,\r\n    FOREIGN KEY (InvoiceId) REFERENCES \"invoices\" (InvoiceId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackI
d) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE INDEX IFK_InvoiceLineInvoiceId ON \"invoice_items\" (I
nvoiceId)\n\nCREATE INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerId)
\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)\n\nCR
EATE TABLE \"customers\"\r\n(\r\n    CustomerId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    FirstName NVARCHAR(40)  NOT NULL,\r\n    LastName NVA
RCHAR(20)  NOT NULL,\r\n    Company NVARCHAR(80),\r\n    Address NVARCHAR(7
0),\r\n    City NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVAR
CHAR(40),\r\n    PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n
Fax NVARCHAR(24),\r\n    Email NVARCHAR(60)  NOT NULL,\r\n    SupportRepId I
NTEGER,\r\n    FOREIGN KEY (SupportRepId) REFERENCES \"employees\" (Employee
Id) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"e
mployees\"\r\n(\r\n    EmployeeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NUL
L,\r\n    LastName NVARCHAR(20)  NOT NULL,\r\n    FirstName NVARCHAR(20)  NO
T NULL,\r\n    Title NVARCHAR(30),\r\n    ReportsTo INTEGER,\r\n    BirthDat
e DATETIME,\r\n    HireDate DATETIME,\r\n    Address NVARCHAR(70),\r\n    Ci
ty NVARCHAR(40),\r\n    State NVARCHAR(40),\r\n    Country NVARCHAR(40),\r\n
PostalCode NVARCHAR(10),\r\n    Phone NVARCHAR(24),\r\n    Fax NVARCHAR(2
4),\r\n    Email NVARCHAR(60),\r\n    FOREIGN KEY (ReportsTo) REFERENCES \"e
mployees\" (EmployeeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)
\n\nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMARY KEY AUTOINCR
EMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    AlbumId INTEGE
R,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGER,\r\n    Comp
oser NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n    Bytes INTE
GER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY (AlbumId)
REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACT
ION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTypeId) REFER
ENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE TABLE \"playlist_track\"\r\n(\r\n    PlaylistId INTEGE
R  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_Playlist
Track PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) RE
FERENCES \"playlists\" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t
\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeR
eportsTo ON \"employees\" (ReportsTo)\n\n\n===Additional Context \n\nIn the
chinook database invoice means order\n\n===Response Guidelines \n1. If the p
rovided context is sufficient, please generate a valid SQL query without any
explanations for the question. \n2. If the provided context is almost suffic
ient but requires knowledge of a specific string in a particular column, ple
ase generate an intermediate SQL query to find the distinct strings in that
column. Prepend the query with a comment saying intermediate_sql \n3. If the
provided context is insufficient, please explain why it can't be generated.
\n4. Please use the most relevant table(s). \n5. If the question has been as
```

```
ked and answered before, please repeat the answer exactly as it was given be
fore. \n"}, {"role": "user", "content": "  \n    Hint: album quantity is fou
nd in invoice_items, \n    \n    Find the top 5 customers who bought the mos
t albums in total quantity (across all invoices):\n"}, {"role": "assistant",
"content": "SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FROM
\"invoices\" i JOIN \"invoice_items\" ii ON i.InvoiceId = ii.InvoiceId WHERE
ii.TrackId IN (SELECT t.TrackId FROM \"tracks\" t JOIN \"albums\" a ON t.Alb
umId = a.AlbumId) GROUP BY i.CustomerId ORDER BY TotalAlbumsBought DESC LIMI
T 5"}, {"role": "user", "content": "  \n     Find the customer who bought th
e most albums in total quantity (across all invoices): \n"}, {"role": "assis
tant", "content": "SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBough
t\nFROM \"invoices\" i\nJOIN \"invoice_items\" ii ON i.InvoiceId = ii.Invoic
eId\nJOIN \"tracks\" t ON ii.TrackId = t.TrackId\nWHERE t.MediaTypeId = 1 --
Assuming MediaTypeId 1 represents albums\nGROUP BY i.CustomerId\nORDER BY To
talAlbumsBought DESC\nLIMIT 1"}, {"role": "user", "content": "  \n     Find
the customer with the most invoices \n"}, {"role": "assistant", "content":
"SELECT CustomerId, COUNT(*) AS InvoiceCount FROM \"invoices\" GROUP BY Cust
omerId ORDER BY InvoiceCount DESC LIMIT 1"}, {"role": "user", "content": "
\n    Get the average invoice total for each customer:\n"}, {"role": "assist
ant", "content": "SELECT CustomerId, AVG(Total) AS AverageInvoiceTotal FROM
\"invoices\" GROUP BY CustomerId"}, {"role": "user", "content": "  \n    Fin
d the top 5 most expensive tracks (based on unit price):\n"}, {"role": "assi
stant", "content": "SELECT TrackId, Name, UnitPrice FROM \"tracks\" ORDER BY
UnitPrice DESC LIMIT 5"}, {"role": "user", "content": "  \n    Get the total
number of invoices for each customer\n"}, {"role": "assistant", "content":
"SELECT CustomerId, COUNT(*) AS TotalInvoices FROM \"invoices\" GROUP BY Cus
tomerId"}, {"role": "user", "content": "what are the top 5 countries that cu
stomers come from?"}, {"role": "assistant", "content": "SELECT Country, COUN
T(*) AS CustomerCount FROM \"customers\" GROUP BY Country ORDER BY CustomerC
ount DESC LIMIT 5"}, {"role": "user", "content": "  \n    Find all invoices
since 2010 and the total amount invoiced:\n"}, {"role": "assistant", "conten
t": "SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM \"invoices\" WHERE s
trftime('%Y', InvoiceDate) >= '2010' GROUP BY InvoiceDate"}, {"role": "use
r", "content": "  \n    List all invoices with a total exceeding $10:\n"},
{"role": "assistant", "content": " SELECT * FROM \"invoices\" WHERE Total >
10"}, {"role": "user", "content": " \n    There are 3 tables: artists, album
s and tracks, where albums and artists are linked by ArtistId, albums and tr
acks are linked by AlbumId,\n    Can you find the top 10 most popular artist
s based on the number of tracks\n"}, {"role": "assistant", "content": "SELEC
T a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FROM artists a LEFT J
OIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tracks t ON alb.AlbumI
d = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DESC LIMIT 10"}, {"rol
e": "user", "content": "  \n     Find the top 5 customers who spent the most
money overall, \n     \n     Hint: order total can be found on invoices tabl
e, calculation using invoice_items detail table is unnecessary \n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:52:22.72131452
6Z', 'message': {'role': 'assistant', 'content': 'SELECT CustomerId, SUM(Tot
al) AS TotalSpent FROM "invoices" GROUP BY CustomerId ORDER BY TotalSpent DE
SC LIMIT 5'}, 'done_reason': 'stop', 'done': True, 'total_duration': 1249235
70130, 'load_duration': 14421354, 'prompt_eval_count': 2022, 'prompt_eval_du
ration': 115108940000, 'eval_count': 31, 'eval_duration': 8268145000}
LLM Response: SELECT CustomerId, SUM(Total) AS TotalSpent FROM "invoices" GR
OUP BY CustomerId ORDER BY TotalSpent DESC LIMIT 5
SELECT CustomerId, SUM(Total) AS TotalSpent FROM "invoices" GROUP BY Custome
rId ORDER BY TotalSpent DESC LIMIT 5
```

```
   CustomerId  TotalSpent
0           6       49.62
1          26       47.62
2          57       46.62
3          45       45.62
4          46       45.62
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n     Find the top 5 customers who spent the most money overall, \n     \n
Hint: order total can be found on invoices table, calculation using invoice_
items detail table is unnecessary \n'\n\nThe DataFrame was produced using th
is query: SELECT CustomerId, SUM(Total) AS TotalSpent FROM \"invoices\" GROU
P BY CustomerId ORDER BY TotalSpent DESC LIMIT 5\n\nThe following is informa
tion about the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n
CustomerId      int64\nTotalSpent    float64\ndtype: object"}, {"role": "use
r", "content": "Can you generate the Python plotly code to chart the results
of the dataframe? Assume the data is in a pandas dataframe called 'df'. If t
here is only one value in the dataframe, use an Indicator. Respond with only
Python code. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:52:45.4353413
Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.ex
press as px\n\nfig = px.bar(df, x='CustomerId', y='TotalSpent', title='Top 5
Customers by Total Spent')\nfig.show()\n```"}, 'done_reason': 'stop', 'don
e': True, 'total_duration': 22691646581, 'load_duration': 55160710, 'prompt_
eval_count': 211, 'prompt_eval_duration': 11300097000, 'eval_count': 44, 'ev
al_duration': 11291530000}
```


Top 5 Customers by Total Spent
TotalSpent
50
40
30
20
10
0
10
20
30
40
50
CustomerId

```
Out[37]: ('SELECT CustomerId, SUM(Total) AS TotalSpent FROM "invoices" GROUP BY Cust
         omerId ORDER BY TotalSpent DESC LIMIT 5',
             CustomerId  TotalSpent
          0           6       49.62
          1          26       47.62
          2          57       46.62
          3          45       45.62
          4          46       45.62,
          Figure({
              'data': [{'alignmentgroup': 'True',
                        'hovertemplate': 'CustomerId=%{x}<br>TotalSpent=%{y}<extra>
         </extra>',
                        'legendgroup': '',
                        'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
                        'name': '',
                        'offsetgroup': '',
                        'orientation': 'v',
                        'showlegend': False,
                        'textposition': 'auto',
                        'type': 'bar',
                        'x': array([ 6, 26, 57, 45, 46]),
                        'xaxis': 'x',
                        'y': array([49.62, 47.62, 46.62, 45.62, 45.62]),
                        'yaxis': 'y'}],
              'layout': {'barmode': 'relative',
                         'legend': {'tracegroupgap': 0},
                         'template': '...',
                         'title': {'text': 'Top 5 Customers by Total Spent'},
                         'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'CustomerId'}},
                         'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'TotalSpent'}}}
          }))
```

```
In [38]: question = """
              Get all playlists containing at least 10 tracks and the total duration
         """

         vn.ask(question=question)
```

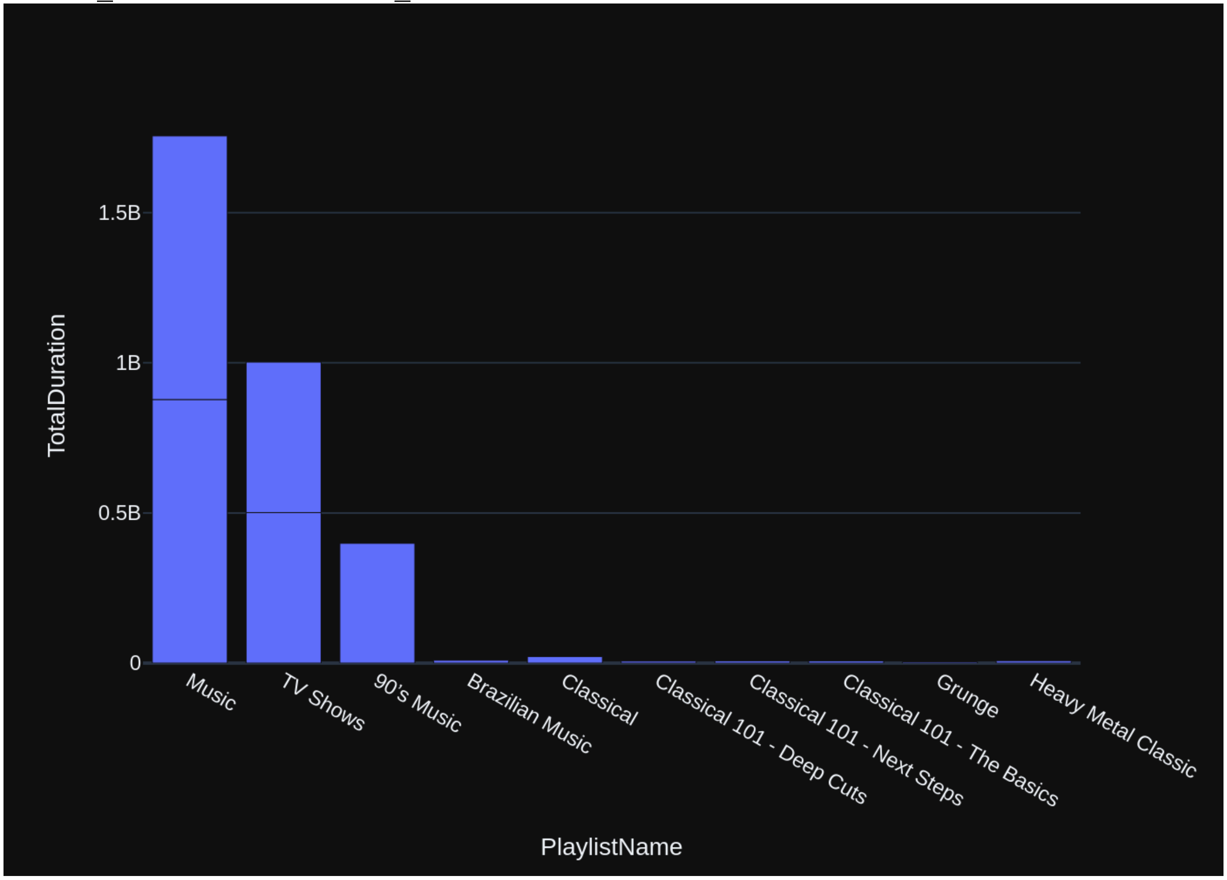
```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE INDEX IFK_PlaylistTrackTrackId ON "pla
ylist_track" (TrackId)\n\nCREATE TABLE "playlists"\r\n(\r\n    PlaylistId IN
TEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n
CREATE TABLE "playlist_track"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n
TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY
(PlaylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES "playlist
s" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FORE
IGN KEY (TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON DELETE NO ACTION
ON UPDATE NO ACTION\r\n)\n\nCREATE TABLE "tracks"\r\n(\r\n    TrackId INTEGE
R PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r
\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId
INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NUL
L,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FO
REIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACTIO
N ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (Gen
reId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (M
ediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO ACTI
ON ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackGenreId ON "tracks" (Ge
nreId)\n\nCREATE INDEX IFK_TrackAlbumId ON "tracks" (AlbumId)\n\nCREATE INDE
X IFK_TrackMediaTypeId ON "tracks" (MediaTypeId)\n\nCREATE INDEX IFK_AlbumAr
tistId ON "albums" (ArtistId)\n\nCREATE TABLE "albums"\r\n(\r\n    AlbumId I
NTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)  NOT N
ULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) REFERE
NCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r
\n)\n\nCREATE TABLE "genres"\r\n(\r\n    GenreId INTEGER PRIMARY KEY AUTOINC
REMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===Additional Context
\n\nIn the chinook database invoice means order\n\n===Response Guidelines \n
1. If the provided context is sufficient, please generate a valid SQL query
without any explanations for the question. \n2. If the provided context is a
lmost sufficient but requires knowledge of a specific string in a particular
column, please generate an intermediate SQL query to find the distinct strin
gs in that column. Prepend the query with a comment saying intermediate_sql
\n3. If the provided context is insufficient, please explain why it can\'t b
e generated. \n4. Please use the most relevant table(s). \n5. If the questio
n has been asked and answered before, please repeat the answer exactly as it
was given before. \n'}, {'role': 'user', 'content': ' \n    There are 3 tabl
es: artists, albums and tracks, where albums and artists are linked by Artis
tId, albums and tracks are linked by AlbumId,\n    Can you find the top 10 m
ost popular artists based on the number of tracks\n'}, {'role': 'assistant',
'content': 'SELECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FROM
artists a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tracks
t ON alb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DESC LI
MIT 10'}, {'role': 'user', 'content': '  \n     Find the customer who bought
the most albums in total quantity (across all invoices): \n'}, {'role': 'ass
istant', 'content': 'SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBou
ght\nFROM "invoices" i\nJOIN "invoice_items" ii ON i.InvoiceId = ii.InvoiceI
d\nJOIN "tracks" t ON ii.TrackId = t.TrackId\nWHERE t.MediaTypeId = 1 -- Ass
uming MediaTypeId 1 represents albums\nGROUP BY i.CustomerId\nORDER BY Total
AlbumsBought DESC\nLIMIT 1'}, {'role': 'user', 'content': '  \n    Find all
tracks with a name containing "What" (case-insensitive)\n'}, {'role': 'assis
tant', 'content': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role':
'user', 'content': '  \n    Hint: album quantity is found in invoice_items,
\n    \n    Find the top 5 customers who bought the most albums in total qua
```

```
ntity (across all invoices):\n'}, {'role': 'assistant', 'content': 'SELECT
i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FROM "invoices" i JOIN
"invoice_items" ii ON i.InvoiceId = ii.InvoiceId WHERE ii.TrackId IN (SELECT
t.TrackId FROM "tracks" t JOIN "albums" a ON t.AlbumId = a.AlbumId) GROUP BY
i.CustomerId ORDER BY TotalAlbumsBought DESC LIMIT 5'}, {'role': 'user', 'co
ntent': '  \n    Find the top 5 most expensive tracks (based on unit pric
e):\n'}, {'role': 'assistant', 'content': 'SELECT TrackId, Name, UnitPrice F
ROM "tracks" ORDER BY UnitPrice DESC LIMIT 5'}, {'role': 'user', 'content':
'  \n    List all albums and their corresponding artist names  \n'}, {'rol
e': 'assistant', 'content': 'SELECT a.Title AS AlbumTitle, ar.Name AS Artist
Name FROM "albums" a JOIN "artists" ar ON a.ArtistId = ar.ArtistId'}, {'rol
e': 'user', 'content': '  \n    Find all invoices since 2010 and the total a
mount invoiced:\n'}, {'role': 'assistant', 'content': 'SELECT InvoiceDate, S
UM(Total) AS TotalAmount FROM "invoices" WHERE strftime(\'%Y\', InvoiceDate)
>= \'2010\' GROUP BY InvoiceDate'}, {'role': 'user', 'content': 'Can you lis
t all tables in the SQLite database catalog?'}, {'role': 'assistant', 'conte
nt': "SELECT name FROM sqlite_master WHERE type='table'"}, {'role': 'user',
'content': '  \n    List all invoices with a total exceeding $10:\n'}, {'rol
e': 'assistant', 'content': ' SELECT * FROM "invoices" WHERE Total > 10'},
{'role': 'user', 'content': '  \n     Find the top 5 customers who spent the
most money overall, \n     \n     Hint: order total can be found on invoices
table, calculation using invoice_items detail table is unnecessary \n'}, {'r
ole': 'assistant', 'content': 'SELECT CustomerId, SUM(Total) AS TotalSpent F
ROM "invoices" GROUP BY CustomerId ORDER BY TotalSpent DESC LIMIT 5'}, {'rol
e': 'user', 'content': '  \n     Get all playlists containing at least 10 tr
acks and the total duration of those tracks:\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE INDEX IFK_PlaylistTrackTrackId ON \"playlist_track
\" (TrackId)\n\nCREATE TABLE \"playlists\"\r\n(\r\n    PlaylistId INTEGER PR
IMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE T
ABLE \"playlist_track\"\r\n(\r\n    PlaylistId INTEGER  NOT NULL,\r\n    Tra
ckId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_PlaylistTrack PRIMARY KEY  (Pla
ylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) REFERENCES \"playlists\"
(PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN
KEY (TrackId) REFERENCES \"tracks\" (TrackId) \r\n\t\tON DELETE NO ACTION ON
UPDATE NO ACTION\r\n)\n\nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER
PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n
AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGE
R,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n
Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY
(AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTy
peId) REFERENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (Genr
eId)\n\nCREATE INDEX IFK_TrackAlbumId ON \"tracks\" (AlbumId)\n\nCREATE INDE
X IFK_TrackMediaTypeId ON \"tracks\" (MediaTypeId)\n\nCREATE INDEX IFK_Album
ArtistId ON \"albums\" (ArtistId)\n\nCREATE TABLE \"albums\"\r\n(\r\n    Alb
umId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARCHAR(160)
NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (ArtistId) R
EFERENCES \"artists\" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO AC
TION\r\n)\n\nCREATE TABLE \"genres\"\r\n(\r\n    GenreId INTEGER PRIMARY KEY
AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\n\n===Additional Co
ntext \n\nIn the chinook database invoice means order\n\n===Response Guideli
nes \n1. If the provided context is sufficient, please generate a valid SQL
query without any explanations for the question. \n2. If the provided contex
t is almost sufficient but requires knowledge of a specific string in a part
icular column, please generate an intermediate SQL query to find the distinc
t strings in that column. Prepend the query with a comment saying intermedia
te_sql \n3. If the provided context is insufficient, please explain why it c
an't be generated. \n4. Please use the most relevant table(s). \n5. If the q
uestion has been asked and answered before, please repeat the answer exactly
as it was given before. \n"}, {"role": "user", "content": " \n    There are
3 tables: artists, albums and tracks, where albums and artists are linked by
ArtistId, albums and tracks are linked by AlbumId,\n    Can you find the top
10 most popular artists based on the number of tracks\n"}, {"role": "assista
nt", "content": "SELECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount
FROM artists a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN t
racks t ON alb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount D
ESC LIMIT 10"}, {"role": "user", "content": "  \n     Find the customer who
bought the most albums in total quantity (across all invoices): \n"}, {"rol
e": "assistant", "content": "SELECT i.CustomerId, SUM(ii.Quantity) AS TotalA
lbumsBought\nFROM \"invoices\" i\nJOIN \"invoice_items\" ii ON i.InvoiceId =
ii.InvoiceId\nJOIN \"tracks\" t ON ii.TrackId = t.TrackId\nWHERE t.MediaType
Id = 1 -- Assuming MediaTypeId 1 represents albums\nGROUP BY i.CustomerId\nO
RDER BY TotalAlbumsBought DESC\nLIMIT 1"}, {"role": "user", "content": "  \n
Find all tracks with a name containing \"What\" (case-insensitive)\n"}, {"ro
le": "assistant", "content": "SELECT * FROM tracks WHERE Name LIKE '%Wha
t%'"}, {"role": "user", "content": "  \n    Hint: album quantity is found in
invoice_items, \n    \n    Find the top 5 customers who bought the most albu
ms in total quantity (across all invoices):\n"}, {"role": "assistant", "cont
ent": "SELECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FROM \"inv
oices\" i JOIN \"invoice_items\" ii ON i.InvoiceId = ii.InvoiceId WHERE ii.T
rackId IN (SELECT t.TrackId FROM \"tracks\" t JOIN \"albums\" a ON t.AlbumId
= a.AlbumId) GROUP BY i.CustomerId ORDER BY TotalAlbumsBought DESC LIMIT
5"}, {"role": "user", "content": "  \n    Find the top 5 most expensive trac
ks (based on unit price):\n"}, {"role": "assistant", "content": "SELECT Trac
kId, Name, UnitPrice FROM \"tracks\" ORDER BY UnitPrice DESC LIMIT 5"}, {"ro
le": "user", "content": "  \n    List all albums and their corresponding art
ist names  \n"}, {"role": "assistant", "content": "SELECT a.Title AS AlbumTi
tle, ar.Name AS ArtistName FROM \"albums\" a JOIN \"artists\" ar ON a.Artist
Id = ar.ArtistId"}, {"role": "user", "content": "  \n    Find all invoices s
ince 2010 and the total amount invoiced:\n"}, {"role": "assistant", "conten
t": "SELECT InvoiceDate, SUM(Total) AS TotalAmount FROM \"invoices\" WHERE s
trftime('%Y', InvoiceDate) >= '2010' GROUP BY InvoiceDate"}, {"role": "use
r", "content": "Can you list all tables in the SQLite database catalog?"},
{"role": "assistant", "content": "SELECT name FROM sqlite_master WHERE type
='table'"}, {"role": "user", "content": "  \n    List all invoices with a to
tal exceeding $10:\n"}, {"role": "assistant", "content": " SELECT * FROM \"i
nvoices\" WHERE Total > 10"}, {"role": "user", "content": "  \n     Find the
top 5 customers who spent the most money overall, \n     \n     Hint: order
total can be found on invoices table, calculation using invoice_items detail
table is unnecessary \n"}, {"role": "assistant", "content": "SELECT Customer
Id, SUM(Total) AS TotalSpent FROM \"invoices\" GROUP BY CustomerId ORDER BY
TotalSpent DESC LIMIT 5"}, {"role": "user", "content": "  \n     Get all pla
```

```
ylists containing at least 10 tracks and the total duration of those track
s:\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:54:34.74289889
Z', 'message': {'role': 'assistant', 'content': ' SELECT\n    p.Name AS Play
listName,\n    SUM(t.Milliseconds) AS TotalDuration\nFROM\n    "playlists" p
\nJOIN\n    "playlist_track" pt ON p.PlaylistId = pt.PlaylistId\nJOIN\n
"tracks" t ON pt.TrackId = t.TrackId\nGROUP BY\n    p.PlaylistId, p.Name\nHA
VING\n    COUNT(t.TrackId) >= 10'}, 'done_reason': 'stop', 'done': True, 'to
tal_duration': 109220492097, 'load_duration': 15379241, 'prompt_eval_count':
1493, 'prompt_eval_duration': 82121248000, 'eval_count': 97, 'eval_duratio
n': 25682358000}
LLM Response:  SELECT
    p.Name AS PlaylistName,
    SUM(t.Milliseconds) AS TotalDuration
FROM
    "playlists" p
JOIN
    "playlist_track" pt ON p.PlaylistId = pt.PlaylistId
JOIN
    "tracks" t ON pt.TrackId = t.TrackId
GROUP BY
    p.PlaylistId, p.Name
HAVING
    COUNT(t.TrackId) >= 10
 SELECT
    p.Name AS PlaylistName,
    SUM(t.Milliseconds) AS TotalDuration
FROM
    "playlists" p
JOIN
    "playlist_track" pt ON p.PlaylistId = pt.PlaylistId
JOIN
    "tracks" t ON pt.TrackId = t.TrackId
GROUP BY
    p.PlaylistId, p.Name
HAVING
    COUNT(t.TrackId) >= 10
                  PlaylistName  TotalDuration
0                        Music      877683083
1                     TV Shows      501094957
2                   90’s Music      398705153
3                        Music      877683083
4                     TV Shows      501094957
5              Brazilian Music        9486559
6                    Classical       21770592
7     Classical 101 - Deep Cuts        6755730
8    Classical 101 - Next Steps        7575051
9    Classical 101 - The Basics        7439811
10                      Grunge        4122018
11         Heavy Metal Classic        8206312
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
```

```
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n     Get all playlists containing at least 10 tracks and the total duratio
n of those tracks:\n'\n\nThe DataFrame was produced using this query:  SELEC
T\n    p.Name AS PlaylistName,\n    SUM(t.Milliseconds) AS TotalDuration\nFR
OM\n    \"playlists\" p\nJOIN\n    \"playlist_track\" pt ON p.PlaylistId = p
t.PlaylistId\nJOIN\n    \"tracks\" t ON pt.TrackId = t.TrackId\nGROUP BY\n
p.PlaylistId, p.Name\nHAVING\n    COUNT(t.TrackId) >= 10\n\nThe following is
information about the resulting pandas DataFrame 'df': \nRunning df.dtypes g
ives:\n PlaylistName     object\nTotalDuration     int64\ndtype: object"},
{"role": "user", "content": "Can you generate the Python plotly code to char
t the results of the dataframe? Assume the data is in a pandas dataframe cal
led 'df'. If there is only one value in the dataframe, use an Indicator. Res
pond with only Python code. Do not answer with any explanations -- just the
code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:55:24.37392678
7Z', 'message': {'role': 'assistant', 'content': '```python\nimport plotly.e
xpress as px\n\nif len(df) > 1:\n    fig = px.bar(df, x=\'PlaylistName\', y=
\'TotalDuration\')\n    fig.show()\nelse:\n    import dash\n    import dash_
core_components as dcc\n    import dash_html_components as html\n\n    app =
dash.Dash(__name__)\n\n    app.layout = html.Div([\n        html.H2(\'Playli
st Duration\'),\n        html.Div(f\'Playlist: {df["PlaylistName"].values
[0]}\'),\n        html.Div(f\'Total Duration: {df["TotalDuration"].values
[0]} milliseconds\')\n    ])\n\n    app.run_server(debug=True)\n```'}, 'done
_reason': 'stop', 'done': True, 'total_duration': 49603436718, 'load_duratio
n': 52430181, 'prompt_eval_count': 255, 'prompt_eval_duration': 12978209000,
'eval_count': 142, 'eval_duration': 36523832000}
```



Out[38]:
```
(' SELECT\n    p.Name AS PlaylistName,\n    SUM(t.Milliseconds) AS TotalDur
ation\nFROM\n    "playlists" p\nJOIN\n    "playlist_track" pt ON p.Playlist
Id = pt.PlaylistId\nJOIN\n    "tracks" t ON pt.TrackId = t.TrackId\nGROUP B
Y\n    p.PlaylistId, p.Name\nHAVING\n    COUNT(t.TrackId) >= 10',
                   PlaylistName  TotalDuration
 0                        Music      877683083
 1                     TV Shows      501094957
 2                   90’s Music      398705153
 3                        Music      877683083
 4                     TV Shows      501094957
 5              Brazilian Music        9486559
 6                    Classical       21770592
 7    Classical 101 - Deep Cuts        6755730
 8   Classical 101 - Next Steps        7575051
 9   Classical 101 - The Basics        7439811
 10                      Grunge        4122018
 11         Heavy Metal Classic        8206312,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'PlaylistName=%{x}<br>TotalDuration=%{y}<ex
tra></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array(['Music', 'TV Shows', '90’s Music', 'Music', 'TV
Shows',
                           'Brazilian Music', 'Classical', 'Classical 101 -
Deep Cuts',
                           'Classical 101 - Next Steps', 'Classical 101 - T
he Basics', 'Grunge',
                           'Heavy Metal Classic'], dtype=object),
               'xaxis': 'x',
               'y': array([877683083, 501094957, 398705153, 877683083, 5010
94957,   9486559,
                            21770592,   6755730,   7575051,   7439811,   41
22018,   8206312]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'margin': {'t': 60},
                'template': '...',
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'PlaylistName'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'TotalDuration'}}}
 }))
```

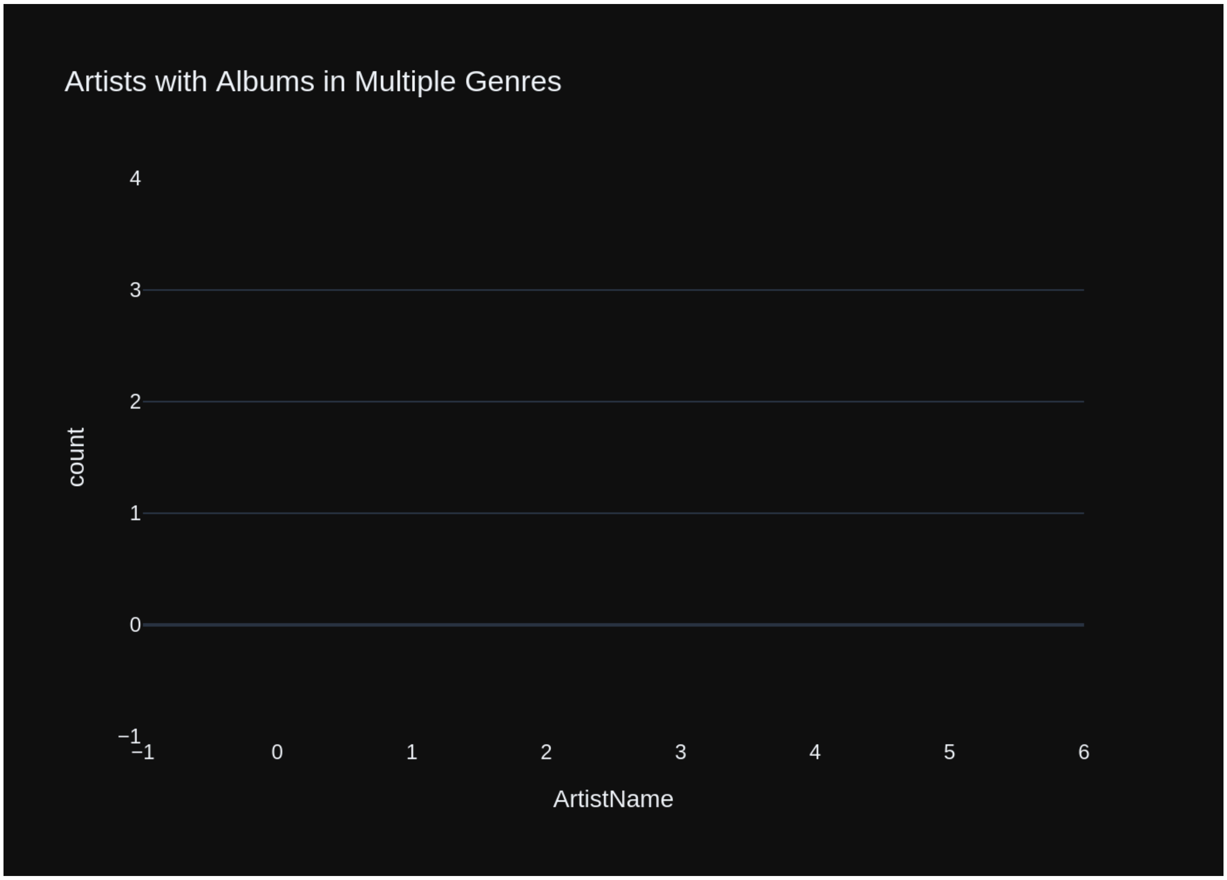
In [39]:
```
question = """
     Identify artists who have albums with tracks appearing in multiple genr
```

```
"""

vn.ask(question=question)
```

```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "tracks"\r\n(\r\n    TrackId INT
EGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NUL
L,\r\n    AlbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    Genr
eId INTEGER,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT
NULL,\r\n    Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n
FOREIGN KEY (AlbumId) REFERENCES "albums" (AlbumId) \r\n\t\tON DELETE NO ACT
ION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES "genres" (G
enreId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY
(MediaTypeId) REFERENCES "media_types" (MediaTypeId) \r\n\t\tON DELETE NO AC
TION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON "albums"
(ArtistId)\n\nCREATE INDEX IFK_TrackGenreId ON "tracks" (GenreId)\n\nCREATE
INDEX IFK_TrackAlbumId ON "tracks" (AlbumId)\n\nCREATE TABLE "albums"\r\n(\r
\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NVARC
HAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY (A
rtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDA
TE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackMediaTypeId ON "tracks" (MediaTyp
eId)\n\nCREATE TABLE "genres"\r\n(\r\n    GenreId INTEGER PRIMARY KEY AUTOIN
CREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_Playlis
tTrackTrackId ON "playlist_track" (TrackId)\n\nCREATE TABLE "artists"\r\n(\r
\n    ArtistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARC
HAR(120)\r\n)\n\nCREATE TABLE "playlist_track"\r\n(\r\n    PlaylistId INTEGE
R  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT PK_Playlist
Track PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KEY (PlaylistId) RE
FERENCES "playlists" (PlaylistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO A
CTION,\r\n    FOREIGN KEY (TrackId) REFERENCES "tracks" (TrackId) \r\n\t\tON
DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional Context \n\nIn
the chinook database invoice means order\n\n===Response Guidelines \n1. If t
he provided context is sufficient, please generate a valid SQL query without
any explanations for the question. \n2. If the provided context is almost su
fficient but requires knowledge of a specific string in a particular column,
please generate an intermediate SQL query to find the distinct strings in th
at column. Prepend the query with a comment saying intermediate_sql \n3. If
the provided context is insufficient, please explain why it can\'t be genera
ted. \n4. Please use the most relevant table(s). \n5. If the question has be
en asked and answered before, please repeat the answer exactly as it was giv
en before. \n'}, {'role': 'user', 'content': ' \n    There are 3 tables: art
ists, albums and tracks, where albums and artists are linked by ArtistId, al
bums and tracks are linked by AlbumId,\n    Can you find the top 10 most pop
ular artists based on the number of tracks\n'}, {'role': 'assistant', 'conte
nt': 'SELECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackCount FROM artis
ts a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT JOIN tracks t ON
alb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCount DESC LIMIT 1
0'}, {'role': 'user', 'content': '  \n    List all albums and their correspo
nding artist names  \n'}, {'role': 'assistant', 'content': 'SELECT a.Title A
S AlbumTitle, ar.Name AS ArtistName FROM "albums" a JOIN "artists" ar ON a.A
rtistId = ar.ArtistId'}, {'role': 'user', 'content': '  \n     Find the cust
omer who bought the most albums in total quantity (across all invoices):
\n'}, {'role': 'assistant', 'content': 'SELECT i.CustomerId, SUM(ii.Quantit
y) AS TotalAlbumsBought\nFROM "invoices" i\nJOIN "invoice_items" ii ON i.Inv
oiceId = ii.InvoiceId\nJOIN "tracks" t ON ii.TrackId = t.TrackId\nWHERE t.Me
diaTypeId = 1 -- Assuming MediaTypeId 1 represents albums\nGROUP BY i.Custom
erId\nORDER BY TotalAlbumsBought DESC\nLIMIT 1'}, {'role': 'user', 'conten
t': '  \n    Hint: album quantity is found in invoice_items, \n    \n    Fin
```

```
d the top 5 customers who bought the most albums in total quantity (across a
ll invoices):\n'}, {'role': 'assistant', 'content': 'SELECT i.CustomerId, SU
M(ii.Quantity) AS TotalAlbumsBought FROM "invoices" i JOIN "invoice_items" i
i ON i.InvoiceId = ii.InvoiceId WHERE ii.TrackId IN (SELECT t.TrackId FROM
"tracks" t JOIN "albums" a ON t.AlbumId = a.AlbumId) GROUP BY i.CustomerId O
RDER BY TotalAlbumsBought DESC LIMIT 5'}, {'role': 'user', 'content': '  \n
Get all playlists containing at least 10 tracks and the total duration of th
ose tracks:\n'}, {'role': 'assistant', 'content': ' SELECT\n    p.Name AS Pl
aylistName,\n    SUM(t.Milliseconds) AS TotalDuration\nFROM\n    "playlists"
p\nJOIN\n    "playlist_track" pt ON p.PlaylistId = pt.PlaylistId\nJOIN\n
"tracks" t ON pt.TrackId = t.TrackId\nGROUP BY\n    p.PlaylistId, p.Name\nHA
VING\n    COUNT(t.TrackId) >= 10'}, {'role': 'user', 'content': '  \n    Fin
d the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'assi
stant', 'content': 'SELECT TrackId, Name, UnitPrice FROM "tracks" ORDER BY U
nitPrice DESC LIMIT 5'}, {'role': 'user', 'content': '  \n    Find all track
s with a name containing "What" (case-insensitive)\n'}, {'role': 'assistan
t', 'content': "SELECT * FROM tracks WHERE Name LIKE '%What%'"}, {'role': 'u
ser', 'content': 'Can you list all tables in the SQLite database catalog?'},
{'role': 'assistant', 'content': "SELECT name FROM sqlite_master WHERE type
='table'"}, {'role': 'user', 'content': 'what are the top 5 countries that c
ustomers come from?'}, {'role': 'assistant', 'content': 'SELECT Country, COU
NT(*) AS CustomerCount FROM "customers" GROUP BY Country ORDER BY CustomerCo
unt DESC LIMIT 5'}, {'role': 'user', 'content': '  \n    List all invoices w
ith a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT *
FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': '  \n     Id
entify artists who have albums with tracks appearing in multiple genres:\n\n
\n'}]
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
rate a SQL query to answer the question. Your response should ONLY be based
on the given context and follow the response guidelines and format instructi
ons. \n===Tables \nCREATE TABLE \"tracks\"\r\n(\r\n    TrackId INTEGER PRIMA
RY KEY AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(200)  NOT NULL,\r\n    A
lbumId INTEGER,\r\n    MediaTypeId INTEGER  NOT NULL,\r\n    GenreId INTEGE
R,\r\n    Composer NVARCHAR(220),\r\n    Milliseconds INTEGER  NOT NULL,\r\n
Bytes INTEGER,\r\n    UnitPrice NUMERIC(10,2)  NOT NULL,\r\n    FOREIGN KEY
(AlbumId) REFERENCES \"albums\" (AlbumId) \r\n\t\tON DELETE NO ACTION ON UPD
ATE NO ACTION,\r\n    FOREIGN KEY (GenreId) REFERENCES \"genres\" (GenreId)
\r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION,\r\n    FOREIGN KEY (MediaTy
peId) REFERENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums\" (Art
istId)\n\nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (GenreId)\n\nCREATE IN
DEX IFK_TrackAlbumId ON \"tracks\" (AlbumId)\n\nCREATE TABLE \"albums\"\r\n
(\r\n    AlbumId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n    Title NV
ARCHAR(160)  NOT NULL,\r\n    ArtistId INTEGER  NOT NULL,\r\n    FOREIGN KEY
(ArtistId) REFERENCES \"artists\" (ArtistId) \r\n\t\tON DELETE NO ACTION ON
UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_TrackMediaTypeId ON \"tracks\" (Me
diaTypeId)\n\nCREATE TABLE \"genres\"\r\n(\r\n    GenreId INTEGER PRIMARY KE
Y AUTOINCREMENT NOT NULL,\r\n    Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK
_PlaylistTrackTrackId ON \"playlist_track\" (TrackId)\n\nCREATE TABLE \"arti
sts\"\r\n(\r\n    ArtistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n
Name NVARCHAR(120)\r\n)\n\nCREATE TABLE \"playlist_track\"\r\n(\r\n    Playl
istId INTEGER  NOT NULL,\r\n    TrackId INTEGER  NOT NULL,\r\n    CONSTRAINT
PK_PlaylistTrack PRIMARY KEY  (PlaylistId, TrackId),\r\n    FOREIGN KEY (Pla
ylistId) REFERENCES \"playlists\" (PlaylistId) \r\n\t\tON DELETE NO ACTION O
N UPDATE NO ACTION,\r\n    FOREIGN KEY (TrackId) REFERENCES \"tracks\" (Trac
kId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\n\n===Additional
Context \n\nIn the chinook database invoice means order\n\n===Response Guide
lines \n1. If the provided context is sufficient, please generate a valid SQ
L query without any explanations for the question. \n2. If the provided cont
ext is almost sufficient but requires knowledge of a specific string in a pa
rticular column, please generate an intermediate SQL query to find the disti
nct strings in that column. Prepend the query with a comment saying intermed
iate_sql \n3. If the provided context is insufficient, please explain why it
can't be generated. \n4. Please use the most relevant table(s). \n5. If the
question has been asked and answered before, please repeat the answer exactl
y as it was given before. \n"}, {"role": "user", "content": " \n    There ar
e 3 tables: artists, albums and tracks, where albums and artists are linked
by ArtistId, albums and tracks are linked by AlbumId,\n    Can you find the
top 10 most popular artists based on the number of tracks\n"}, {"role": "ass
istant", "content": "SELECT a.Name AS ArtistName, COUNT(t.TrackId) AS TrackC
ount FROM artists a LEFT JOIN albums alb ON a.ArtistId = alb.ArtistId LEFT J
OIN tracks t ON alb.AlbumId = t.AlbumId GROUP BY a.ArtistId ORDER BY TrackCo
unt DESC LIMIT 10"}, {"role": "user", "content": "  \n    List all albums an
d their corresponding artist names  \n"}, {"role": "assistant", "content":
"SELECT a.Title AS AlbumTitle, ar.Name AS ArtistName FROM \"albums\" a JOIN
\"artists\" ar ON a.ArtistId = ar.ArtistId"}, {"role": "user", "content": "
\n     Find the customer who bought the most albums in total quantity (acros
s all invoices): \n"}, {"role": "assistant", "content": "SELECT i.CustomerI
d, SUM(ii.Quantity) AS TotalAlbumsBought\nFROM \"invoices\" i\nJOIN \"invoic
e_items\" ii ON i.InvoiceId = ii.InvoiceId\nJOIN \"tracks\" t ON ii.TrackId
= t.TrackId\nWHERE t.MediaTypeId = 1 -- Assuming MediaTypeId 1 represents al
bums\nGROUP BY i.CustomerId\nORDER BY TotalAlbumsBought DESC\nLIMIT 1"}, {"r
ole": "user", "content": "  \n    Hint: album quantity is found in invoice_i
tems, \n    \n    Find the top 5 customers who bought the most albums in tot
al quantity (across all invoices):\n"}, {"role": "assistant", "content": "SE
LECT i.CustomerId, SUM(ii.Quantity) AS TotalAlbumsBought FROM \"invoices\" i
JOIN \"invoice_items\" ii ON i.InvoiceId = ii.InvoiceId WHERE ii.TrackId IN
(SELECT t.TrackId FROM \"tracks\" t JOIN \"albums\" a ON t.AlbumId = a.Album
Id) GROUP BY i.CustomerId ORDER BY TotalAlbumsBought DESC LIMIT 5"}, {"rol
e": "user", "content": "  \n     Get all playlists containing at least 10 tr
acks and the total duration of those tracks:\n"}, {"role": "assistant", "con
tent": " SELECT\n    p.Name AS PlaylistName,\n    SUM(t.Milliseconds) AS Tot
alDuration\nFROM\n    \"playlists\" p\nJOIN\n    \"playlist_track\" pt ON p.
PlaylistId = pt.PlaylistId\nJOIN\n    \"tracks\" t ON pt.TrackId = t.TrackId
\nGROUP BY\n    p.PlaylistId, p.Name\nHAVING\n    COUNT(t.TrackId) >= 10"},
{"role": "user", "content": "  \n    Find the top 5 most expensive tracks (b
ased on unit price):\n"}, {"role": "assistant", "content": "SELECT TrackId,
Name, UnitPrice FROM \"tracks\" ORDER BY UnitPrice DESC LIMIT 5"}, {"role":
"user", "content": "  \n    Find all tracks with a name containing \"What\"
(case-insensitive)\n"}, {"role": "assistant", "content": "SELECT * FROM trac
ks WHERE Name LIKE '%What%'"}, {"role": "user", "content": "Can you list all
tables in the SQLite database catalog?"}, {"role": "assistant", "content":
"SELECT name FROM sqlite_master WHERE type='table'"}, {"role": "user", "cont
ent": "what are the top 5 countries that customers come from?"}, {"role": "a
ssistant", "content": "SELECT Country, COUNT(*) AS CustomerCount FROM \"cust
omers\" GROUP BY Country ORDER BY CustomerCount DESC LIMIT 5"}, {"role": "us
er", "content": "  \n    List all invoices with a total exceeding $10:\n"},
{"role": "assistant", "content": " SELECT * FROM \"invoices\" WHERE Total >
10"}, {"role": "user", "content": "  \n     Identify artists who have albums
with tracks appearing in multiple genres:\n\n\n"}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:57:13.70238704
9Z', 'message': {'role': 'assistant', 'content': ' SELECT a.Name AS ArtistNa
me FROM "artists" a JOIN "albums" alb ON a.ArtistId = alb.ArtistId JOIN "tra
cks" t ON alb.AlbumId = t.AlbumId JOIN "genres" g ON t.GenreId = g.GenreId W
HERE g.Name IN (SELECT Name FROM genres GROUP BY Name HAVING COUNT(Name) >
1)'}, 'done_reason': 'stop', 'done': True, 'total_duration': 109177780700,
'load_duration': 13497775, 'prompt_eval_count': 1513, 'prompt_eval_duratio
n': 85369998000, 'eval_count': 84, 'eval_duration': 22336476000}
LLM Response:  SELECT a.Name AS ArtistName FROM "artists" a JOIN "albums" al
b ON a.ArtistId = alb.ArtistId JOIN "tracks" t ON alb.AlbumId = t.AlbumId JO
IN "genres" g ON t.GenreId = g.GenreId WHERE g.Name IN (SELECT Name FROM gen
res GROUP BY Name HAVING COUNT(Name) > 1)
 SELECT a.Name AS ArtistName FROM "artists" a JOIN "albums" alb ON a.ArtistI
d = alb.ArtistId JOIN "tracks" t ON alb.AlbumId = t.AlbumId JOIN "genres" g
ON t.GenreId = g.GenreId WHERE g.Name IN (SELECT Name FROM genres GROUP BY N
ame HAVING COUNT(Name) > 1)
Empty DataFrame
Columns: [ArtistName]
Index: []
Info: Ollama parameters:
model=mistral-nemo:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that con
tains the results of the query that answers the question the user asked: '
\n     Identify artists who have albums with tracks appearing in multiple ge
nres:\n\n\n'\n\nThe DataFrame was produced using this query:  SELECT a.Name
AS ArtistName FROM \"artists\" a JOIN \"albums\" alb ON a.ArtistId = alb.Art
istId JOIN \"tracks\" t ON alb.AlbumId = t.AlbumId JOIN \"genres\" g ON t.Ge
nreId = g.GenreId WHERE g.Name IN (SELECT Name FROM genres GROUP BY Name HAV
ING COUNT(Name) > 1)\n\nThe following is information about the resulting pan
das DataFrame 'df': \nRunning df.dtypes gives:\n ArtistName    object\ndtyp
e: object"}, {"role": "user", "content": "Can you generate the Python plotly
code to chart the results of the dataframe? Assume the data is in a pandas d
ataframe called 'df'. If there is only one value in the dataframe, use an In
dicator. Respond with only Python code. Do not answer with any explanations
-- just the code."}]
Info: Ollama Response:
{'model': 'mistral-nemo:latest', 'created_at': '2024-08-01T20:57:53.27278055
7Z', 'message': {'role': 'assistant', 'content': "```python\nimport plotly.e
xpress as px\n\nfig = px.bar(df, x='ArtistName', title='Artists with Albums
in Multiple Genres')\nfig.show()\n```\n```python\nif len(df) == 1:\n    fig
= px.indicator(df, value=len(df), title='Number of Artists with Albums in Mu
ltiple Genres')\n    fig.show()\nelse:\n    fig = px.bar(df, x='ArtistName',
title='Artists with Albums in Multiple Genres')\n    fig.show()\n```"}, 'don
e_reason': 'stop', 'done': True, 'total_duration': 39568180144, 'load_durati
on': 54265265, 'prompt_eval_count': 228, 'prompt_eval_duration': 1144366000
0, 'eval_count': 109, 'eval_duration': 28021302000}
```


Artists with Albums in Multiple Genres
count
4
3
2
1
0
−1
−1
0
1
2
3
4
5
6
ArtistName

```
Out[39]: (' SELECT a.Name AS ArtistName FROM "artists" a JOIN "albums" alb ON a.Arti
         stId = alb.ArtistId JOIN "tracks" t ON alb.AlbumId = t.AlbumId JOIN "genre
         s" g ON t.GenreId = g.GenreId WHERE g.Name IN (SELECT Name FROM genres GROU
         P BY Name HAVING COUNT(Name) > 1)',
          Empty DataFrame
          Columns: [ArtistName]
          Index: [],
          Figure({
              'data': [{'alignmentgroup': 'True',
                        'hovertemplate': 'ArtistName=%{x}<br>count=%{y}<extra></extr
         a>',
                        'legendgroup': '',
                        'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
                        'name': '',
                        'offsetgroup': '',
                        'orientation': 'v',
                        'showlegend': False,
                        'textposition': 'auto',
                        'type': 'bar',
                        'x': array([], dtype=object),
                        'xaxis': 'x',
                        'y': array([], dtype=int64),
                        'yaxis': 'y'}],
              'layout': {'barmode': 'relative',
                         'legend': {'tracegroupgap': 0},
                         'template': '...',
                         'title': {'text': 'Artists with Albums in Multiple Genre
         s'},
                         'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'ArtistName'}},
                         'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
         ext': 'count'}}}
          }))
```

Check completion time

```
In [ ]:
```

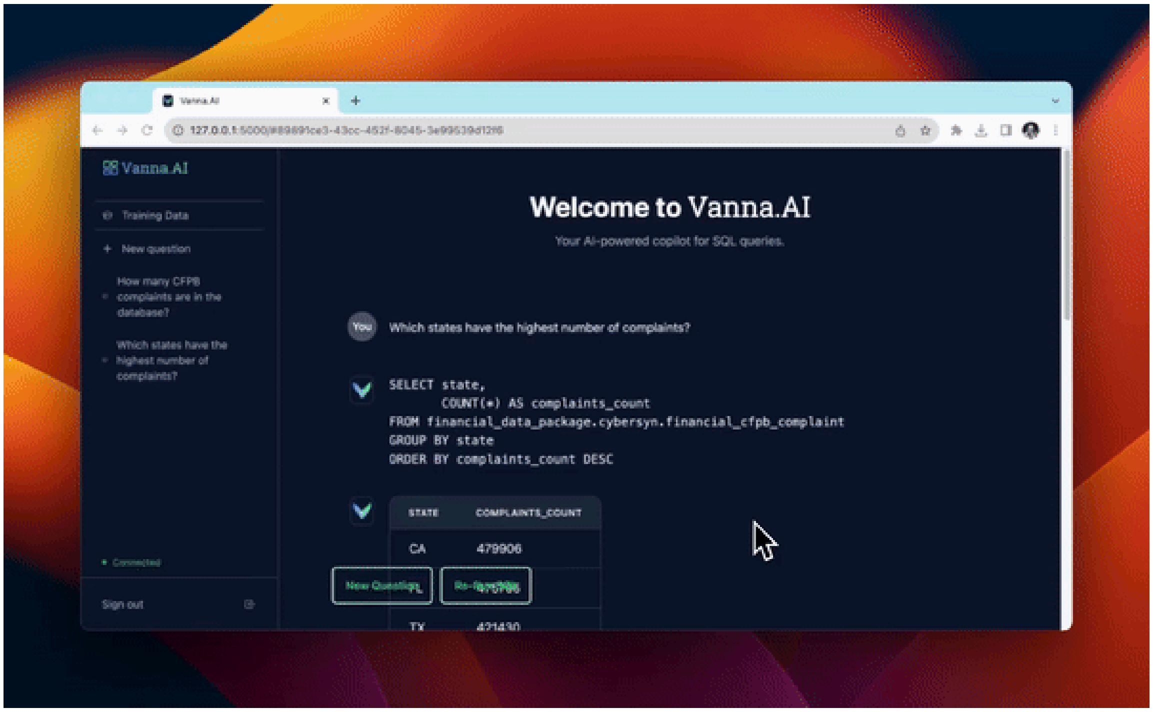
```
In [40]: ts_stop = time()

         elapsed_time = ts_stop - ts_start
         print(f"test running on '{hostname}' with '{model_name}' LLM took : {elapsed
```

```
test running on 'ducklover1' with 'mistral-nemo' LLM took : 2644.15 sec
```

```
In [41]: from datetime import datetime
         print(datetime.now())
```

```
2024-08-01 16:57:53.331921
```

Launch the User Interface


Vanna.AI
127.0.0.1:5000/#89891ce3-43cc-452f-8045-3e99539d12f6
Vanna.AI
Training Data
New question
How many CFPB complaints are in the database?
Which states have the highest number of complaints?
Connected
Sign out
You
New Question
Re-Run SQL

Welcome to Vanna.AI

Your AI-powered copilot for SQL queries.

Which states have the highest number of complaints?

```
SELECT state,
       COUNT(*) AS complaints_count
FROM financial_data_package.cybersyn.financial_cfpb_complaint
GROUP BY state
ORDER BY complaints_count DESC
```

STATE	COMPLAINTS_COUNT
CA	479906
FL	[illegible]
TX	421430

from vanna.flask import VannaFlaskApp app = VannaFlaskApp(vn) app.run()

Next Steps

Using Vanna via Jupyter notebooks is great for getting started but check out additional customizable interfaces like the

- Streamlit app
- Flask app
- Slackbot