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'

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]:

```
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 termin
    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]:
```
# 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';
```

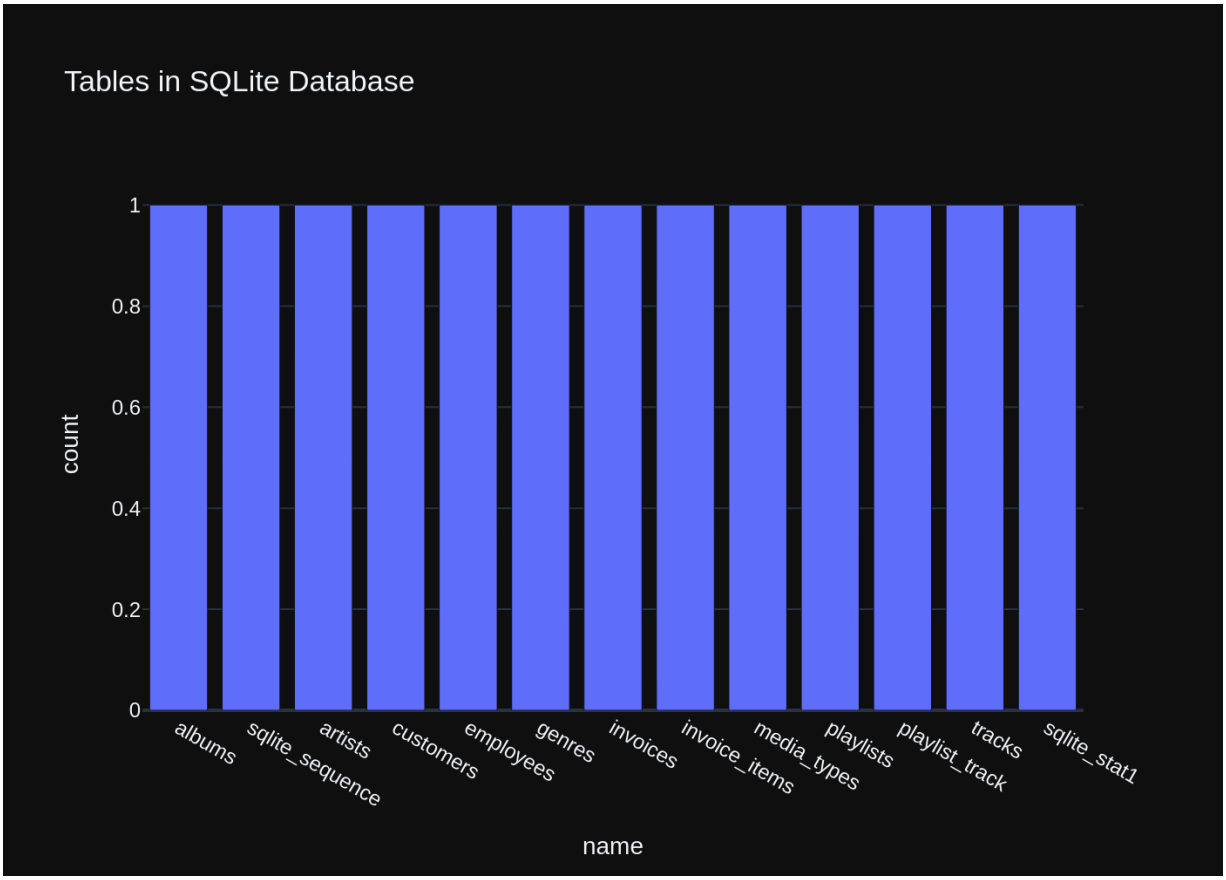
In [16]:
```
vn.ask(question="Can you list all tables in the SQLite database catalog?")
```

```
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: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:latest', 'created_at': '2024-08-01T19:17:57.479816913Z',
'message': {'role': 'assistant', 'content': " SELECT name FROM sqlite_master
WHERE type='table';"}, 'done_reason': 'stop', 'done': True, 'total_duratio
n': 36960199164, 'load_duration': 2593113288, 'prompt_eval_count': 1071, 'pr
ompt_eval_duration': 32145993000, 'eval_count': 14, 'eval_duration': 2121965
000}
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: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:latest', 'created_at': '2024-08-01T19:18:16.296041315Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nif df.shape[0] > 1:\n    fig = px.bar(df, x="name", title=\'Tables
in SQLite Database\')\nelse:\n    fig = px.scatter(x=df.index, y=[None], tit
le=\'Table in SQLite Database\')\nfig.show()\n```'}, 'done_reason': 'stop',
'done': True, 'total_duration': 18784457050, 'load_duration': 3770616, 'prom
pt_eval_count': 166, 'prompt_eval_duration': 5423201000, 'eval_count': 84,
'eval_duration': 13261514000}
```


Tables in SQLite Database
count
1
0.8
0.6
0.4
0.2
0
albums
sqlite_sequence
artists
customers
employees
genres
invoices
invoice_items
media_types
playlists
playlist_track
tracks
sqlite_stat1
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': [{'alignmentgroup': 'True',
               'hovertemplate': 'name=%{x}<br>count=%{y}<extra></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array(['albums', 'sqlite_sequence', 'artists', 'custome
rs', 'employees',
                           'genres', 'invoices', 'invoice_items', 'media_ty
pes', 'playlists',
                           'playlist_track', 'tracks', 'sqlite_stat1'], dty
pe=object),
               'xaxis': 'x',
               'y': array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'template': '...',
                'title': {'text': 'Tables in SQLite Database'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'name'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'count'}}}
 }))
```

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 ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n   InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   CustomerId INTEGER 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 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 "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 "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 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 "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   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) 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 "playlists"\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 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 "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 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 "media_types"\r\n(\r\n   MediaTypeId 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. 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 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': 'Can you list all tables

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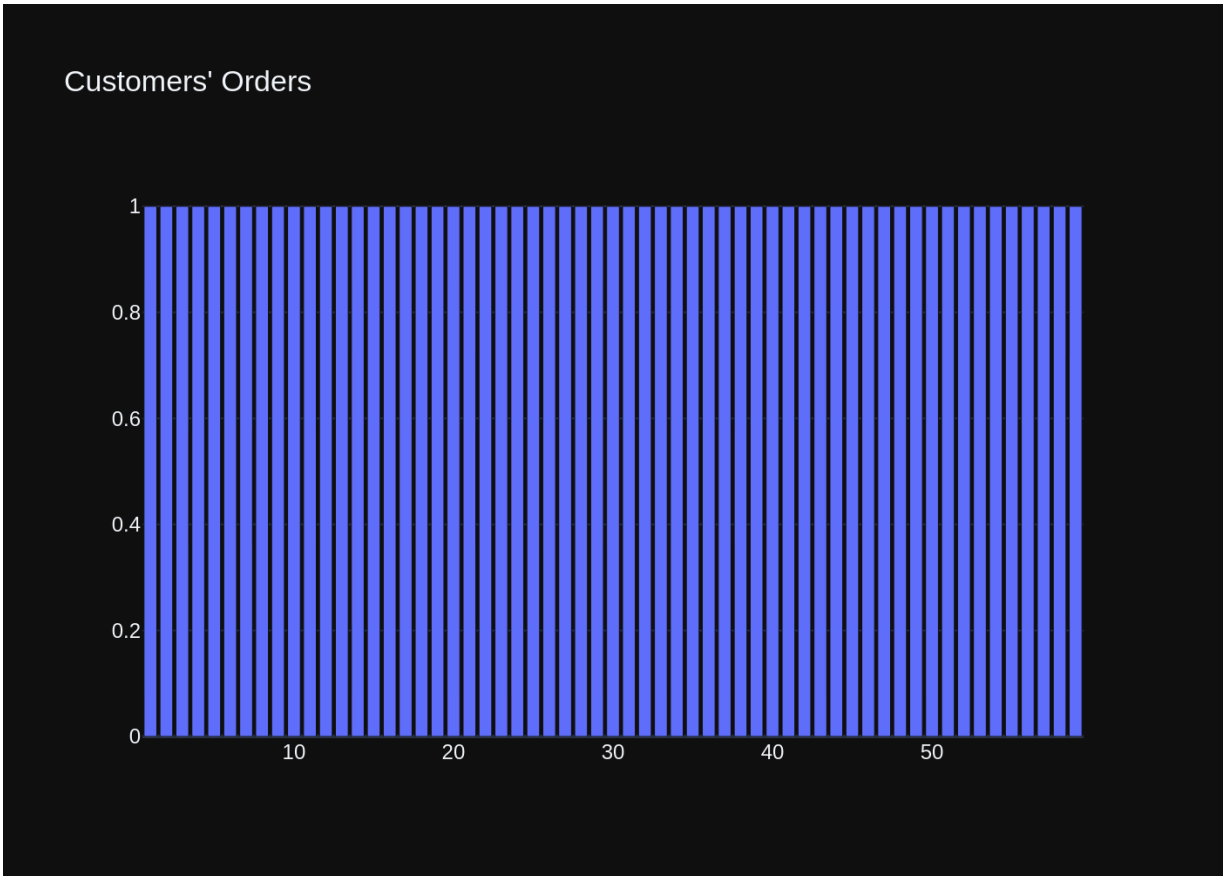
in the SQLite database catalog?'}, {'role': 'assistant', 'content': "SELECT
name FROM sqlite_master WHERE type='table'"}, {'role': 'user', 'content': "w
hich table stores customer's orders"}]
Info: Ollama parameters:
model=mistral:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "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:latest', 'created_at': '2024-08-01T19:19:04.980597463Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId
FROM "customers"'}, 'done_reason': 'stop', 'done': True, 'total_duration': 4
8258765102, 'load_duration': 4209287, 'prompt_eval_count': 1373, 'prompt_eva
l_duration': 45916062000, 'eval_count': 14, 'eval_duration': 2148151000}
LLM Response:  SELECT "customers".CustomerId FROM "customers"
 SELECT "customers".CustomerId FROM "customers"
    CustomerId
0            1
1            3
2           12
3           15
4           18
5           19
6           24
7           29
8           30
9           33
10          37
11          38
12          42
13          43
14          44
15          45
16          46
17          52
18          53
19          58
20          59
21           4
22           5
23           8
24           9
25          10
26          13
27          16
28          20
29          22
30          23
31          26
32          27
33          32
34          34
35          35
```

```
36          39
37          40
38          49
39          55
40          56
41           2
42           6
43           7
44          11
45          14
46          17
47          21
48          25
49          28
50          31
51          36
52          41
53          47
54          48
55          50
56          51
57          54
58          57
Info: Ollama parameters:
model=mistral: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
ich table stores customer's orders'\n\nThe DataFrame was produced using this
query:  SELECT \"customers\".CustomerId FROM \"customers\"\n\nThe following
is information about the resulting pandas DataFrame 'df': \nRunning df.dtype
s gives:\n CustomerId    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:latest', 'created_at': '2024-08-01T19:19:45.556558746Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.graph_
objects as go\n\nif len(df) == 1:\n    fig = go.Indicator(\n        domain =
{\'x\': [0, 1], \'y\': [0, 1]},\n        value = df.iloc[0][\'CustomerId
\'],\n        title = {\'text\': "Unique Customer ID", \'font\':{\'size\': 2
4}},\n        mode = "gauge+number+delta",\n        gauge = {\'axis\': {\'ra
nge\': [None, df.iloc[0][\'CustomerId\']]},\n                \'bar\': {\'col
or\': "lightgray"},\n               \'steps\': [{\'range\': [0, 5], \'color
\': "green"}]})\nelse:\n    fig = go.Figure(data=go.Bar(x=df[\'CustomerId
\'].values, y=[1]*len(df)))\nfig.update_layout(title_text="Customers\' Order
s")\n```'}, 'done_reason': 'stop', 'done': True, 'total_duration': 405555547
22, 'load_duration': 45789355, 'prompt_eval_count': 166, 'prompt_eval_durati
on': 5436065000, 'eval_count': 220, 'eval_duration': 35028734000}
```


Customers' Orders
1
0.8
0.6
0.4
0.2
0
10
20
30
40
50

Out[17]: (' SELECT "customers".CustomerId FROM "customers"',

	CustomerId
0	1
1	3
2	12
3	15
4	18
5	19
6	24
7	29
8	30
9	33
10	37
11	38
12	42
13	43
14	44
15	45
16	46
17	52
18	53
19	58
20	59
21	4
22	5
23	8
24	9
25	10
26	13
27	16
28	20
29	22
30	23
31	26
32	27
33	32
34	34
35	35
36	39
37	40
38	49
39	55
40	56
41	2
42	6
43	7
44	11
45	14
46	17
47	21
48	25
49	28
50	31
51	36
52	41
53	47

```
54          48
55          50
56          51
57          54
58          57,
Figure({
    'data': [{'type': 'bar',
              'x': array([ 1,  3, 12, 15, 18, 19, 24, 29, 30, 33, 37, 38,
42, 43, 44, 45, 46, 52,
                           53, 58, 59,  4,  5,  8,  9, 10, 13, 16, 20, 22,
23, 26, 27, 32, 34, 35,
                           39, 40, 49, 55, 56,  2,  6,  7, 11, 14, 17, 21,
25, 28, 31, 36, 41, 47,
                           48, 50, 51, 54, 57]),
              'y': [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1,
                    1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1,
                    1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1]}],
     'layout': {'template': '...', 'title': {'text': "Customers' Orders"}}
 }))
```

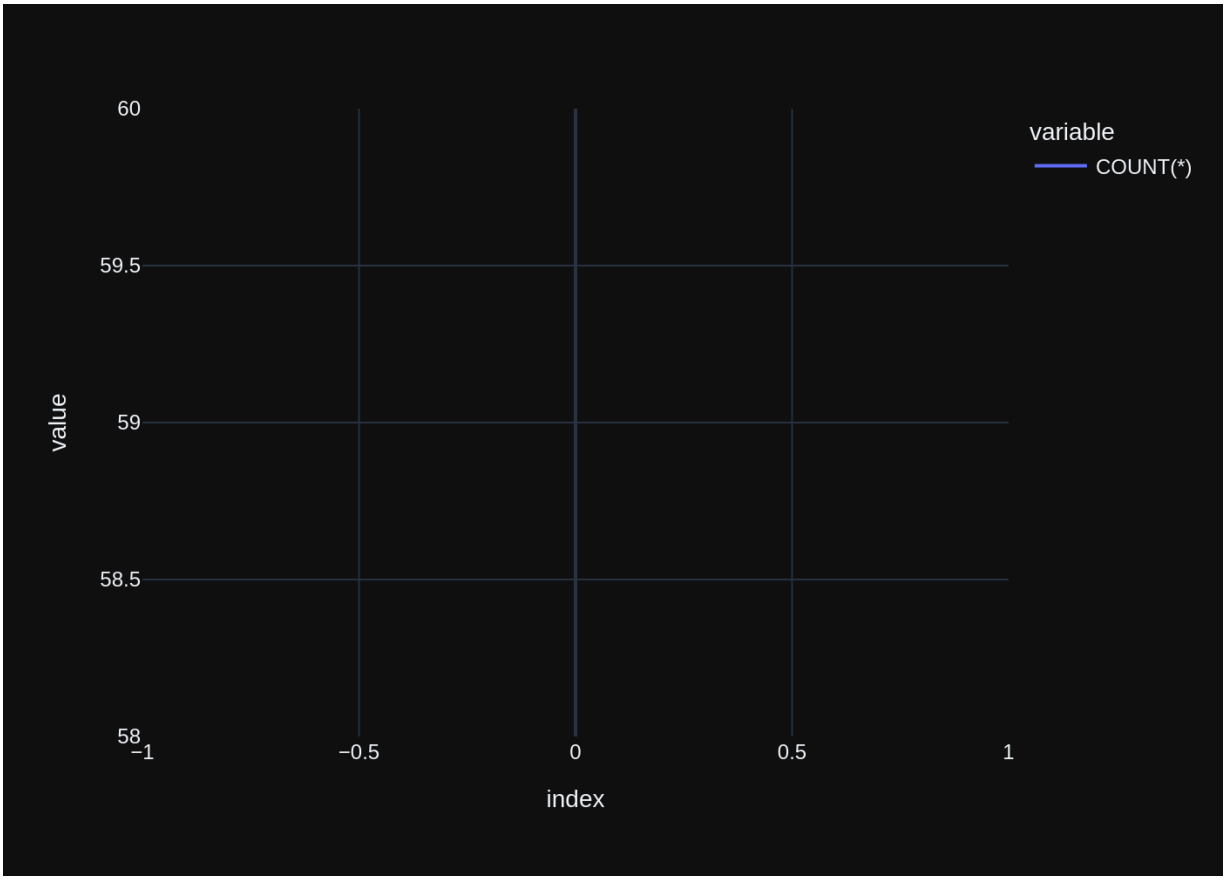
In [18]:
```
vn.ask(question="How many customers are there")
```

```
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 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': "which table stores customer's orders"}, {'role': 'assistant', 'c
ontent': ' SELECT "customers".CustomerId FROM "customers"'}, {'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': 'How many customers are there'}]
```

```
Info: Ollama parameters:
model=mistral: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": "which table stores customer's orders"}, {"rol
e": "assistant", "content": " SELECT \"customers\".CustomerId FROM \"custome
rs\""}, {"role": "user", "content": "Can you list all tables in the SQLite d
atabase catalog?"}, {"role": "assistant", "content": "SELECT name FROM sqlit
e_master WHERE type='table'"}, {"role": "user", "content": "How many custome
rs are there"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:20:31.973477286Z',
'message': {'role': 'assistant', 'content': ' SELECT COUNT(*) FROM "customer
s"'}, 'done_reason': 'stop', 'done': True, 'total_duration': 46331087306, 'l
oad_duration': 4682911, 'prompt_eval_count': 1278, 'prompt_eval_duration': 4
4173888000, 'eval_count': 12, 'eval_duration': 1868871000}
LLM Response: SELECT COUNT(*) FROM "customers"
 SELECT COUNT(*) FROM "customers"
   COUNT(*)
0   59
Info: Ollama parameters:
model=mistral: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:latest', 'created_at': '2024-08-01T19:20:54.440447287Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.graph_
objects as go\n\nfig = go.Indicator(\n   value=df.iloc[0],\n   domain=
{"x": [0, 1], "y": [0, 1]},\n   title="Customers count",\n   mode="gauge+n
umber+delta",\n   delta={"reference": 0, "increasing": {"color": "gree
n"}},\n)\nfig.show()\n```'}, 'done_reason': 'stop', 'done': True, 'total_dur
ation': 22440069621, 'load_duration': 50520908, 'prompt_eval_count': 164, 'p
rompt_eval_duration': 5447456000, 'eval_count': 107, 'eval_duration': 168511
91000}



Out[18]:
```
(' SELECT COUNT(*) FROM "customers"',
    COUNT(*)
 0        59,
 Figure({
     'data': [{'hovertemplate': 'variable=COUNT(*)<br>index=%{x}<br>value=%
{y}<extra></extra>',
               'legendgroup': 'COUNT(*)',
               'line': {'color': '#636efa', 'dash': 'solid'},
               'marker': {'symbol': 'circle'},
               'mode': 'lines',
               'name': 'COUNT(*)',
               'orientation': 'v',
               'showlegend': True,
               'type': 'scatter',
               'x': array([0]),
               'xaxis': 'x',
               'y': array([59]),
               '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 [ ]:

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

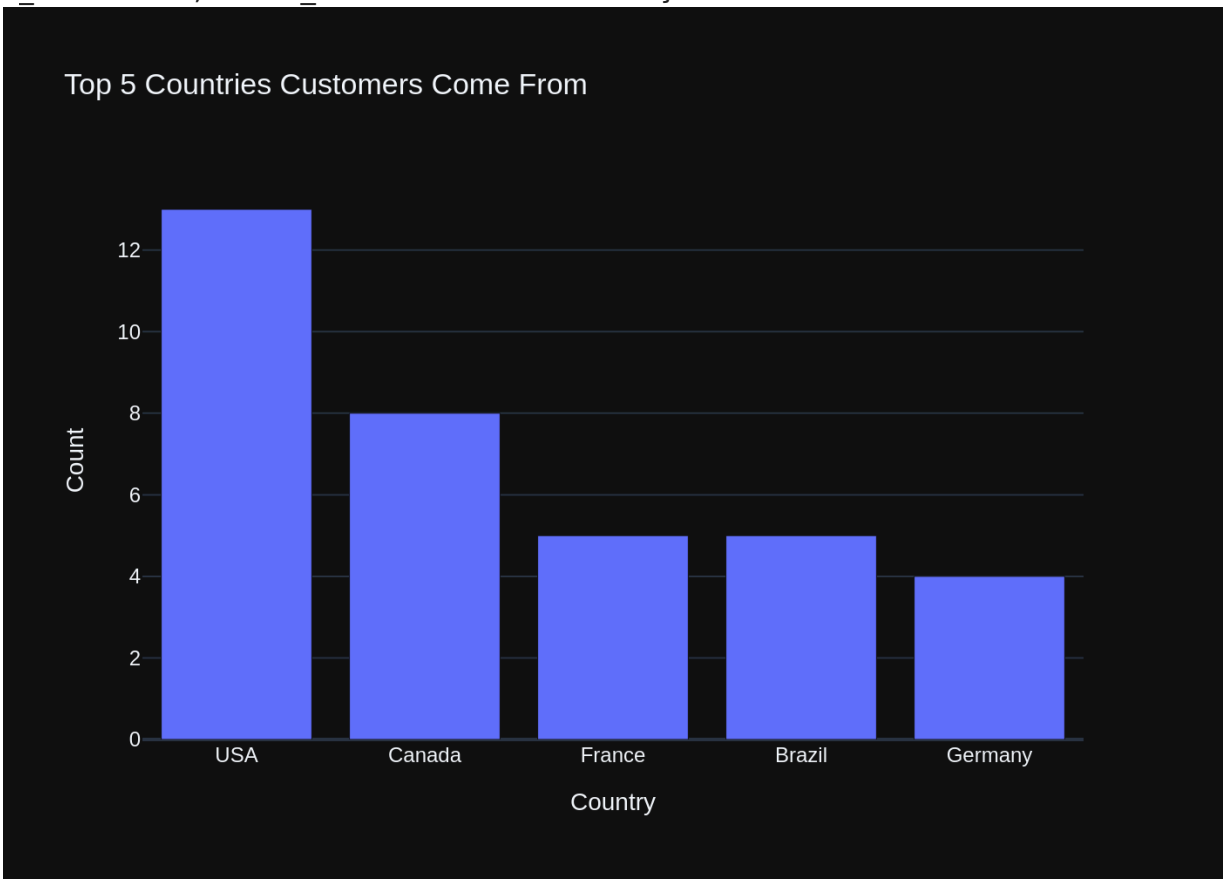
```
Number of requested results 10 is greater than number of elements in index
3, updating n_results = 3
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please help to generate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n   InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   CustomerId INTEGER 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 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 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 "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 "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 "media_types"\r\n(\r\n   MediaTypeId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_CustomerSupportRepId ON "customers" (SupportRepId)\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   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) 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 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 "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 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 sqlite_sequence(name,seq)\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 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 "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\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 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': "which table stores customer's orders"}, {'role': 'assist
ant', 'content': ' SELECT "customers".CustomerId FROM "customers"'}, {'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': 'what are the top 5 countries
that customers come from?'}]
Info: Ollama parameters:
model=mistral: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": "which table stores customer's
orders"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId
FROM \"customers\""}, {"role": "user", "content": "Can you list all tables i
n the SQLite database catalog?"}, {"role": "assistant", "content": "SELECT n
ame FROM sqlite_master WHERE type='table'"}, {"role": "user", "content": "wh
at are the top 5 countries that customers come from?"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:21:56.262990752Z',
'message': {'role': 'assistant', 'content': ' SELECT Country, COUNT(*) AS Co
unt\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, 'done
_reason': 'stop', 'done': True, 'total_duration': 61711709186, 'load_duratio
n': 3219649, 'prompt_eval_count': 1632, 'prompt_eval_duration': 56727968000,
'eval_count': 28, 'eval_duration': 4526444000}
LLM Response:  SELECT Country, COUNT(*) AS Count
FROM customers
GROUP BY Country
ORDER BY Count DESC
LIMIT 5
 SELECT Country, COUNT(*) AS Count
FROM customers
GROUP BY Country
ORDER BY Count DESC
LIMIT 5
   Country  Count
0      USA     13
1   Canada      8
2   France      5
```

```
3   Brazil      5
4  Germany      4
Info: Ollama parameters:
model=mistral: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 Count\nFROM customers
\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5\n\nThe following is informa
tion about the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n
Country    object\nCount       int64\ndtype: object"}, {"role": "user", "con
tent": "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 the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:22:16.775980206Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\n\nfig = px.bar(df, x=\'Country\', y=\'Count\', title="Top 5 Countri
es Customers Come From")\nif len(df) == 1:\n    fig = px.scatter(df, x=df.in
dex, y=df[\'Count\'], mode=\'markers+lines\')\nfig.show()\n```'}, 'done_reas
on': 'stop', 'done': True, 'total_duration': 20488095138, 'load_duration': 4
6932517, 'prompt_eval_count': 187, 'prompt_eval_duration': 6211899000, 'eval
_count': 90, 'eval_duration': 14184376000}
```



Out[19]:
```
(' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORD
ER BY Count DESC\nLIMIT 5',
    Country  Count
 0      USA     13
 1   Canada      8
 2   France      5
 3   Brazil      5
 4  Germany      4,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'Country=%{x}<br>Count=%{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},
                'template': '...',
                'title': {'text': 'Top 5 Countries Customers Come From'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'Country'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'Count'}}}
 }))
```

More SQL questions

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

In [20]:
```
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
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_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 Count\nFROM c
ustomers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, {'role': 'user',
'content': 'How many customers are there'}, {'role': 'assistant', 'content':
' SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'content': "which tab
le stores customer's orders"}, {'role': 'assistant', 'content': ' SELECT "cu
stomers".CustomerId FROM "customers"'}, {'role': 'user', 'content': '  \n
List all albums and their corresponding artist names  \n'}]
Info: Ollama parameters:
model=mistral:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
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\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
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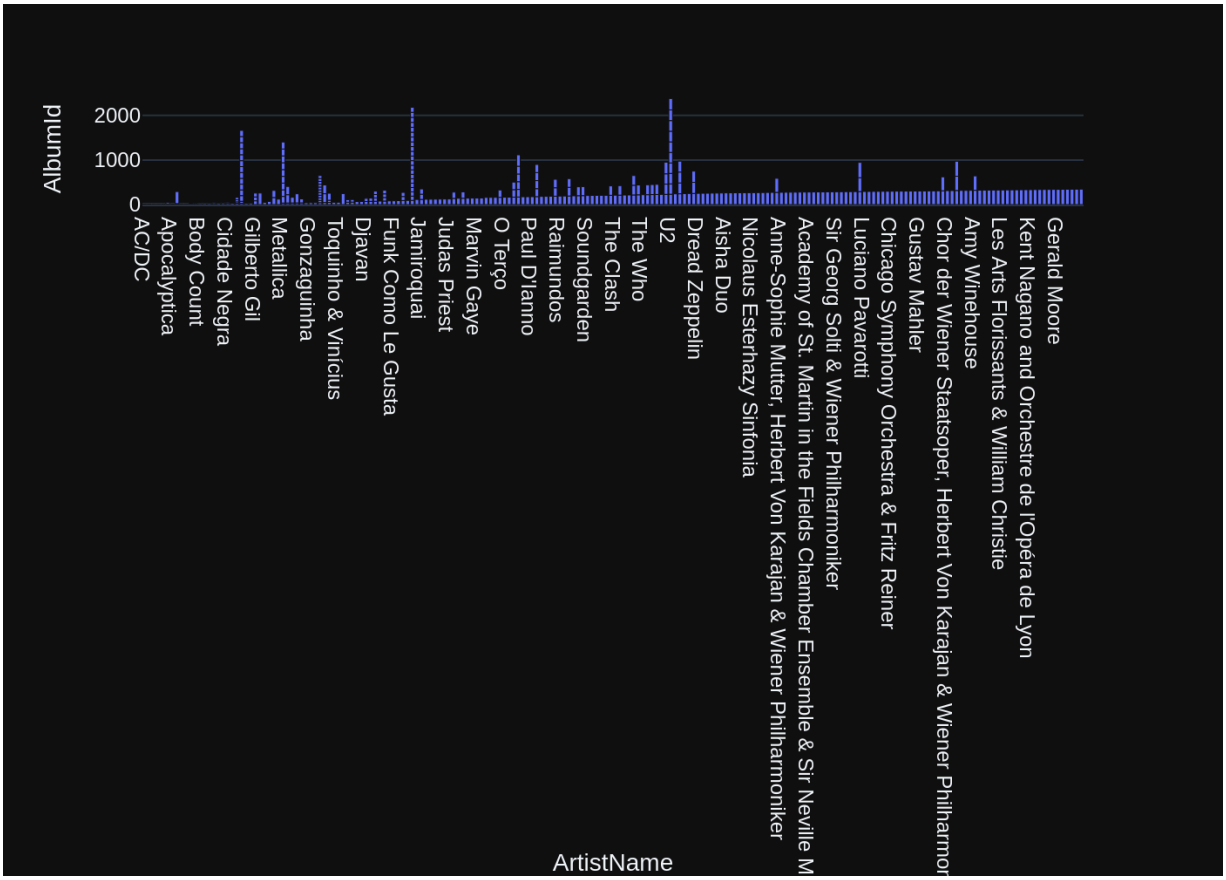
"content": "Can you list all tables in the SQLite database catalog?"}, {"rol
e": "assistant", "content": "SELECT name FROM sqlite_master WHERE type='tabl
e'"}, {"role": "user", "content": "what are the top 5 countries that custome
rs come from?"}, {"role": "assistant", "content": " SELECT Country, COUNT(*)
AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"},
{"role": "user", "content": "How many customers are there"}, {"role": "assis
tant", "content": " SELECT COUNT(*) FROM \"customers\""}, {"role": "user",
"content": "which table stores customer's orders"}, {"role": "assistant", "c
ontent": " SELECT \"customers\".CustomerId FROM \"customers\""}, {"role": "u
ser", "content": " \n   List all albums and their corresponding artist nam
es \n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:22:55.237550892Z',
'message': {'role': 'assistant', 'content': ' SELECT "albums".AlbumId, "arti
sts".Name AS ArtistName FROM "albums" INNER JOIN "artists" ON "albums".Artis
tId = "artists".ArtistId;'}, 'done_reason': 'stop', 'done': True, 'total_dur
ation': 38368827463, 'load_duration': 3344276, 'prompt_eval_count': 927, 'pr
ompt_eval_duration': 30186327000, 'eval_count': 49, 'eval_duration': 7655600
000}
LLM Response: SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "a
lbums" INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId;
Info: Output from LLM: SELECT "albums".AlbumId, "artists".Name AS ArtistNam
e FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artists".Artist
Id;
Extracted SQL: SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "a
lbums" INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId
SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JO

```
IN "artists" ON "albums".ArtistId = "artists".ArtistId
     AlbumId                                          ArtistName
0          1                                               AC/DC
1          4                                               AC/DC
2          2                                              Accept
3          3                                              Accept
4          5                                           Aerosmith
..       ...                                                 ...
342      342   Mela Tenenbaum, Pro Musica Prague & Richard Kapp
343      344                             Emerson String Quartet
344      345  C. Monteverdi, Nigel Rogers - Chiaroscuro; Lon...
345      346                                       Nash Ensemble
346      347                              Philip Glass Ensemble

[347 rows x 2 columns]
Info: Ollama parameters:
model=mistral: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 \"albums\".AlbumId, \"artists\".N
ame AS ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".Artis
tId = \"artists\".ArtistId\n\nThe following is information about the resulti
ng pandas DataFrame 'df': \nRunning df.dtypes gives:\n AlbumId        int64
\nArtistName    object\ndtype: object"}, {"role": "user", "content": "Can yo
u generate the Python plotly code to chart the results of the dataframe? Ass
ume the data is in a pandas dataframe called 'df'. If there is only one valu
e 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:latest', 'created_at': '2024-08-01T19:23:18.739952372Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nfig = px.bar("AlbumId", "ArtistName", data=df)\nfig.update_layout(t
itle="Albums by Artist")\n\n# If there is only one value in the dataframe, u
se an Indicator\nif df.shape[0] == 1:\n    fig = px.indicator(df, title="Alb
um: {}".format(df["ArtistName"].iloc[0]))\n```'}, 'done_reason': 'stop', 'do
ne': True, 'total_duration': 23481539658, 'load_duration': 3677082, 'prompt_
eval_count': 211, 'prompt_eval_duration': 6249897000, 'eval_count': 111, 'ev
al_duration': 17138273000}
```


AlbumId
2000
1000
0
AC/DC
Apocalyptica
Body Count
Cidade Negra
Gilberto Gil
Metallica
Gonzaguinha
Toquinho & Vinícius
Djavan
Funk Como Le Gusta
Jamiroquai
Judas Priest
Marvin Gaye
O Terço
Paul D'Ianno
Raimundos
Soundgarden
The Clash
The Who
U2
Dread Zeppelin
Aisha Duo
Nicolaus Esterhazy Sinfonia
Anne-Sophie Mutter, Herbert Von Karajan & Wiener Philharmoniker
Academy of St. Martin in the Fields Chamber Ensemble & Sir Neville M
Sir Georg Solti & Wiener Philharmoniker
Luciano Pavarotti
Chicago Symphony Orchestra & Fritz Reiner
Gustav Mahler
Chor der Wiener Staatsoper, Herbert Von Karajan & Wiener Philharmor
Amy Winehouse
Les Arts Florissants & William Christie
Kent Nagano and Orchestre de l'Opéra de Lyon
Gerald Moore
ArtistName

Out[20]:
```
('SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER
JOIN "artists" ON "albums".ArtistId = "artists".ArtistId',
      AlbumId                                          ArtistName
 0          1                                               AC/DC
 1          4                                               AC/DC
 2          2                                              Accept
 3          3                                              Accept
 4          5                                           Aerosmith
 ..       ...                                                 ...
 342      342   Mela Tenenbaum, Pro Musica Prague & Richard Kapp
 343      344                             Emerson String Quartet
 344      345  C. Monteverdi, Nigel Rogers - Chiaroscuro; Lon...
 345      346                                       Nash Ensemble
 346      347                              Philip Glass Ensemble

 [347 rows x 2 columns],
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'ArtistName=%{x}<br>AlbumId=%{y}<extra></ex
tra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
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               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array(['AC/DC', 'AC/DC', 'Accept', ...,
                           'C. Monteverdi, Nigel Rogers - Chiaroscuro; Lond
on Baroque; London Cornett & Sackbu',
                           'Nash Ensemble', 'Philip Glass Ensemble'], dtype
=object),
               'xaxis': 'x',
               'y': array([  1,   4,   2, ..., 345, 346, 347]),
               'yaxis': 'y'}],
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                'margin': {'t': 60},
                'template': '...',
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'ArtistName'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'AlbumId'}}}
 }))
```

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
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
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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
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{'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS
ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artist
s".ArtistId'}, {'role': 'user', 'content': 'Can you list all tables in the S
QLite database catalog?'}, {'role': 'assistant', 'content': "SELECT name FRO
M sqlite_master WHERE type='table'"}, {'role': 'user', 'content': 'what are
the top 5 countries that customers come from?'}, {'role': 'assistant', 'cont
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"customers"'}, {'role': 'user', 'content': "which table stores customer's or
ders"}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId FRO
M "customers"'}, {'role': 'user', 'content': '  \n    Find all tracks with a
name containing "What" (case-insensitive)\n'}]
Info: Ollama parameters:
model=mistral:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to gene
```

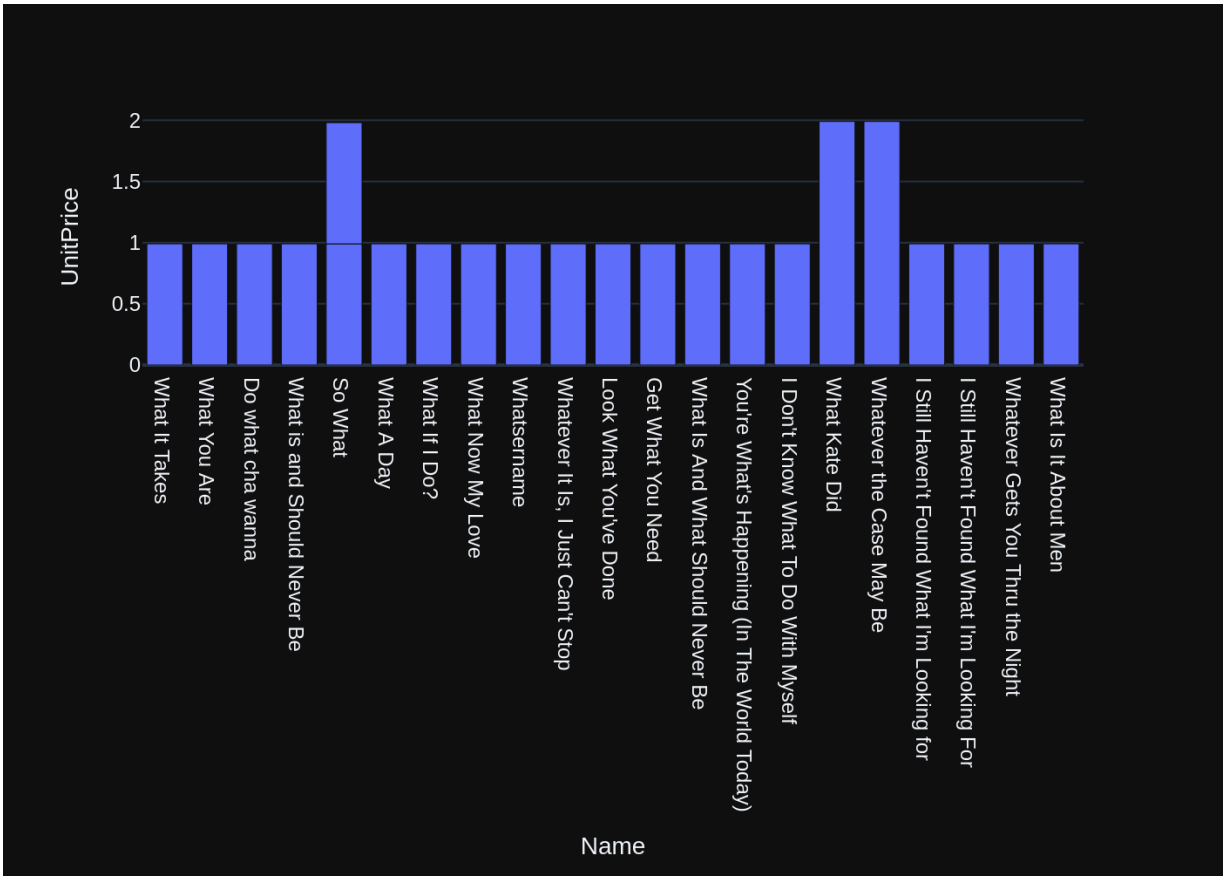
rate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE INDEX IFK_TrackGenreId ON \"tracks\" (GenreId)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON \"playlist_track\" (TrackId)\n\nCREATE 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 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 \"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_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 NOT NULL,\r\n   CONSTRAINT PK_PlaylistTrack PRIMARY KEY (PlaylistId, 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_InvoiceLineTrackId ON \"invoice_items\" (TrackId)\n\nCREATE INDEX IFK_AlbumArtistId ON \"albums\" (ArtistId)\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\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 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 before, please 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 \"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".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 countries that customers come from?"}, {"role": "assistant", "content": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": "How many customers are there"}, {"role": "assistant", "content": " SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "which table stores customer's orders"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId FROM \"customers\""}, {"role": "user", "content": " \n   Find all tracks with a name containing \"What\" (case-insensitive)\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:23:55.715824552Z', 'message': {'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LOWER(Name) LIKE \'%what%\''}, 'done_reason': 'stop', 'done': True, 'total_duration': 36824937280, 'load_duration': 2820092, 'prompt_eval_count': 1022, 'prompt_eval_duration': 32902237000, 'eval_count': 21, 'eval_duration': 3205757000}

```
LLM Response:  SELECT * FROM "tracks" WHERE LOWER(Name) LIKE '%what%'
 SELECT * FROM "tracks" WHERE LOWER(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: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
\" WHERE LOWER(Name) LIKE '%what%'\n\nThe following is information about the
resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n TrackId
int64\nName             object\nAlbumId           int64\nMediaTypeId       i
nt64\nGenreId           int64\nComposer         object\nMilliseconds      in
t64\nBytes             int64\nUnitPrice       float64\ndtype: object"}, {"ro
le": "user", "content": "Can you generate the Python plotly code to chart th
e 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 the cod
e."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:24:17.152828809Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nif df.shape[0] > 1:\n    fig = px.bar(df, x="Name", y="UnitPrice")
\nelse:\n    fig = px.bar(df, y="UnitPrice", text=\'Name\', title=f\'Track:
{df.iloc[0,0]}\')\nfig.show()\n```'}, 'done_reason': 'stop', 'done': True,
'total_duration': 21408771405, 'load_duration': 3130830, 'prompt_eval_coun
t': 239, 'prompt_eval_duration': 7338862000, 'eval_count': 90, 'eval_duratio
n': 13934222000}
```


UnitPrice
2
1.5
1
0.5
0
What It Takes
What You Are
Do what cha wanna
What is and Should Never Be
So What
What A Day
What If I Do?
What Now My Love
Whatsername
Whatever It Is, I Just Can't Stop
Look What You've Done
Get What You Need
What Is And What Should Never Be
You're What's Happening (In The World Today)
I Don't Know What To Do With Myself
What Kate Did
Whatever the Case May Be
I Still Haven't Found What I'm Looking for
I Still Haven't Found What I'm Looking For
Whatever Gets You Thru the Night
What Is It About Men
Name

Out[21]: (' SELECT * FROM "tracks" WHERE LOWER(Name) LIKE \'%what%\'',

	TrackId	Name	AlbumId	MediaTypeId	GenreId	Composer
0	26	What It Takes	5	1	1	Steven Tyler, Joe Perry, Desmond Child
1	88	What You Are	10	1	1	Audioslave/Chris Cornell
2	130	Do what cha wanna	13	1	2	George Duke
3	342	What is and Should Never Be	30	1	1	Jimmy Page/Robert Plant
4	607	So What	48	1	2	Miles Davis
5	960	What A Day	76	1	1	Mike Bordin, Billy Gould, Mike Patton
6	1000	What If I Do?	80	1	1	Dave Grohl, Taylor Hawkins, Nate Mendel, Chris...
7	1039	What Now My Love	83	1	12	carl sigman/gilbert becaud/pierre leroyer
8	1145	Whatsername	89	1	4	Green Day
9	1440	Whatever It Is, I Just Can't Stop	116	1	1	Jay Kay/Kay, Jay
10	1469	Look What You've Done	119	1	4	N. Cester
11	1470	Get What You Need	119	1	4	C. Cester/C. Muncey/N. Cester
12	1628	What Is And What Should Never Be	133	1	1	Jimmy Page, Robert Plant
13	1778	You're What's Happening (In The World Today)	146	1	14	Allen Story/George Gordy/Robert Gordy
14	1823	So What	149	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',
               'hovertemplate': 'Name=%{x}<br>UnitPrice=%{y}<extra></extra
>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array(['What It Takes', 'What You Are', 'Do what cha wa
nna',
                           'What is and Should Never Be', 'So What', 'What
A Day', 'What If I Do?',
                           'What Now My Love', 'Whatsername', "Whatever It
```

```
Is, I Just Can't Stop",
                            "Look What You've Done", 'Get What You Need',
                            'What Is And What Should Never Be',
                            "You're What's Happening (In The World Today)",
'So What',
                            "I Don't Know What To Do With Myself", 'What Kat
e Did',
                            'Whatever the Case May Be',
                            "I Still Haven't Found What I'm Looking for",
                            "I Still Haven't Found What I'm Looking For",
                            'Whatever Gets You Thru the Night', 'What Is It
About Men'],
                           dtype=object),
               'xaxis': 'x',
               'y': array([0.99, 0.99, 0.99, 0.99, 0.99, 0.99, 0.99, 0.99,
0.99, 0.99, 0.99, 0.99,
                           0.99, 0.99, 0.99, 0.99, 1.99, 1.99, 0.99, 0.99,
0.99, 0.99]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'margin': {'t': 60},
                'template': '...',
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'Name'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'UnitPrice'}}}
 }))
```

In [22]:

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

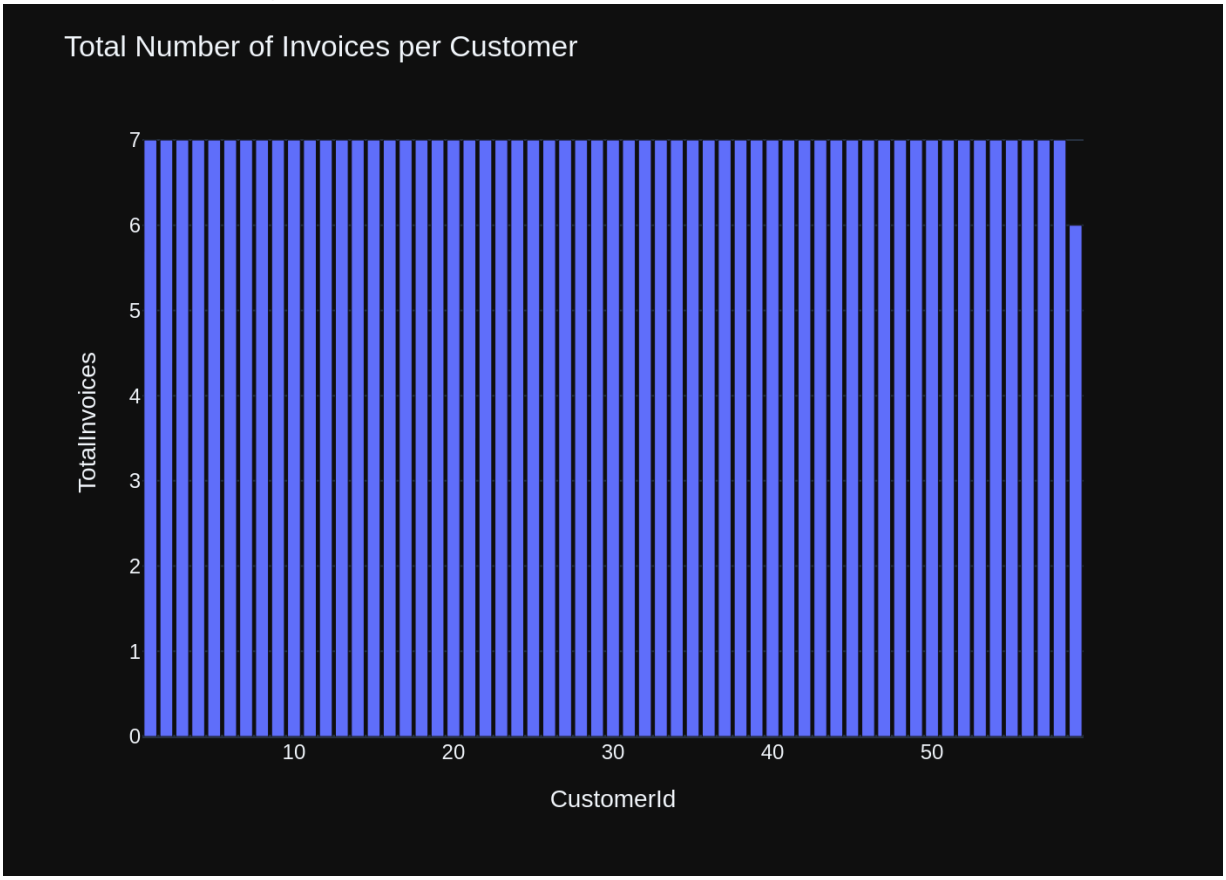
```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    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 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 "cu
stomers"'}, {'role': 'user', 'content': 'what are the top 5 countries that c
ustomers come from?'}, {'role': 'assistant', 'content': ' SELECT Country, CO
UNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMI
T 5'}, {'role': 'user', 'content': "which table stores customer's orders"},
{'role': 'assistant', 'content': ' SELECT "customers".CustomerId FROM "custo
mers"'}, {'role': 'user', 'content': ' \n   List all albums and their corr
esponding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "albu
ms".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists"
ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'content': '
\n   Find all tracks with a name containing "What" (case-insensitive)\n'},
{'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LOWER(Name)
LIKE \'%what%\''}, {'role': 'user', 'content': 'Can you list all tables in t
he SQLite database catalog?'}, {'role': 'assistant', 'content': "SELECT name
FROM sqlite_master WHERE type='table'"}, {'role': 'user', 'content': ' \n
Get the total number of invoices for each customer\n'}]
Info: Ollama parameters:
model=mistral: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": "
SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "what are
the top 5 countries that customers come from?"}, {"role": "assistant", "cont
ent": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country
\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": "which table s
tores customer's orders"}, {"role": "assistant", "content": " SELECT \"custo
mers\".CustomerId FROM \"customers\""}, {"role": "user", "content": "  \n
List all albums and their corresponding artist names  \n"}, {"role": "assist
ant", "content": "SELECT \"albums\".AlbumId, \"artists\".Name AS ArtistName
FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".
ArtistId"}, {"role": "user", "content": "  \n    Find all tracks with a name
containing \"What\" (case-insensitive)\n"}, {"role": "assistant", "content":
" SELECT * FROM \"tracks\" WHERE LOWER(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    Get the total number of inv
oices for each customer\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:25:21.014142256Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId,
COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "customers" LEFT JOIN "i
nvoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "custome
rs".CustomerId'}, 'done_reason': 'stop', 'done': True, 'total_duration': 637
60463785, 'load_duration': 3609879, 'prompt_eval_count': 1590, 'prompt_eval_
duration': 52325666000, 'eval_count': 66, 'eval_duration': 10608413000}
LLM Response:  SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId")
AS TotalInvoices FROM "customers" LEFT JOIN "invoices" ON "customers".Custom
erId = "invoices".CustomerId GROUP BY "customers".CustomerId
 SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoic
es FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoic
es".CustomerId GROUP BY "customers".CustomerId
    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: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 \"customers\".CustomerId, COUNT(\"inv
oices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LEFT JOIN \"invoi
ces\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"custo
mers\".CustomerId\n\nThe following is information about the resulting pandas
DataFrame 'df': \nRunning df.dtypes gives:\n CustomerId       int64\nTotalIn
voices    int64\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:latest', 'created_at': '2024-08-01T19:25:50.092324588Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\n\nfig = px.bar(df, x="CustomerId", y="TotalInvoices")\nfig.update_l
ayout(title=\'Total Number of Invoices per Customer\')\nfig.show()\n\nif df.
shape[0] == 1:\n    fig = go.Indicators(\n        domain={"x": [0, 1], "y":
[0, 1]},\n        value=df["TotalInvoices"].iloc[0],\n        title="Total I
nvoices"\n    )\n    fig.show()\n```'}, 'done_reason': 'stop', 'done': True,
'total_duration': 29051474585, 'load_duration': 3889454, 'prompt_eval_coun
t': 235, 'prompt_eval_duration': 7181055000, 'eval_count': 140, 'eval_durati
on': 21779092000}
```



Out[22]: (' SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInv
oices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "in
voices".CustomerId GROUP BY "customers".CustomerId',

	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({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'CustomerId=%{x}<br>TotalInvoices=%{y}<extr
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},
                 'margin': {'t': 60},
                 'template': '...',
                 'title': {'text': 'Total 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
7, updating n_results = 7
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

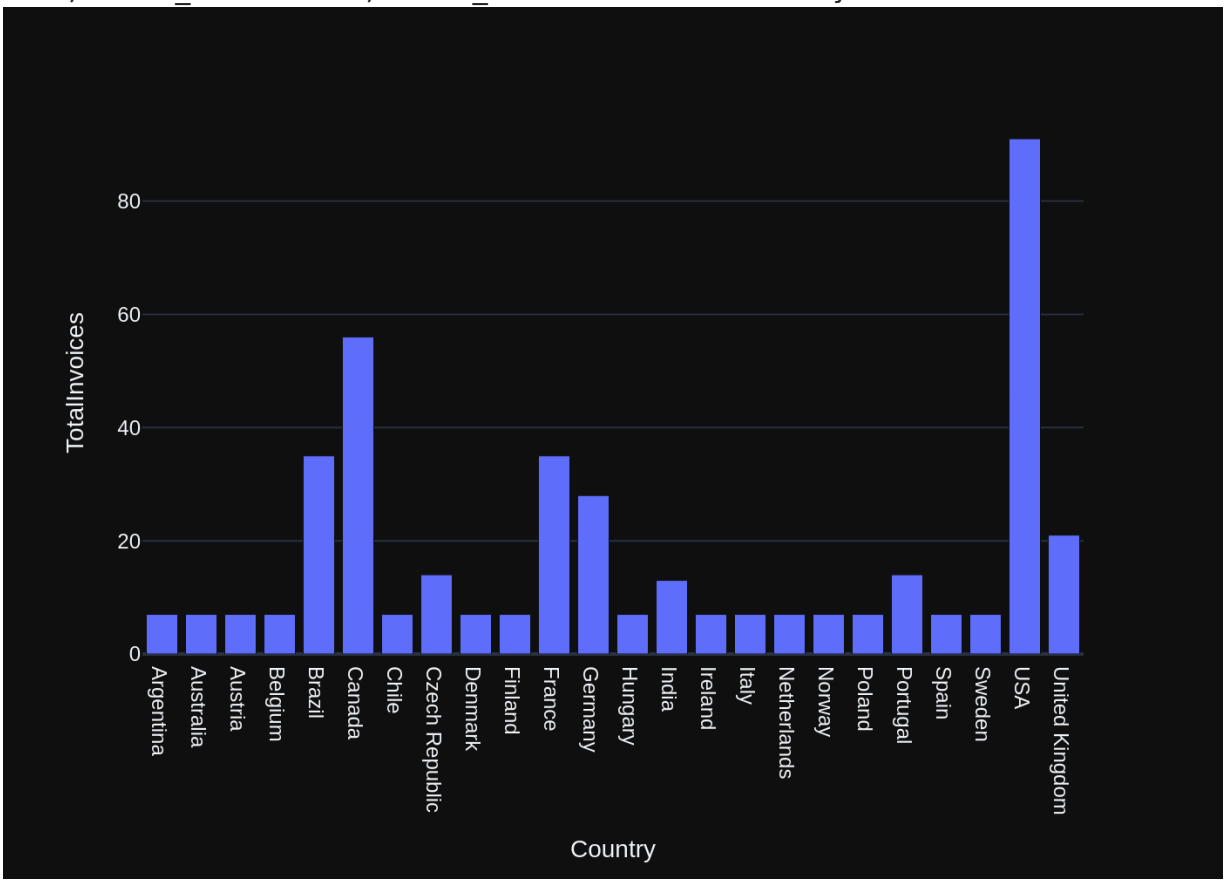
```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    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_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 "customer
s".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "customer
s" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GR
OUP BY "customers".CustomerId'}, {'role': 'user', 'content': 'what are the t
op 5 countries that customers come from?'}, {'role': 'assistant', 'content':
' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER
BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content': 'How many customers ar
e there'}, {'role': 'assistant', 'content': ' SELECT COUNT(*) FROM "customer
s"'}, {'role': 'user', 'content': "which table stores customer's orders"},
{'role': 'assistant', 'content': ' SELECT "customers".CustomerId FROM "custo
mers"'}, {'role': 'user', 'content': ' \n   List all albums and their corr
esponding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "albu
ms".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists"
ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'content': '
\n   Find all tracks with a name containing "What" (case-insensitive)\n'},
{'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LOWER(Name)
LIKE \'%what%\''}, {'role': 'user', 'content': 'Can you list all tables in t
he SQLite database catalog?'}, {'role': 'assistant', 'content': "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: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": " S
ELECT \"customers\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalIn
voices FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId
= \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "use
r", "content": "what are the top 5 countries that customers come from?"},
{"role": "assistant", "content": " SELECT Country, COUNT(*) AS Count\nFROM c
ustomers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user",
"content": "How many customers are there"}, {"role": "assistant", "content":
" SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "which t
able stores customer's orders"}, {"role": "assistant", "content": " SELECT
\"customers\".CustomerId FROM \"customers\""}, {"role": "user", "content": "
\n   List all albums and their corresponding artist names \n"}, {"role":
"assistant", "content": "SELECT \"albums\".AlbumId, \"artists\".Name AS Arti
stName FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".ArtistId = \"art
ists\".ArtistId"}, {"role": "user", "content": " \n   Find all tracks with
a name containing \"What\" (case-insensitive)\n"}, {"role": "assistant", "co
ntent": " SELECT * FROM \"tracks\" WHERE LOWER(Name) LIKE '%what%'"}, {"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 the total number
of invoices per country:\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:26:59.296409085Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".Country, CO
UNT("invoices"."InvoiceId") AS TotalInvoices FROM "customers" INNER JOIN "in

```
voices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customer
s".Country'}, 'done_reason': 'stop', 'done': True, 'total_duration': 6910888
6667, 'load_duration': 3266193, 'prompt_eval_count': 1749, 'prompt_eval_dura
tion': 57883110000, 'eval_count': 64, 'eval_duration': 10321769000}
LLM Response:  SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS
TotalInvoices FROM "customers" INNER JOIN "invoices" ON "customers".Customer
Id = "invoices".CustomerId GROUP BY "customers".Country
 SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvoices
FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoice
s".CustomerId GROUP BY "customers".Country
          Country  TotalInvoices
0       Argentina             7
1       Australia             7
2         Austria             7
3         Belgium             7
4          Brazil            35
5          Canada            56
6           Chile             7
7   Czech Republic            14
8         Denmark             7
9         Finland             7
10         France            35
11        Germany            28
12        Hungary             7
13          India            13
14        Ireland             7
15          Italy             7
16    Netherlands             7
17         Norway             7
18         Poland             7
19       Portugal            14
20          Spain             7
21         Sweden             7
22            USA            91
23  United Kingdom            21
Info: Ollama parameters:
model=mistral: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 total number of invoices per country:\n'\n\nThe DataFrame was
produced using this query:  SELECT \"customers\".Country, COUNT(\"invoices
\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invoices
\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customer
s\".Country\n\nThe following is information about the resulting pandas DataF
rame 'df': \nRunning df.dtypes gives:\n Country          object\nTotalInvoic
es     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:latest', 'created_at': '2024-08-01T19:27:28.341551908Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
```

s as px\nfig = px.bar("Country", "TotalInvoices", data=df)\nfig.update_layout(title="Total Number of Invoices per Country")\nif len(df) == 1:\n   fig = px.scatter(x=[df["Country"].iloc[0]], y=[df["TotalInvoices"].iloc[0]], mode=\'markers\', marker=dict(color=\'red\', symbol="star"))\n   fig.update_layout(title="Single Invoice Count: {}".format(df["Country"].iloc[0]))\n```'},
'done_reason': 'stop', 'done': True, 'total_duration': 29018321020, 'load_duration': 47638835, 'prompt_eval_count': 230, 'prompt_eval_duration': 7031804000, 'eval_count': 141, 'eval_duration': 21888553000}



Out[23]:
```
(' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvoic
es FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invo
ices".CustomerId GROUP BY "customers".Country',
            Country  TotalInvoices
 0        Argentina             7
 1        Australia             7
 2          Austria             7
 3          Belgium             7
 4           Brazil            35
 5           Canada            56
 6            Chile             7
 7   Czech Republic            14
 8          Denmark             7
 9          Finland             7
 10          France            35
 11         Germany            28
 12         Hungary             7
 13           India            13
 14         Ireland             7
 15           Italy             7
 16     Netherlands             7
 17          Norway             7
 18          Poland             7
 19        Portugal            14
 20           Spain             7
 21          Sweden             7
 22             USA            91
 23  United Kingdom            21,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'Country=%{x}<br>TotalInvoices=%{y}<extra>
</extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array(['Argentina', 'Australia', 'Austria', 'Belgium',
'Brazil', 'Canada',
                           'Chile', 'Czech Republic', 'Denmark', 'Finland',
'France', 'Germany',
                           'Hungary', 'India', 'Ireland', 'Italy', 'Netherl
ands', 'Norway',
                           'Poland', 'Portugal', 'Spain', 'Sweden', 'USA',
'United Kingdom'],
                          dtype=object),
               'xaxis': 'x',
               'y': array([ 7,  7,  7,  7, 35, 56,  7, 14,  7,  7, 35, 28,
7, 13,  7,  7,  7,  7,
                            7, 14,  7,  7, 91, 21]),
               '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': 'TotalInvoices'}}}
 }))
```

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
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 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': '
SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoice
s FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoice
s".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content':
' \n   Find the total number of invoices per country:\n'}, {'role': 'assis
tant', 'content': ' SELECT "customers".Country, COUNT("invoices"."InvoiceI
d") AS TotalInvoices FROM "customers" INNER JOIN "invoices" ON "customers".C
ustomerId = "invoices".CustomerId GROUP BY "customers".Country'}, {'role':
'user', 'content': 'How many customers are there'}, {'role': 'assistant', 'c
ontent': ' SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'content':
'what are the top 5 countries that customers come from?'}, {'role': 'assista
nt', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP B
Y Country\nORDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content': ' \n
List all albums and their corresponding artist names \n'}, {'role': 'assist
ant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM
"albums" INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId'},
{'role': 'user', 'content': "which table stores customer's orders"}, {'rol
e': 'assistant', 'content': ' SELECT "customers".CustomerId FROM "customer
s"'}, {'role': 'user', 'content': ' \n   Find all tracks with a name conta
ining "What" (case-insensitive)\n'}, {'role': 'assistant', 'content': ' SELE
CT * FROM "tracks" WHERE LOWER(Name) LIKE \'%what%\''}, {'role': 'user', 'co
ntent': '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: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

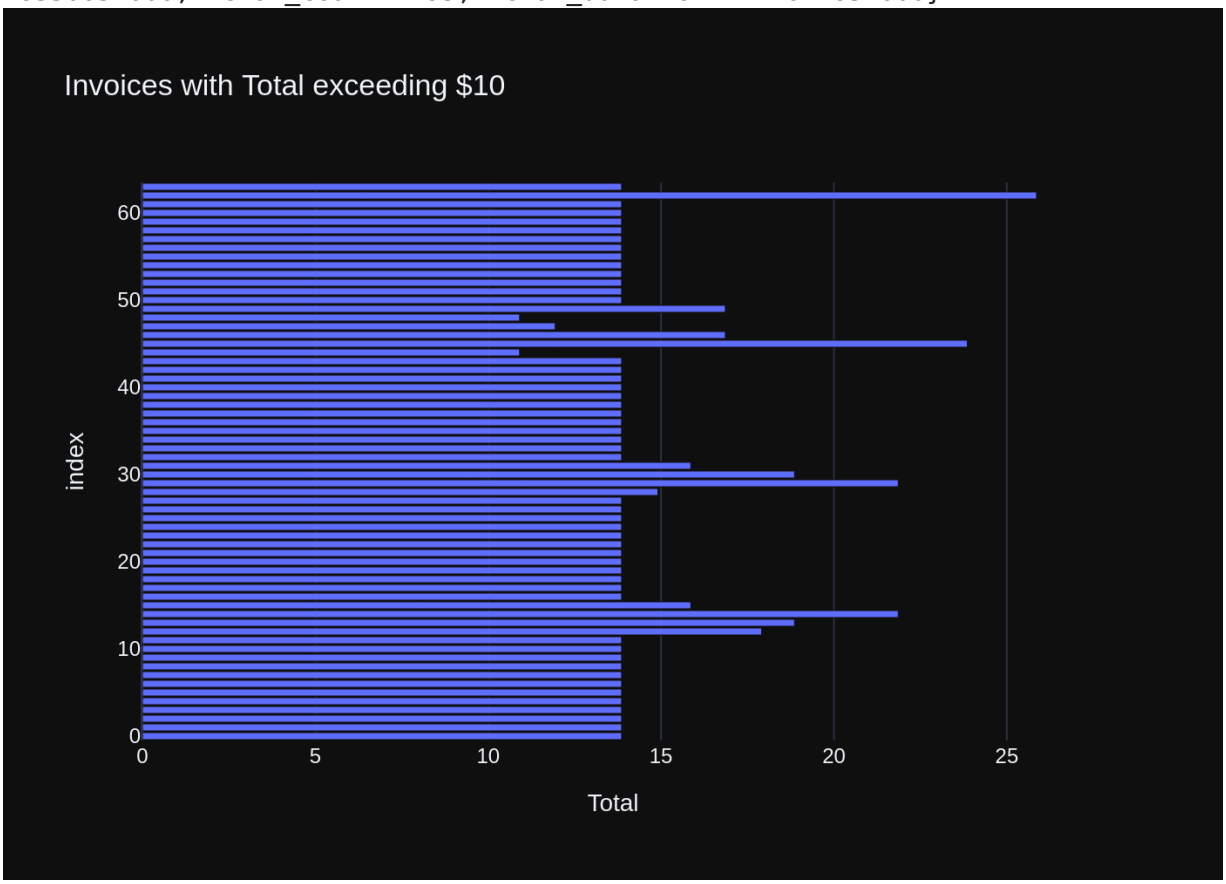
DELETE NO ACTION ON UPDATE NO ACTION,\r\n   FOREIGN KEY (MediaTypeId) REFER
ENCES \"media_types\" (MediaTypeId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO
ACTION\r\n)\n\nCREATE INDEX IFK_EmployeeReportsTo ON \"employees\" (ReportsT
o)\n\nCREATE TABLE \"customers\"\r\n(\r\n   CustomerId INTEGER PRIMARY 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 \"customers\".CustomerId, COUNT
(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LEFT JOIN
\"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY
\"customers\".CustomerId"}, {"role": "user", "content": " \n   Find the to
tal number of invoices per country:\n"}, {"role": "assistant", "content": "
SELECT \"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvo
ices FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId
= \"invoices\".CustomerId GROUP BY \"customers\".Country"}, {"role": "user",
"content": "How many customers are there"}, {"role": "assistant", "content":
" SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "what ar
e the top 5 countries that customers come from?"}, {"role": "assistant", "co
ntent": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Countr
y\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": " \n   List
all albums and their corresponding artist names \n"}, {"role": "assistant",
"content": "SELECT \"albums\".AlbumId, \"artists\".Name AS ArtistName FROM
\"albums\" INNER JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".Artis
tId"}, {"role": "user", "content": "which table stores customer's orders"},
{"role": "assistant", "content": " SELECT \"customers\".CustomerId FROM \"cu
stomers\""}, {"role": "user", "content": " \n   Find all tracks with a nam
e containing \"What\" (case-insensitive)\n"}, {"role": "assistant", "conten
t": " SELECT * FROM \"tracks\" WHERE LOWER(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": " \n   List all invoices with
a total exceeding $10:\n"}]

```
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:28:35.66307132Z',
'message': {'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate,
CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, Billi
ngPostalCode, Total FROM "invoices" WHERE Total > 10'}, 'done_reason': 'sto
p', 'done': True, 'total_duration': 67199876737, 'load_duration': 2905425,
'prompt_eval_count': 1759, 'prompt_eval_duration': 58319121000, 'eval_coun
t': 49, 'eval_duration': 7871853000}
LLM Response:  SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, Bi
llingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM "invo
ices" WHERE Total > 10
 SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, Bil
lingState, BillingCountry, BillingPostalCode, Total FROM "invoices" WHERE To
tal > 10
    InvoiceId          InvoiceDate  CustomerId             BillingAddress  \
0           5  2009-01-11 00:00:00          23            69 Salem Street
1          12  2009-02-11 00:00:00           2    Theodor-Heuss-Straße 34
2          19  2009-03-14 00:00:00          40             8, Rue Hanovre
3          26  2009-04-14 00:00:00          19            1 Infinite Loop
4          33  2009-05-15 00:00:00          57            Calle Lira, 198
..        ...                  ...         ...                        ...
59        383  2013-08-12 00:00:00          10  Rua Dr. Falcão Filho, 155
60        390  2013-09-12 00:00:00          48      Lijnbaansgracht 120bg
61        397  2013-10-13 00:00:00          27             1033 N Park Ave
62        404  2013-11-13 00:00:00           6               Rilská 3174/6
63        411  2013-12-14 00:00:00          44            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: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 InvoiceId, InvoiceDate, CustomerId, Billi
ngAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Tot
al FROM \"invoices\" WHERE Total > 10\n\nThe following is information about
the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n InvoiceId
int64\nInvoiceDate           object\nCustomerId             int64\nBillingAd
dress        object\nBillingCity           object\nBillingState          obj
ect\nBillingCountry        object\nBillingPostalCode     object\nTotal
```

float64\ndtype: 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 dataframe called 'df'. If there is only one value in the datafra me, use an Indicator. Respond with only Python code. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:28:58.803249514Z', 'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres s as px\n\nfig = px.bar(df, x=\'Total\', title="Invoices with Total exceedin g $10")\nif len(df) == 1:\n   fig = px.scatter(df, x=df.index, y=\'Total\', size=\'Total\', title="Single Invoice with Total exceeding $10")\nfig.show() \n```'}, 'done_reason': 'stop', 'done': True, 'total_duration': 23114103641, 'load_duration': 3139616, 'prompt_eval_count': 265, 'prompt_eval_duration': 8350652000, 'eval_count': 95, 'eval_duration': 14671851000}



Out[24]:
```
(' SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity,
BillingState, BillingCountry, BillingPostalCode, Total FROM "invoices" WHER
E Total > 10',
     InvoiceId          InvoiceDate  CustomerId             BillingAddress
\
 0           5  2009-01-11 00:00:00          23           69 Salem Street
 1          12  2009-02-11 00:00:00           2    Theodor-Heuss-Straße 34
 2          19  2009-03-14 00:00:00          40             8, Rue Hanovre
 3          26  2009-04-14 00:00:00          19           1 Infinite Loop
 4          33  2009-05-15 00:00:00          57           Calle Lira, 198
 ..        ...                  ...         ...                       ...
 59        383  2013-08-12 00:00:00          10  Rua Dr. Falcão Filho, 155
 60        390  2013-09-12 00:00:00          48     Lijnbaansgracht 120bg
 61        397  2013-10-13 00:00:00          27           1033 N Park Ave
 62        404  2013-11-13 00:00:00           6             Rilská 3174/6
 63        411  2013-12-14 00:00:00          44           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': [{'alignmentgroup': 'True',
               'hovertemplate': 'Total=%{x}<br>index=%{y}<extra></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'h',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': 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]),
               'xaxis': 'x',
```

```
               'y': array([ 0,  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, 60, 61, 62, 63]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
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                'title': {'text': 'Invoices with Total exceeding $10'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'Total'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'index'}}}
 }))
```

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
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 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
```

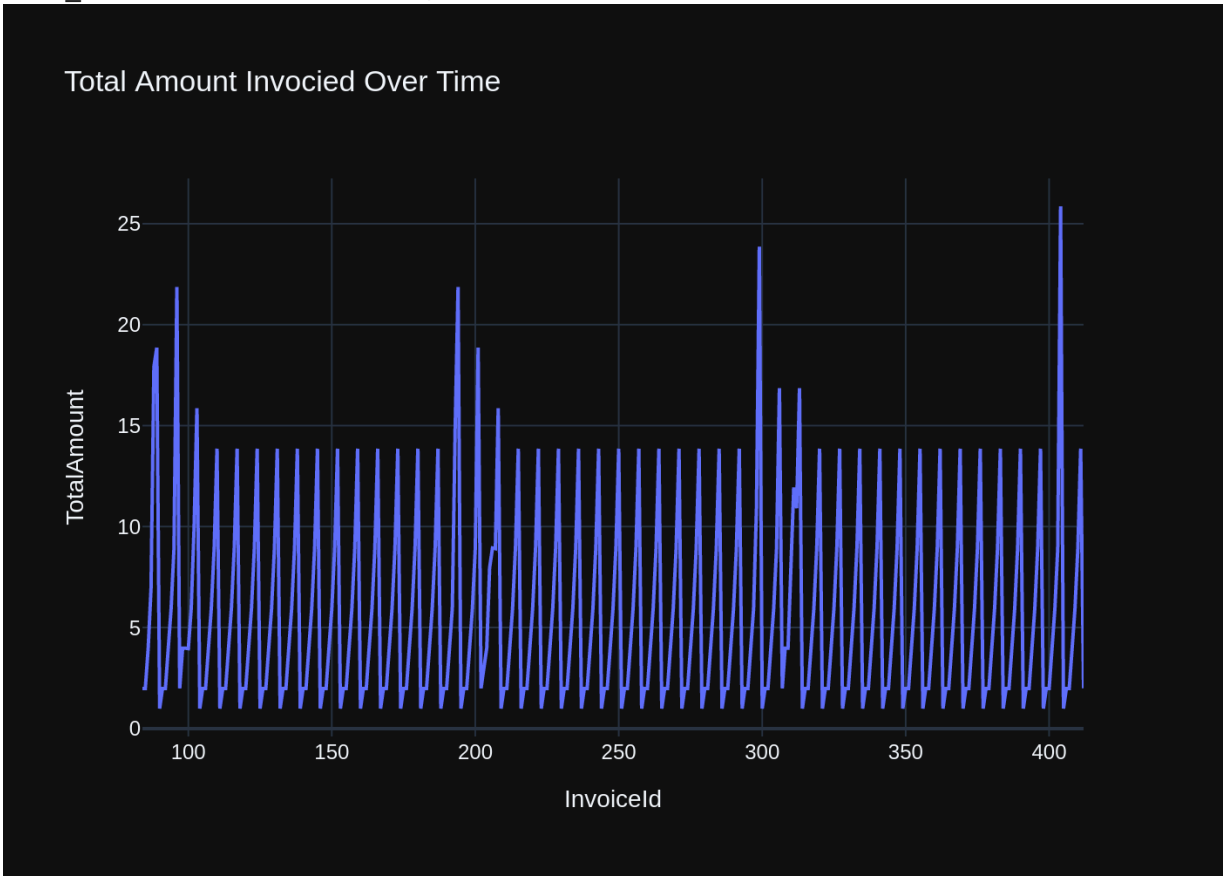
provided context is almost sufficient but requires knowledge of a specific s
tring in a particular column, please generate an intermediate SQL query to f
ind the distinct strings in that column. Prepend the query with a comment sa
ying intermediate_sql \n3. If the provided context is insufficient, please 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 InvoiceId, InvoiceDate, CustomerId, BillingAddres
s, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM
"invoices" WHERE Total > 10'}, {'role': 'user', 'content': ' \n   Find the
total number of invoices per country:\n'}, {'role': 'assistant', 'content':
' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvoices
FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoice
s".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'content': '
\n   Get the total number of invoices for each customer\n'}, {'role': 'assi
stant', 'content': ' SELECT "customers".CustomerId, COUNT("invoices"."Invoic
eId") AS TotalInvoices FROM "customers" LEFT JOIN "invoices" ON "customers".
CustomerId = "invoices".CustomerId GROUP BY "customers".CustomerId'}, {'rol
e': 'user', 'content': 'How many customers are there'}, {'role': 'assistan
t', 'content': ' SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'conte
nt': 'what are the top 5 countries that customers come from?'}, {'role': 'as
sistant', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGR
OUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content':
"which table stores customer's orders"}, {'role': 'assistant', 'content': '
SELECT "customers".CustomerId FROM "customers"'}, {'role': 'user', 'conten
t': ' \n   Find all tracks with a name containing "What" (case-insensitiv
e)\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LOWE
R(Name) LIKE \'%what%\''}, {'role': 'user', 'content': ' \n   List all alb
ums and their corresponding artist names \n'}, {'role': 'assistant', 'conte
nt': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" IN
NER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'us
er', '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 201
0 and the total amount invoiced:\n'}]
Info: Ollama parameters:
model=mistral: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\" (InvoiceId)\n\nCREATE INDEX IFK_InvoiceCustomerId ON \"invoices\" (CustomerId)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON \"invoice_items\" (TrackId)\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   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) 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 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 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 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 \"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 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 \"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 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\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 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 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": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": " \n   Find the total number of invoices per country:\n"}, {"role": "assistant", "content": " SELECT \"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customer

```
s\".Country"}, {"role": "user", "content": "  \n    Get the total number of
invoices for each customer\n"}, {"role": "assistant", "content": " SELECT
\"customers\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices
FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"in
voices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "c
ontent": "How many customers are there"}, {"role": "assistant", "content": "
SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": "what are
the top 5 countries that customers come from?"}, {"role": "assistant", "cont
ent": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country
\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": "which table s
tores customer's orders"}, {"role": "assistant", "content": " SELECT \"custo
mers\".CustomerId FROM \"customers\""}, {"role": "user", "content": "  \n
Find all tracks with a name containing \"What\" (case-insensitive)\n"}, {"ro
le": "assistant", "content": " SELECT * FROM \"tracks\" WHERE LOWER(Name) LI
KE '%what%'"}, {"role": "user", "content": "  \n    List all albums and thei
r corresponding artist names  \n"}, {"role": "assistant", "content": "SELECT
\"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" INNER JOI
N \"artists\" ON \"albums\".ArtistId = \"artists\".ArtistId"}, {"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    Find all invoices since 201
0 and the total amount invoiced:\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:30:16.150489682Z',
'message': {'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(Total) A
S TotalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDate) >=
\'2010\'\n   GROUP BY InvoiceId'}, 'done_reason': 'stop', 'done': True, 'tot
al_duration': 77241634702, 'load_duration': 3039827, 'prompt_eval_count': 20
24, 'prompt_eval_duration': 67320240000, 'eval_count': 53, 'eval_duration':
8706232000}
LLM Response:  SELECT InvoiceId, SUM(Total) AS TotalAmount
   FROM "invoices"
   WHERE strftime('%Y', InvoiceDate) >= '2010'
   GROUP BY InvoiceId
 SELECT InvoiceId, SUM(Total) AS TotalAmount
   FROM "invoices"
   WHERE strftime('%Y', InvoiceDate) >= '2010'
   GROUP BY InvoiceId
     InvoiceId  TotalAmount
0            84         1.98
1            85         1.98
2            86         3.96
3            87         6.94
4            88        17.91
..          ...          ...
324         408         3.96
325         409         5.94
326         410         8.91
327         411        13.86
328         412         1.99

[329 rows x 2 columns]
Info: Ollama parameters:
model=mistral:latest,
options={},
keep_alive=None
```

Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that contains 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 InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY InvoiceId\n\nThe following is information about the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n InvoiceId   int64\nTotalAmount   float64\ndtype: 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 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:latest', 'created_at': '2024-08-01T19:30:40.651753883Z', 'message': {'role': 'assistant', 'content': '```python\nimport plotly.express as px\n\nif df.shape[0] == 1:\n   fig = px.bar(df, x="InvoiceId", y="TotalAmount")\n   fig.update_layout(title="Single Invoice Data", showlegend=False)\nelse:\n   fig = px.line(df, x="InvoiceId", y="TotalAmount", title="Total Amount Invocied Over Time")\nfig.show()\n```'}, 'done_reason': 'stop', 'done': True, 'total_duration': 24474162590, 'load_duration': 3083621, 'prompt_eval_count': 229, 'prompt_eval_duration': 7355358000, 'eval_count': 110, 'eval_duration': 16984581000}



Out[25]:
```
(' SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM "invoices"\n   WHER
E strftime(\'%Y\', InvoiceDate) >= \'2010\'\n   GROUP BY InvoiceId',
      InvoiceId  TotalAmount
 0           84         1.98
 1           85         1.98
 2           86         3.96
 3           87         6.94
 4           88        17.91
 ..         ...          ...
 324        408         3.96
 325        409         5.94
 326        410         8.91
 327        411        13.86
 328        412         1.99

 [329 rows x 2 columns],
 Figure({
     'data': [{'hovertemplate': 'InvoiceId=%{x}<br>TotalAmount=%{y}<extra>
</extra>',
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               'line': {'color': '#636efa', 'dash': 'solid'},
               'marker': {'symbol': 'circle'},
               'mode': 'lines',
               'name': '',
               'orientation': 'v',
               'showlegend': False,
               'type': 'scatter',
               'x': array([ 84,  85,  86, ..., 410, 411, 412]),
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               'y': array([ 1.98,  1.98,  3.96, ...,  8.91, 13.86,  1.99]),
               'yaxis': 'y'}],
     'layout': {'legend': {'tracegroupgap': 0},
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                'title': {'text': 'Total Amount Invocied Over Time'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'InvoiceId'}},
                '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
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 ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE INDEX IFK_EmployeeReportsTo ON "employees" (ReportsTo)\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   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) 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 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 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_CustomerSupportRepId ON "customers" (SupportRepId)\n\nCREATE TABLE "invoices"\r\n(\r\n   InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   CustomerId INTEGER 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 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 "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 "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   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 "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 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 sqlite_stat1(tbl,idx,stat)\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 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 questi
on has been asked and answered before, please repeat the answer exactly as i
t was given before. \n'}, {'role': 'user', 'content': 'what are the top 5 co
untries that customers come from?'}, {'role': 'assistant', 'content': ' SELE
CT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Co
unt DESC\nLIMIT 5'}, {'role': 'user', 'content': ' \n   Find all invoices
since 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'conten
t': ' SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM "invoices"\n   WH
ERE strftime(\'%Y\', InvoiceDate) >= \'2010\'\n   GROUP BY InvoiceId'}, {'ro
le': 'user', 'content': ' \n   List all invoices with a total exceeding $1
0:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, Cu
stomerId, BillingAddress, BillingCity, BillingState, BillingCountry, Billing
PostalCode, Total FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'cont
ent': ' \n   List all albums and their corresponding artist names \n'},
{'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS
ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artist
s".ArtistId'}, {'role': 'user', 'content': ' \n   Get the total number of
invoices for each customer\n'}, {'role': 'assistant', 'content': ' SELECT "c
ustomers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "c
ustomers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".Custom
erId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content': "which t
able stores customer's orders"}, {'role': 'assistant', 'content': ' SELECT
"customers".CustomerId FROM "customers"'}, {'role': 'user', 'content': ' \n
Find the total number of invoices per country:\n'}, {'role': 'assistant', 'c
ontent': ' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS Tota
lInvoices FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId =
"invoices".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'cont
ent': 'How many customers are there'}, {'role': 'assistant', 'content': ' SE
LECT COUNT(*) FROM "customers"'}, {'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 all tracks with a name containing "What" (case-inse
nsitive)\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHER
E LOWER(Name) LIKE \'%what%\''}, {'role': 'user', 'content': " \n   List a
ll employees and their reporting manager's name (if any):\n"}]
Info: Ollama parameters:
model=mistral: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": "what are the top 5 countries that customers come fro
m?"}, {"role": "assistant", "content": " SELECT Country, COUNT(*) AS Count\n
FROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"}, {"role":
"user", "content": " \n   Find all invoices since 2010 and the total amoun
t invoiced:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, SUM(To
tal) AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y', InvoiceDa
te) >= '2010'\n   GROUP BY InvoiceId"}, {"role": "user", "content": " \n
List all invoices with a total exceeding $10:\n"}, {"role": "assistant", "co
ntent": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, Billing
City, BillingState, BillingCountry, BillingPostalCode, Total FROM \"invoices
\" WHERE Total > 10"}, {"role": "user", "content": " \n   List all albums
and their corresponding artist names \n"}, {"role": "assistant", "content":
"SELECT \"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" I

```
NNER JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".ArtistId"}, {"rol
e": "user", "content": "  \n    Get the total number of invoices for each cu
stomer\n"}, {"role": "assistant", "content": " SELECT \"customers\".Customer
Id, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LE
FT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId G
ROUP BY \"customers\".CustomerId"}, {"role": "user", "content": "which table
stores customer's orders"}, {"role": "assistant", "content": " SELECT \"cust
omers\".CustomerId FROM \"customers\""}, {"role": "user", "content": "  \n
Find the total number of invoices per country:\n"}, {"role": "assistant", "c
ontent": " SELECT \"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") A
S TotalInvoices FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".
CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".Country"}, {"rol
e": "user", "content": "How many customers are there"}, {"role": "assistan
t", "content": " SELECT COUNT(*) FROM \"customers\""}, {"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 tracks with a name conta
ining \"What\" (case-insensitive)\n"}, {"role": "assistant", "content": " SE
LECT * FROM \"tracks\" WHERE LOWER(Name) LIKE '%what%'"}, {"role": "user",
"content": "  \n    List all employees and their reporting manager's name (i
f any):\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:31:58.433331568Z',
'message': {'role': 'assistant', 'content': ' SELECT e1.LastName, e1.FirstNa
me, e2.LastName, e2.FirstName AS ReportingManager\n   FROM employees e1\n
LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID;'}, 'done_reason': 's
top', 'done': True, 'total_duration': 77677282499, 'load_duration': 3991203,
'prompt_eval_count': 1991, 'prompt_eval_duration': 66471945000, 'eval_coun
t': 60, 'eval_duration': 9862077000}
LLM Response:  SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName A
S ReportingManager
   FROM employees e1
   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID;
Info: Output from LLM:  SELECT e1.LastName, e1.FirstName, e2.LastName, e2.Fi
rstName AS ReportingManager
   FROM employees e1
   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID;
Extracted SQL: SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName A
S ReportingManager
   FROM employees e1
   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID
SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName AS ReportingMana
ger
   FROM employees e1
   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID
   LastName FirstName  LastName ReportingManager
0     Adams    Andrew      None             None
1   Edwards     Nancy     Adams           Andrew
2   Peacock      Jane   Edwards            Nancy
3      Park  Margaret   Edwards            Nancy
4   Johnson     Steve   Edwards            Nancy
5  Mitchell   Michael     Adams           Andrew
6      King    Robert  Mitchell          Michael
7  Callahan     Laura  Mitchell          Michael
Info: Ollama parameters:
model=mistral: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.LastName, e1.FirstNam
e, e2.LastName, e2.FirstName AS ReportingManager\n   FROM employees e1\n   L
EFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID\n\nThe following is in
formation about the resulting pandas DataFrame 'df': \nRunning df.dtypes giv
es:\n LastName            object\nFirstName           object\nLastName
object\nReportingManager    object\ndtype: object"}, {"role": "user", "conte
nt": "Can you generate the Python plotly code to chart the results of the da
taframe? Assume the data is in a pandas dataframe called 'df'. If there is o
nly one value in the dataframe, use an Indicator. Respond with only Python c
ode. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:32:28.253364012Z',
'message': {'role': 'assistant', 'content': "```python\nimport plotly.expres
s as px\n\nfig = px.bar(df, x='LastName', y='FirstName', color='ReportingMan
ager', barmode='group')\nfig.update_layout(margin=dict(l=0, r=0, t=0, b=0))
\nfig.update_traces(marker_colorscale=px.colors.qualitative.Plotly)\nif len
(df) == 1:\n    fig = px.scatter(df, x='LastName', y=None, name='Employee',
marker=dict(color='black', symbol='circle'))\n```"}, 'done_reason': 'stop',
'done': True, 'total_duration': 29799967208, 'load_duration': 4030873, 'prom
pt_eval_count': 235, 'prompt_eval_duration': 7188139000, 'eval_count': 145,
'eval_duration': 22477398000}
Couldn't run plotly code:  The truth value of a Series is ambiguous. Use a.e
mpty, a.bool(), a.item(), a.any() or a.all().
```

```
Traceback (most recent call last):
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/vann
a/base/base.py", line 1999, in get_plotly_figure
    exec(plotly_code, globals(), ldict)
  File "<string>", line 3, in <module>
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/plotl
y/express/_chart_types.py", line 373, in bar
    return make_figure(
           ^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/plotl
y/express/_core.py", line 2090, in make_figure
    args = build_dataframe(args, constructor)
           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/plotl
y/express/_core.py", line 1492, in build_dataframe
    df_output, wide_id_vars = process_args_into_dataframe(
                              ^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/plotl
y/express/_core.py", line 1228, in process_args_into_dataframe
    df_output[col_name] = to_unindexed_series(
                          ^^^^^^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/plotl
y/express/_core.py", line 1076, in to_unindexed_series
    return pd.Series(x, name=name).reset_index(drop=True)
           ^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/panda
s/core/series.py", line 584, in __init__
    data = sanitize_array(data, index, dtype, copy)
           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/panda
s/core/construction.py", line 633, in sanitize_array
    return sanitize_array(
           ^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/panda
s/core/construction.py", line 606, in sanitize_array
    subarr = maybe_infer_to_datetimelike(data)
             ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/panda
s/core/dtypes/cast.py", line 1182, in maybe_infer_to_datetimelike
    raise ValueError(value.ndim)  # pragma: no cover
    ^^^^^^^^^^^^^^^^^^^^^^^^^^^^
ValueError: 2

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/vann
a/base/base.py", line 1675, in ask
    fig = self.get_plotly_figure(plotly_code=plotly_code, df=df)
          ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/vann
a/base/base.py", line 2016, in get_plotly_figure
    elif len(categorical_cols) >= 1 and df[categorical_cols[0]].nunique() <
10:
                                        ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
^^
```

```
  File "/home/gongai/anaconda3/envs/vanna/lib/python3.11/site-packages/panda
s/core/generic.py", line 1577, in __nonzero__
    raise ValueError(
ValueError: The truth value of a Series is ambiguous. Use a.empty, a.bool(),
a.item(), a.any() or a.all().
```

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
1, updating n_results = 1
```

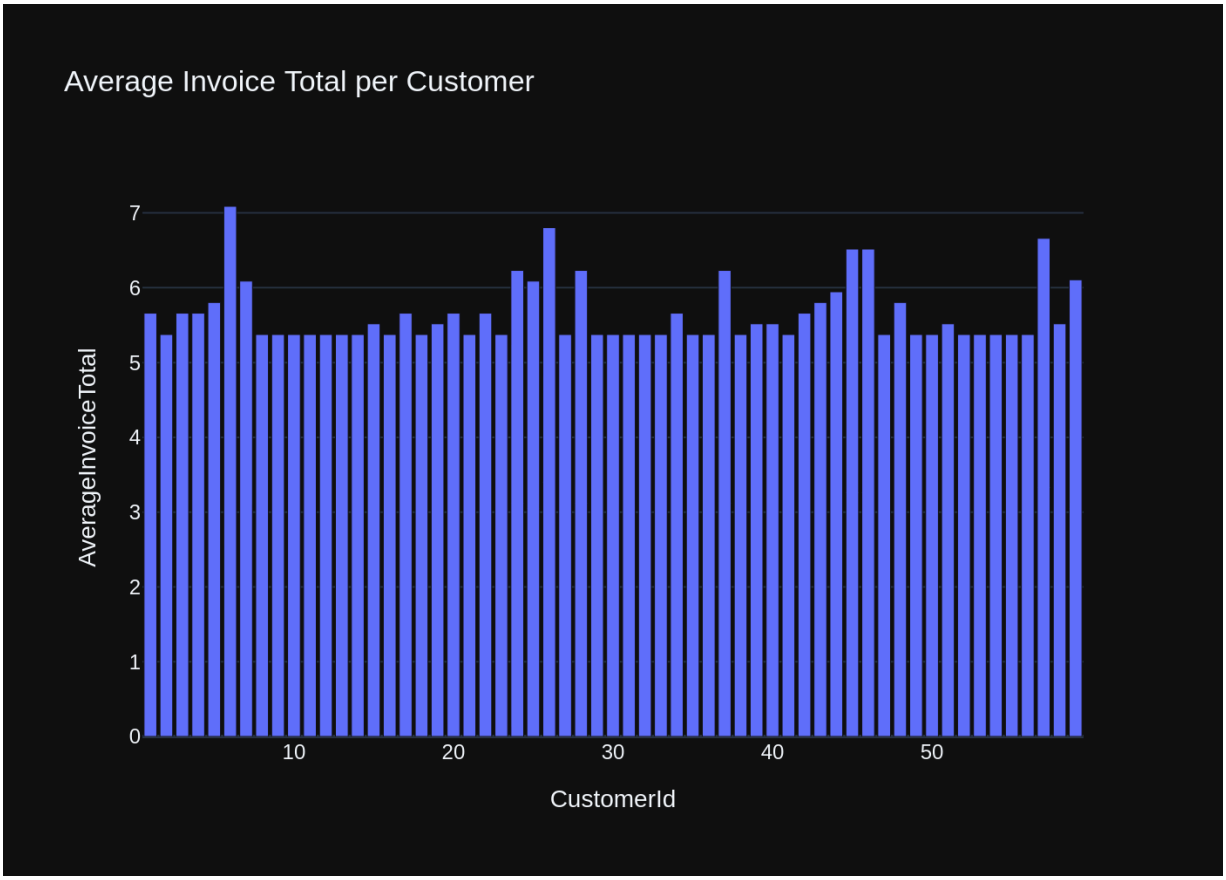
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please help to generate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n   InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   CustomerId INTEGER 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_InvoiceCustomerId ON "invoices" (CustomerId)\n\nCREATE INDEX 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 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 INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nCREATE TABLE sqlite_stat1(tbl,idx,stat)\n\nCREATE INDEX IFK_CustomerSupportRepId ON "customers" (SupportRepId)\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 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_EmployeeReportsTo ON "employees" (ReportsTo)\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   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) 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 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 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 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 "customers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content': ' \n   Find the total number of invoices per country:\n'}, {'role': 'assistant', 'content': ' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'content': ' \n

Find all invoices since 2010 and the total amount invoiced:\n'}, {'role': 'a
ssistant', 'content': ' SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM
"invoices"\n   WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\'\n   GROUP BY
InvoiceId'}, {'role': 'user', 'content': ' \n   List all invoices with a t
otal exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceI
d, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, Billi
ngCountry, BillingPostalCode, Total FROM "invoices" WHERE Total > 10'}, {'ro
le': 'user', 'content': 'How many customers are there'}, {'role': 'assistan
t', 'content': ' SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'conte
nt': 'what are the top 5 countries that customers come from?'}, {'role': 'as
sistant', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGR
OUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content':
"which table stores customer's orders"}, {'role': 'assistant', 'content': '
SELECT "customers".CustomerId FROM "customers"'}, {'role': 'user', 'conten
t': " \n   List all employees and their reporting manager's name (if an
y):\n"}, {'role': 'assistant', 'content': 'SELECT e1.LastName, e1.FirstName,
e2.LastName, e2.FirstName AS ReportingManager\n   FROM employees e1\n   LEFT
JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID'}, {'role': 'user', 'conte
nt': ' \n   List all albums and their corresponding artist names \n'},
{'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS
ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artist
s".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 LOWER(Name) LIKE \'%what%\''}, {'role':
'user', 'content': ' \n   Get the average invoice total for each custome
r:\n'}]
Info: Ollama parameters:
model=mistral: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 \"cus
tomers\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM
\"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoice
s\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "conten
t": " \n   Find the total number of invoices per country:\n"}, {"role": "a
ssistant", "content": " SELECT \"customers\".Country, COUNT(\"invoices\".\"I
nvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invoices\" ON
\"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".Co
untry"}, {"role": "user", "content": " \n   Find all invoices since 2010 a
nd the total amount invoiced:\n"}, {"role": "assistant", "content": " SELECT
InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftim
e('%Y', InvoiceDate) >= '2010'\n   GROUP BY InvoiceId"}, {"role": "user", "c
ontent": " \n   List all invoices with a total exceeding $10:\n"}, {"rol
e": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, Bil
lingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, T
otal FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": "How
many customers are there"}, {"role": "assistant", "content": " SELECT COUNT
(*) FROM \"customers\""}, {"role": "user", "content": "what are the top 5 co
untries that customers come from?"}, {"role": "assistant", "content": " SELE
CT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Co
unt DESC\nLIMIT 5"}, {"role": "user", "content": "which table stores custome
r's orders"}, {"role": "assistant", "content": " SELECT \"customers\".Custom
erId FROM \"customers\""}, {"role": "user", "content": " \n   List all emp
loyees and their reporting manager's name (if any):\n"}, {"role": "assistan
t", "content": "SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName
AS ReportingManager\n   FROM employees e1\n   LEFT JOIN employees e2 ON e1.R
eportsTo = e2.EmployeeID"}, {"role": "user", "content": " \n   List all al
bums and their corresponding artist names \n"}, {"role": "assistant", "cont
ent": "SELECT \"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albu
ms\" INNER JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".ArtistId"},
{"role": "user", "content": " \n   Find all tracks with a name containing
\"What\" (case-insensitive)\n"}, {"role": "assistant", "content": " SELECT *
FROM \"tracks\" WHERE LOWER(Name) LIKE '%what%'"}, {"role": "user", "conten

```
t": "  \n    Get the average invoice total for each customer:\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:33:37.225014682Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId,
AVG("invoices"."Total") AS AverageInvoiceTotal FROM "customers" INNER JOIN
"invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "custo
mers".CustomerId'}, 'done_reason': 'stop', 'done': True, 'total_duration': 6
8921130044, 'load_duration': 3440100, 'prompt_eval_count': 1725, 'prompt_eva
l_duration': 57247425000, 'eval_count': 64, 'eval_duration': 10333559000}
LLM Response:  SELECT "customers".CustomerId, AVG("invoices"."Total") AS Ave
rageInvoiceTotal FROM "customers" INNER JOIN "invoices" ON "customers".Custo
merId = "invoices".CustomerId GROUP BY "customers".CustomerId
 SELECT "customers".CustomerId, AVG("invoices"."Total") AS AverageInvoiceTot
al FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoi
ces".CustomerId GROUP BY "customers".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: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 \"customers\".CustomerId, AVG(\"invoic
es\".\"Total\") AS AverageInvoiceTotal FROM \"customers\" INNER JOIN \"invoi
ces\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"custo
mers\".CustomerId\n\nThe following is information about the resulting pandas
DataFrame 'df': \nRunning df.dtypes gives:\n CustomerId               int64
\nAverageInvoiceTotal    float64\ndtype: object"}, {"role": "user", "conten
t": "Can you generate the Python plotly code to chart the results of the dat
aframe? Assume the data is in a pandas dataframe called 'df'. If there is on
ly one value in the dataframe, use an Indicator. Respond with only Python co
de. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:34:15.572915019Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\n\nif df.shape[0] == 1:\n    fig = px.bar(df, x="CustomerId", y="Ave
rageInvoiceTotal", title="Average Invoice Total per Customer")\n    fig.upda
te_layout(template=\'none\')\n    fig.add_trace(go.Indicator(\n        domai
n={"x": [0, 1]},\n        value=df["AverageInvoiceTotal"].iloc[0],\n
title="Total Average Invoice",\n        title_font_family="Arial",\n
title_font_size=18,\n        mode=\'gauge+number\'\n    ))\nelse:\n    fig =
px.bar(df, x="CustomerId", y="AverageInvoiceTotal", title="Average Invoice T
otal per Customer")\nfig.show()\n```'}, 'done_reason': 'stop', 'done': True,
'total_duration': 38327249397, 'load_duration': 3184040, 'prompt_eval_coun
t': 233, 'prompt_eval_duration': 7079706000, 'eval_count': 200, 'eval_durati
on': 31109479000}
```


Average Invoice Total per Customer
AverageInvoiceTotal
0
1
2
3
4
5
6
7
10
20
30
40
50
CustomerId

Out[27]: (' SELECT "customers".CustomerId, AVG("invoices"."Total") AS AverageInvoice
Total FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "i
nvoices".CustomerId GROUP BY "customers".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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{y}<extra></extra>',
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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]),
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               '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,
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5.37428571, 5.37428571,
                           6.23142857, 5.37428571, 5.51714286, 5.51714286,
5.37428571, 5.66      ,
                           5.80285714, 5.94571429, 6.51714286, 6.51714286,
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                           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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     'layout': {'barmode': 'relative',
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                'template': '...',
                'title': {'text': 'Average Invoice Total 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': 'AverageInvoiceTotal'}}}
 }))
```

In [28]:
```
question = """
    Find the top 5 most expensive tracks (based on unit price):
"""

vn.ask(question=question)
```

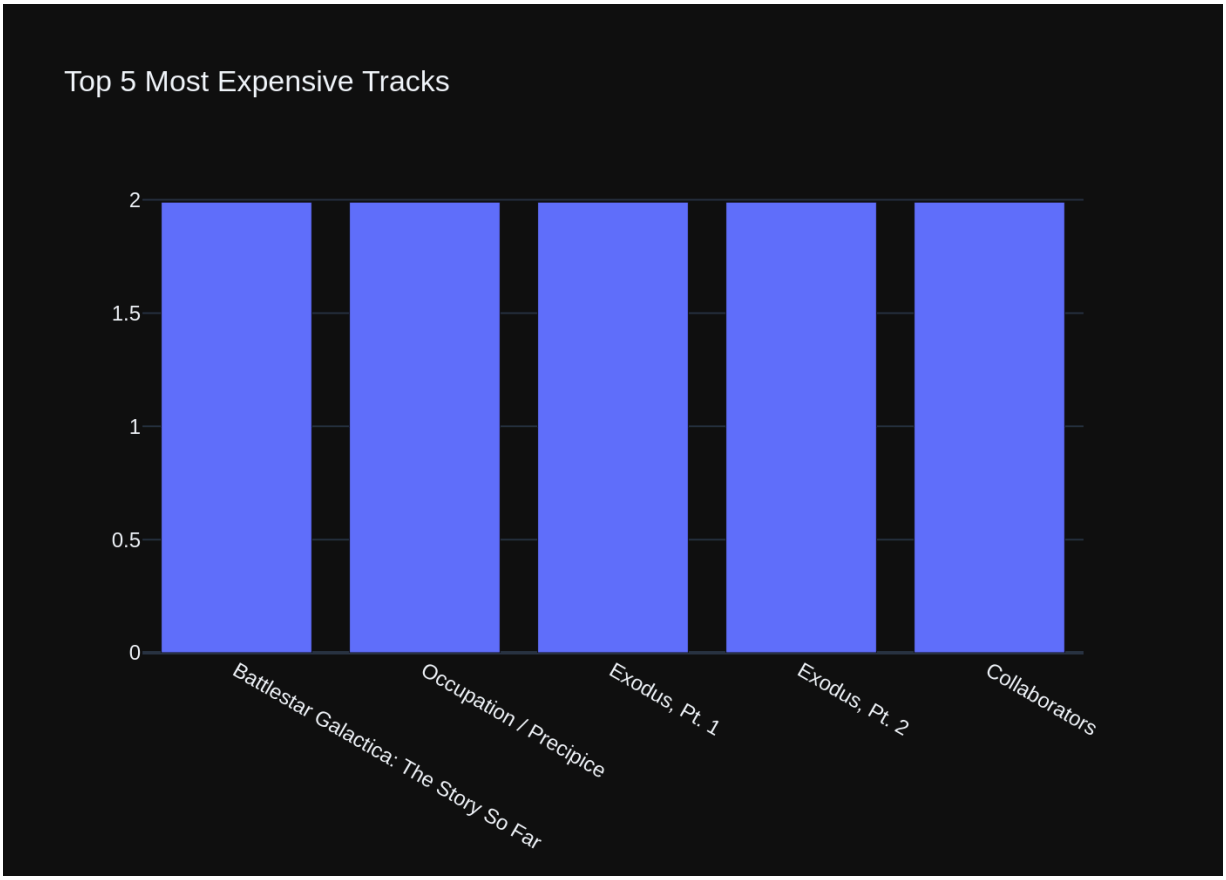
```
Number of requested results 10 is greater than number of elements in index
1, updating n_results = 1
```

SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please help to generate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \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 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 "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_TrackAlbumId ON "tracks" (AlbumId)\n\nCREATE INDEX IFK_TrackGenreId ON "tracks" (GenreId)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON "playlist_track" (TrackId)\n\nCREATE INDEX IFK_InvoiceLineTrackId ON "invoice_items" (TrackId)\n\nCREATE INDEX IFK_TrackMediaTypeId 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   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 "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 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" (ArtistId)\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 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 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 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 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 LOWER(Name) LIKE \'%what%\''}, {'role': 'user', 'content': ' \n   List all invoices with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': ' \n   List all albums and their corresponding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'content': 'what are the top 5 countries that customers come from?'}, {'role': 'assistant', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content': ' \n   Find all invoices since 2010 a

nd the total amount invoiced:\n'}, {'role': 'assistant', 'content': ' SELECT
InvoiceId, SUM(Total) AS TotalAmount\n   FROM "invoices"\n   WHERE strftime
(\'%Y\', InvoiceDate) >= \'2010\'\n   GROUP BY InvoiceId'}, {'role': 'user',
'content': ' \n   Get the average invoice total for each customer:\n'},
{'role': 'assistant', 'content': ' SELECT "customers".CustomerId, AVG("invoi
ces"."Total") AS AverageInvoiceTotal FROM "customers" INNER JOIN "invoices"
ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".Custo
merId'}, {'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': ' \n   Find th
e total number of invoices per country:\n'}, {'role': 'assistant', 'conten
t': ' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvo
ices FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "inv
oices".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'conten
t': ' \n   Get the total number of invoices for each customer\n'}, {'rol
e': 'assistant', 'content': ' SELECT "customers".CustomerId, COUNT("invoice
s"."InvoiceId") AS TotalInvoices FROM "customers" LEFT JOIN "invoices" ON "c
ustomers".CustomerId = "invoices".CustomerId GROUP BY "customers".CustomerI
d'}, {'role': 'user', 'content': 'How many customers are there'}, {'role':
'assistant', 'content': ' SELECT COUNT(*) FROM "customers"'}, {'role': 'use
r', 'content': ' \n   Find the top 5 most expensive tracks (based on unit
price):\n'}]
Info: Ollama parameters:
model=mistral: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 LOWER(Name) LIKE '%wh at%'"}, {"role": "user", "content": " \n   List all invoices with a total exceeding $10:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, Inv oiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCoun try, BillingPostalCode, Total FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": " \n   List all albums and their corresponding artist n ames \n"}, {"role": "assistant", "content": "SELECT \"albums\".AlbumId, \"a rtists\".Name AS ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albu ms\".ArtistId = \"artists\".ArtistId"}, {"role": "user", "content": "what ar e the top 5 countries that customers come from?"}, {"role": "assistant", "co ntent": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Countr y\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": " \n   Find all invoices since 2010 and the total amount invoiced:\n"}, {"role": "assist ant", "content": " SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"in voices\"\n   WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY Invoic eId"}, {"role": "user", "content": " \n   Get the average invoice total fo r each customer:\n"}, {"role": "assistant", "content": " SELECT \"customers \".CustomerId, AVG(\"invoices\".\"Total\") AS AverageInvoiceTotal FROM \"cus tomers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\". CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": "Can you list all tables in the SQLite database catalog?"}, {"role": "assist ant", "content": "SELECT name FROM sqlite_master WHERE type='table'"}, {"rol e": "user", "content": " \n   Find the total number of invoices per countr y:\n"}, {"role": "assistant", "content": " SELECT \"customers\".Country, COU NT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOI N \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP B Y \"customers\".Country"}, {"role": "user", "content": " \n   Get the tota l number of invoices for each customer\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS Tota lInvoices FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".Custome rId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": "How many customers are there"}, {"role": "assistant", "c ontent": " SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": " \n   Find the top 5 most expensive tracks (based on unit price):\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:35:16.279935542Z', 'message': {'role': 'assistant', 'content': ' SELECT "tracks".Name, "track s".UnitPrice\n   FROM "tracks"\n   ORDER BY "tracks".UnitPrice DESC\n   LIMI T 5'}, 'done_reason': 'stop', 'done': True, 'total_duration': 60613468627, 'load_duration': 3951450, 'prompt_eval_count': 1612, 'prompt_eval_duration': 52977735000, 'eval_count': 40, 'eval_duration': 6333891000}

```
LLM Response:  SELECT "tracks".Name, "tracks".UnitPrice
   FROM "tracks"
   ORDER BY "tracks".UnitPrice DESC
   LIMIT 5
 SELECT "tracks".Name, "tracks".UnitPrice
   FROM "tracks"
   ORDER BY "tracks".UnitPrice DESC
   LIMIT 5
                                     Name  UnitPrice
0  Battlestar Galactica: The Story So Far       1.99
1                  Occupation / Precipice       1.99
2                           Exodus, Pt. 1       1.99
3                           Exodus, Pt. 2       1.99
4                           Collaborators       1.99
Info: Ollama parameters:
model=mistral: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 \"tracks\".Name, \"tracks
\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n
LIMIT 5\n\nThe following is information about the resulting pandas DataFrame
'df': \nRunning df.dtypes gives:\n Name          object\nUnitPrice    float6
4\ndtype: object"}, {"role": "user", "content": "Can you generate the Python
plotly code to chart the results of the dataframe? Assume the data is in a p
andas dataframe called 'df'. If there is only one value in the dataframe, us
e an Indicator. Respond with only Python code. Do not answer with any explan
ations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:35:42.854542843Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.graph_
objects as go\n\nfig = go.Figure(data=[go.Bar(x=df[\'Name\'], y=df[\'UnitPri
ce\'])])\nfig.update_layout(title=\'Top 5 Most Expensive Tracks\')\nif len(d
f) == 1:\n    fig = go.Figure(data=[go.Indicator(mode="number+delta", value=
df[\'UnitPrice\'][0], domain={\'x\': [0, 1]})])\n    fig.update_layout(title
=\'Most Expensive Track\')\n```'}, 'done_reason': 'stop', 'done': True, 'tot
al_duration': 26548004925, 'load_duration': 3154349, 'prompt_eval_count': 20
7, 'prompt_eval_duration': 6421969000, 'eval_count': 129, 'eval_duration': 1
9992590000}
```



Out[28]:
```
(' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n   ORDER BY
"tracks".UnitPrice DESC\n   LIMIT 5',
                                        Name  UnitPrice
 0  Battlestar Galactica: The Story So Far       1.99
 1                 Occupation / Precipice       1.99
 2                          Exodus, Pt. 1       1.99
 3                          Exodus, Pt. 2       1.99
 4                          Collaborators       1.99,
 Figure({
     'data': [{'type': 'bar',
               'x': array(['Battlestar Galactica: The Story So Far', 'Occup
ation / Precipice',
                           'Exodus, Pt. 1', 'Exodus, Pt. 2', 'Collaborator
s'], dtype=object),
               'y': array([1.99, 1.99, 1.99, 1.99, 1.99])}],
     'layout': {'template': '...', 'title': {'text': 'Top 5 Most Expensive
Tracks'}}
 }))
```

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 ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \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 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 "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_TrackGenreId ON "tracks" (GenreId)\n\nCREATE TABLE "genres"\r\n(\r\n   GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON "playlist_track" (TrackId)\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 INDEX 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, 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 "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 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 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 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 before, please repeat the answer exactly as it was given before. \n'}, {'role': 'user', 'content': ' \n   Find the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'assistant', 'content': ' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n   ORDER BY "tracks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user', 'content': ' \n   List all albums and their corresponding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'content': ' \n   Find all tracks with a name containing "What" (case-insensitive)\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LOWER(Name) LIKE \'%what%\''}, {'role': 'user', 'content': 'what are the top 5 countries that customers come from?'}, {'role': 'assistant', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 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   List all invoices with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, Billing

PostalCode, Total FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'cont
ent': ' \n   Find all invoices since 2010 and the total amount invoice
d:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(Total) AS T
otalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDate) >=
\'2010\'\n   GROUP BY InvoiceId'}, {'role': 'user', 'content': ' \n   Find
the total number of invoices per country:\n'}, {'role': 'assistant', 'conten
t': ' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvo
ices FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "inv
oices".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'conten
t': 'How many customers are there'}, {'role': 'assistant', 'content': ' SELE
CT COUNT(*) FROM "customers"'}, {'role': 'user', 'content': ' \n   Get the
total number of invoices for each customer\n'}, {'role': 'assistant', 'conte
nt': ' SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS Total
Invoices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId =
"invoices".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'c
ontent': ' \n   List all genres and the number of tracks in each genr
e:\n'}]
Info: Ollama parameters:
model=mistral: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 \"tracks\".Name, \"tracks\".UnitPrice\n   FROM
\"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n   LIMIT 5"}, {"role": "u
ser", "content": " \n   List all albums and their corresponding artist nam
es \n"}, {"role": "assistant", "content": "SELECT \"albums\".AlbumId, \"art
ists\".Name AS ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albums
\".ArtistId = \"artists\".ArtistId"}, {"role": "user", "content": " \n   F
ind all tracks with a name containing \"What\" (case-insensitive)\n"}, {"rol
e": "assistant", "content": " SELECT * FROM \"tracks\" WHERE LOWER(Name) LIK
E '%what%'"}, {"role": "user", "content": "what are the top 5 countries that
customers come from?"}, {"role": "assistant", "content": " SELECT Country, C
OUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIM
IT 5"}, {"role": "user", "content": "Can you list all tables in the SQLite d
atabase catalog?"}, {"role": "assistant", "content": "SELECT name FROM sqlit
e_master WHERE type='table'"}, {"role": "user", "content": " \n   List all
invoices with a total exceeding $10:\n"}, {"role": "assistant", "content": "
SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, Bill
ingState, BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE T
otal > 10"}, {"role": "user", "content": " \n   Find all invoices since 20
10 and the total amount invoiced:\n"}, {"role": "assistant", "content": " SE
LECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n   WHERE st
rftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY InvoiceId"}, {"role": "use
r", "content": " \n   Find the total number of invoices per country:\n"},
{"role": "assistant", "content": " SELECT \"customers\".Country, COUNT(\"inv
oices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invo
ices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"cust
omers\".Country"}, {"role": "user", "content": "How many customers are ther
e"}, {"role": "assistant", "content": " SELECT COUNT(*) FROM \"customers
\""}, {"role": "user", "content": " \n   Get the total number of invoices
for each customer\n"}, {"role": "assistant", "content": " SELECT \"customers
\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"cus
tomers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".C
ustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": "
\n   List all genres and the number of tracks in each genre:\n"}]
Info: Ollama Response:
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ame, COUNT("tracks"."TrackId") AS TrackCount FROM "genres" INNER JOIN "track
s" ON "genres".GenreId = "tracks".GenreId GROUP BY "genres".Name'}, 'done_re
ason': 'stop', 'done': True, 'total_duration': 60433563793, 'load_duration':
3497760, 'prompt_eval_count': 1487, 'prompt_eval_duration': 48881764000, 'ev
al_count': 64, 'eval_duration': 10234133000}
LLM Response: SELECT "genres".Name AS GenreName, COUNT("tracks"."TrackId")
AS TrackCount FROM "genres" INNER JOIN "tracks" ON "genres".GenreId = "track
s".GenreId GROUP BY "genres".Name
 SELECT "genres".Name AS GenreName, COUNT("tracks"."TrackId") AS TrackCount
FROM "genres" INNER JOIN "tracks" ON "genres".GenreId = "tracks".GenreId GRO
UP BY "genres".Name
             GenreName TrackCount
0   Alternative   40
1   Alternative & Punk   332

```
2                Blues          81
3           Bossa Nova          15
4            Classical          74
5               Comedy          17
6                Drama          64
7       Easy Listening          24
8    Electronica/Dance          30
9          Heavy Metal          28
10         Hip Hop/Rap          35
11                Jazz         130
12               Latin         579
13               Metal         374
14               Opera           1
15                 Pop          48
16            R&B/Soul          61
17               Reggae          58
18                Rock        1297
19       Rock And Roll          12
20    Sci Fi & Fantasy          26
21     Science Fiction          13
22          Soundtrack          43
23            TV Shows          93
24               World          28
Info: Ollama parameters:
model=mistral: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 genres and the number of tracks in each genre:\n'\n\nThe Data
Frame was produced using this query:  SELECT \"genres\".Name AS GenreName, C
OUNT(\"tracks\".\"TrackId\") AS TrackCount FROM \"genres\" INNER JOIN \"trac
ks\" ON \"genres\".GenreId = \"tracks\".GenreId GROUP BY \"genres\".Name\n\n
The following is information about the resulting pandas DataFrame 'df': \nRu
nning df.dtypes gives:\n GenreName     object\nTrackCount     int64\ndtype:
object"}, {"role": "user", "content": "Can you generate the Python plotly co
de to chart the results of the dataframe? Assume the data is in a pandas dat
aframe called 'df'. If there is only one value in the dataframe, use an Indi
cator. Respond with only Python code. Do not answer with any explanations --
just the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:37:14.906618184Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.graph_
objects as go\n\nfig = go.Figure(data=[go.Bar(x=df["GenreName"], y=df["Track
Count"])])\nfig.update_layout(title=\'Number of Tracks per Genre\')\n\nif d
f.shape[0] == 1:\n    fig = go.Indicator(value=df["TrackCount"].iloc[0],\n
title={\'text\': \'Tracks\', \'font\': {\'size\': 24}},\n
domain={\'x\': [0, 1], \'y\': [0, .5]})\n    fig.update_layout(title=\'Numbe
r of Tracks\')\n```'}, 'done_reason': 'stop', 'done': True, 'total_duratio
n': 31513680151, 'load_duration': 3259431, 'prompt_eval_count': 232, 'prompt
_eval_duration': 7140086000, 'eval_count': 156, 'eval_duration': 2423887200
0}
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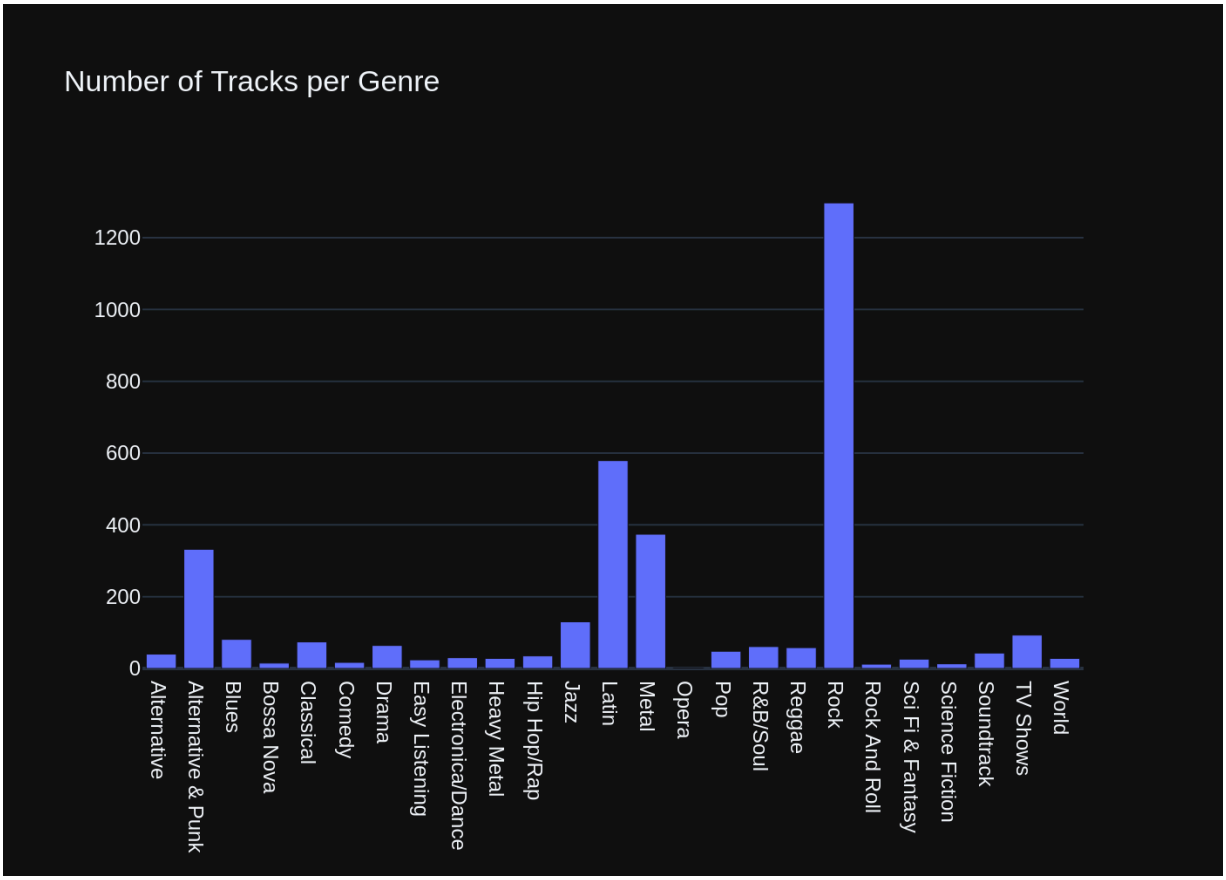

Number of Tracks per Genre
1200
1000
800
600
400
200
0
Alternative
Alternative & Punk
Blues
Bossa Nova
Classical
Comedy
Drama
Easy Listening
Electronica/Dance
Heavy Metal
Hip Hop/Rap
Jazz
Latin
Metal
Opera
Pop
R&B/Soul
Reggae
Rock
Rock And Roll
Sci Fi & Fantasy
Science Fiction
Soundtrack
TV Shows
World

Out[29]:
```
(' SELECT "genres".Name AS GenreName, COUNT("tracks"."TrackId") AS TrackCou
nt FROM "genres" INNER JOIN "tracks" ON "genres".GenreId = "tracks".GenreId
GROUP BY "genres".Name',
              GenreName  TrackCount
 0           Alternative          40
 1   Alternative & Punk         332
 2                Blues          81
 3            Bossa Nova          15
 4             Classical          74
 5                Comedy          17
 6                 Drama          64
 7       Easy Listening          24
 8    Electronica/Dance          30
 9           Heavy Metal          28
 10          Hip Hop/Rap          35
 11                 Jazz         130
 12                Latin         579
 13                Metal         374
 14                Opera           1
 15                  Pop          48
 16            R&B/Soul          61
 17               Reggae          58
 18                 Rock        1297
 19       Rock And Roll          12
 20    Sci Fi & Fantasy          26
 21     Science Fiction          13
 22           Soundtrack          43
 23             TV Shows          93
 24                World          28,
 Figure({
     'data': [{'type': 'bar',
               'x': array(['Alternative', 'Alternative & Punk', 'Blues', 'B
ossa Nova', 'Classical',
                           'Comedy', 'Drama', 'Easy Listening', 'Electronic
a/Dance', 'Heavy Metal',
                           'Hip Hop/Rap', 'Jazz', 'Latin', 'Metal', 'Oper
a', 'Pop', 'R&B/Soul',
                           'Reggae', 'Rock', 'Rock And Roll', 'Sci Fi & Fan
tasy',
                           'Science Fiction', 'Soundtrack', 'TV Shows', 'Wo
rld'], dtype=object),
               'y': array([  40,  332,   81,   15,   74,   17,   64,   24,
30,   28,   35,  130,
                            579,  374,    1,   48,   61,   58, 1297,   12,
26,   13,   43,   93,
                             28])}],
     'layout': {'template': '...', 'title': {'text': 'Number of Tracks per
Genre'}}
 }))
```

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 ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE INDEX IFK_TrackGenreId ON "tracks" (GenreId)\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 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 "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_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 NVARCHAR(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   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 "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 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" (ArtistId)\n\nCREATE TABLE "playlists"\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 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 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 before, please repeat the answer exactly as it was given before. \n'}, {'role': 'user', 'content': ' \n   List all genres and the number of tracks in each genre:\n'}, {'role': 'assistant', 'content': ' SELECT "genres".Name AS GenreName, COUNT("tracks"."TrackId") AS TrackCount FROM "genres" INNER JOIN "tracks" ON "genres".GenreId = "tracks".GenreId GROUP BY "genres".Name'}, {'role': 'user', 'content': ' \n   Find the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'assistant', 'content': ' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n   ORDER BY "tracks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user', 'content': ' \n   Find all tracks with a name containing "What" (case-insensitive) \n'}, {'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LOWER(Name) LIKE \'%what%\''}, {'role': 'user', 'content': ' \n   List all albums and their corresponding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artists".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': ' \n   List all invoices with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId,

InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingC
ountry, BillingPostalCode, Total FROM "invoices" WHERE Total > 10'}, {'rol
e': 'user', 'content': 'what are the top 5 countries that customers come fro
m?'}, {'role': 'assistant', 'content': ' SELECT Country, COUNT(*) AS Count\n
FROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, {'role':
'user', 'content': ' \n   Find all invoices since 2010 and the total amoun
t invoiced:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(To
tal) AS TotalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDa
te) >= \'2010\'\n   GROUP BY InvoiceId'}, {'role': 'user', 'content': 'How m
any customers are there'}, {'role': 'assistant', 'content': ' SELECT COUNT
(*) FROM "customers"'}, {'role': 'user', 'content': ' \n   Get the average
invoice total for each customer:\n'}, {'role': 'assistant', 'content': ' SEL
ECT "customers".CustomerId, AVG("invoices"."Total") AS AverageInvoiceTotal F
ROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoice
s".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content':
' \n   Get all genres that do not have any tracks associated with the
m:\n'}]
Info: Ollama parameters:
model=mistral: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   Lis
t all genres and the number of tracks in each genre:\n"}, {"role": "assistan
t", "content": " SELECT \"genres\".Name AS GenreName, COUNT(\"tracks\".\"Tra
ckId\") AS TrackCount FROM \"genres\" INNER JOIN \"tracks\" ON \"genres\".Ge
nreId = \"tracks\".GenreId GROUP BY \"genres\".Name"}, {"role": "user", "con
tent": " \n   Find the top 5 most expensive tracks (based on unit pric
e):\n"}, {"role": "assistant", "content": " SELECT \"tracks\".Name, \"tracks
\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n
LIMIT 5"}, {"role": "user", "content": " \n   Find all tracks with a name
containing \"What\" (case-insensitive)\n"}, {"role": "assistant", "content":
" SELECT * FROM \"tracks\" WHERE LOWER(Name) LIKE '%what%'"}, {"role": "use
r", "content": " \n   List all albums and their corresponding artist names
\n"}, {"role": "assistant", "content": "SELECT \"albums\".AlbumId, \"artists
\".Name AS ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".A
rtistId = \"artists\".ArtistId"}, {"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   List all invoices with a total exceeding $10:\n"}, {"rol
e": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, Bil
lingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, T
otal FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": "what
are the top 5 countries that customers come from?"}, {"role": "assistant",
"content": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Cou
ntry\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": " \n   F
ind all invoices since 2010 and the total amount invoiced:\n"}, {"role": "as
sistant", "content": " SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM
\"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY In
voiceId"}, {"role": "user", "content": "How many customers are there"}, {"ro
le": "assistant", "content": " SELECT COUNT(*) FROM \"customers\""}, {"rol
e": "user", "content": " \n   Get the average invoice total for each custo
mer:\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerI
d, AVG(\"invoices\".\"Total\") AS AverageInvoiceTotal FROM \"customers\" INN
ER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId G
ROUP BY \"customers\".CustomerId"}, {"role": "user", "content": " \n   Get
all genres that do not have any tracks associated with them:\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:38:24.045724756Z',
'message': {'role': 'assistant', 'content': ' -- Intermediate_sql to get dis
tinct genre names\n   SELECT DISTINCT Name FROM "genres" AS "g" LEFT JOIN "t
racks" ON "tracks".GenreId = "g".GenreId WHERE "tracks".TrackId IS NULL\n\n
-- Final SQL query to filter out genres with no tracks\n   SELECT g.Name FRO
M "genres" AS g WHERE NOT EXISTS (SELECT 1 FROM "tracks" AS t WHERE g.GenreI
d = t.GenreId)'}, 'done_reason': 'stop', 'done': True, 'total_duration': 690
15717081, 'load_duration': 4013337, 'prompt_eval_count': 1487, 'prompt_eval_
duration': 48426137000, 'eval_count': 119, 'eval_duration': 19279685000}
LLM Response: -- Intermediate_sql to get distinct genre names
   SELECT DISTINCT Name FROM "genres" AS "g" LEFT JOIN "tracks" ON "tracks".
GenreId = "g".GenreId WHERE "tracks".TrackId IS NULL

   -- Final SQL query to filter out genres with no tracks
   SELECT g.Name FROM "genres" AS g WHERE NOT EXISTS (SELECT 1 FROM "tracks"
AS t WHERE g.GenreId = t.GenreId)

```
 -- Intermediate_sql to get distinct genre names
   SELECT DISTINCT Name FROM "genres" AS "g" LEFT JOIN "tracks" ON "tracks".
GenreId = "g".GenreId WHERE "tracks".TrackId IS NULL

   -- Final SQL query to filter out genres with no tracks
   SELECT g.Name FROM "genres" AS g WHERE NOT EXISTS (SELECT 1 FROM "tracks"
AS t WHERE g.GenreId = t.GenreId)
Couldn't run sql:  Execution failed on sql ' -- Intermediate_sql to get dist
inct genre names
   SELECT DISTINCT Name FROM "genres" AS "g" LEFT JOIN "tracks" ON "tracks".
GenreId = "g".GenreId WHERE "tracks".TrackId IS NULL

   -- Final SQL query to filter out genres with no tracks
   SELECT g.Name FROM "genres" AS g WHERE NOT EXISTS (SELECT 1 FROM "tracks"
AS t WHERE g.GenreId = t.GenreId)': near "SELECT": syntax error
```

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 ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n   InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   CustomerId INTEGER 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 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 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 "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 "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 "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   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) 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   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 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 KEY (ArtistId) REFERENCES "artists" (ArtistId) \r\n\t\tON DELETE NO ACTION ON UPDATE NO ACTION\r\n)\n\nCREATE INDEX IFK_CustomerSupportRepId 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 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 "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_InvoiceCustomerId ON "invoices" (CustomerId)\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 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 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 before, please repeat the answer exactly as it was given before. \n'}, {'role': 'user', 'content': "which table stores customer's orders"}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId FROM "customers"'}, {'role': 'user', 'content': 'what are the top 5 countries that customers come from?'}, {'role': 'assistant', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content': 'How many customers are there'}, {'role': 'assistant', 'content': ' SELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'content': ' \n   Get the total number of invoices for each customer\n'}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content': ' \n   List all invoices with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': ' \n   Find the total number of invoices per country:\n'}, {'role': 'assistant', 'content': ' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'content': ' \n   Get the average invoice total for each customer:\n'}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId, AVG("invoices"."Total") AS AverageInvoiceTotal FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content': ' \n   Find all invoices since 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\'\n   GROUP BY InvoiceId'}, {'role': 'user', 'content': " \n   List all employees and their reporting manager's name (if any):\n"}, {'role': 'assistant', 'content': 'SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName AS ReportingManager\n   FROM employees e1\n   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID'}, {'role': 'user', 'content': ' \n   List all albums and their corresponding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'content': ' \n   List all customers who have not placed any orders:\n'}]
Info: Ollama parameters:
model=mistral:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to generate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE TABLE \"invoices\"\r\n(\r\n   InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   CustomerId INTEGER 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   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": "which table stores customer's orders"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId FROM \"customers\""}, {"role": "user", "content": "what are the top 5 countries that customers come from?"}, {"role": "assistant", "content": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": "How many customers are there"}, {"role": "assistant", "content": " SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": " \n   Get the total number of invoices for each customer\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": " \n   List all invoices with a total exceeding $10:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": " \n   Find the total number of invoices per country:\n"}, {"role": "assistant", "content": " SELECT \"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".Country"}, {"role": "user", "content": " \n   Get the average invoice total for each customer:\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId, AVG(\"invoices\".\"Total\") AS AverageInvoiceTotal FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": " \n   Find all invoices since 2010 and the total amount invoiced:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY InvoiceId"}, {"role": "user", "content": " \n   List all employees and their reporting manager's name (if any):\n"}, {"role": "assistant", "content": "SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName AS ReportingManager\n   FROM employees e1\n   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID"}, {"role": "user", "content": " \n   List all albums and their corresponding artist names \n"}, {"role": "assistant", "content": "SELECT \"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".ArtistId"}, {"role": "user", "content": " \n   List all customers who have not placed any orders:\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:39:44.432973676Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId,
"customers".FirstName, "customers".LastName\n   FROM "customers"\n   LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId\n   WHERE "invoices".InvoiceId IS NULL;'}, 'done_reason': 'stop', 'done': True, 'total_duration': 80345409469, 'load_duration': 3572080, 'prompt_eval_count': 2022,
'prompt_eval_duration': 67912956000, 'eval_count': 70, 'eval_duration': 11588053000}
LLM Response: SELECT "customers".CustomerId, "customers".FirstName, "customers".LastName
   FROM "customers"
   LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId
   WHERE "invoices".InvoiceId IS NULL;
Info: Output from LLM: SELECT "customers".CustomerId, "customers".FirstName, "customers".LastName
   FROM "customers"
   LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId

```
   WHERE "invoices".InvoiceId IS NULL;
Extracted SQL: SELECT "customers".CustomerId, "customers".FirstName, "custom
ers".LastName
   FROM "customers"
   LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId
   WHERE "invoices".InvoiceId IS NULL
SELECT "customers".CustomerId, "customers".FirstName, "customers".LastName
   FROM "customers"
   LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId
   WHERE "invoices".InvoiceId IS NULL
Empty DataFrame
Columns: [CustomerId, FirstName, LastName]
Index: []
Info: Ollama parameters:
model=mistral: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 who have not placed any orders:\n'\n\nThe DataFrame
was produced using this query: SELECT \"customers\".CustomerId, \"customers
\".FirstName, \"customers\".LastName\n   FROM \"customers\"\n   LEFT JOIN
\"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId\n   WHERE
\"invoices\".InvoiceId IS NULL\n\nThe following is information about the res
ulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n CustomerId    obj
ect\nFirstName     object\nLastName      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:latest', 'created_at': '2024-08-01T19:40:08.39003255Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nfig = px.bar("CustomerId", "FirstName", "LastName", data=df)\nfig.u
pdate_layout(title="Customers without orders")\nfig.show()\n\n# If there is
only one value in the DataFrame, use an Indicator instead\nif len(df) ==
1:\n    fig = px.Indicator(df, title="Customer without orders")\n    fig.sho
w()\n```'}, 'done_reason': 'stop', 'done': True, 'total_duration': 239548275
92, 'load_duration': 4543310, 'prompt_eval_count': 235, 'prompt_eval_duratio
n': 7307965000, 'eval_count': 107, 'eval_duration': 16554092000}
```

Out[31]:
```
('SELECT "customers".CustomerId, "customers".FirstName, "customers".LastNam
e\n   FROM "customers"\n   LEFT JOIN "invoices" ON "customers".CustomerId =
"invoices".CustomerId\n   WHERE "invoices".InvoiceId IS NULL',
 Empty DataFrame
 Columns: [CustomerId, FirstName, LastName]
 Index: [],
 Figure({
     'data': [{'domain': {'x': [0.0, 1.0], 'y': [0.0, 1.0]},
               'hovertemplate': 'CustomerId=%{label}<extra></extra>',
               'labels': array([], dtype=object),
               'legendgroup': '',
               'name': '',
               'showlegend': True,
               'type': 'pie'}],
     'layout': {'legend': {'tracegroupgap': 0}, 'margin': {'t': 60}, 'templ
ate': '...'}
 }))
```

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 ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \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 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 "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 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 "artists"\r\n(\r\n   ArtistId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_AlbumArtistId 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   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 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_TrackGenreId ON "tracks" (GenreId)\n\nCREATE INDEX IFK_PlaylistTrackTrackId 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 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 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 before, please repeat the answer exactly as it was given before. \n'}, {'role': 'user', 'content': ' \n   Find the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'assistant', 'content': ' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n   ORDER BY "tracks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user', 'content': ' \n   List all genres and the number of tracks in each genre:\n'}, {'role': 'assistant', 'content': ' SELECT "genres".Name AS GenreName, COUNT("tracks"."TrackId") AS TrackCount FROM "genres" INNER JOIN "tracks" ON "genres".GenreId = "tracks".GenreId GROUP BY "genres".Name'}, {'role': 'user', 'content': ' \n   List all albums and their corresponding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'content': 'what are the top 5 countries that customers come from?'}, {'role': 'assistant', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 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 tracks with a

name containing "What" (case-insensitive)\n'}, {'role': 'assistant', 'conten
t': ' SELECT * FROM "tracks" WHERE LOWER(Name) LIKE \'%what%\''}, {'role':
'user', 'content': ' \n   List all invoices with a total exceeding $1
0:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, Cu
stomerId, BillingAddress, BillingCity, BillingState, BillingCountry, Billing
PostalCode, Total FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'cont
ent': " \n   List all employees and their reporting manager's name (if an
y):\n"}, {'role': 'assistant', 'content': 'SELECT e1.LastName, e1.FirstName,
e2.LastName, e2.FirstName AS ReportingManager\n   FROM employees e1\n   LEFT
JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID'}, {'role': 'user', 'conte
nt': ' \n   Find the total number of invoices per country:\n'}, {'role':
'assistant', 'content': ' SELECT "customers".Country, COUNT("invoices"."Invo
iceId") AS TotalInvoices FROM "customers" INNER JOIN "invoices" ON "customer
s".CustomerId = "invoices".CustomerId GROUP BY "customers".Country'}, {'rol
e': 'user', 'content': ' \n   Find all invoices since 2010 and the total a
mount invoiced:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, SU
M(Total) AS TotalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', Invoi
ceDate) >= \'2010\'\n   GROUP BY InvoiceId'}, {'role': 'user', 'content': '
\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'}]
Info: Ollama parameters:
model=mistral: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 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 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 before, please repeat the answer exactly as it was given before. \n"}, {"role": "user", "content": " \n   Find the top 5 most expensive tracks (based on unit price):\n"}, {"role": "assistant", "content": " SELECT \"tracks\".Name, \"tracks\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n   LIMIT 5"}, {"role": "user", "content": " \n   List all genres and the number of tracks in each genre:\n"}, {"role": "assistant", "content": " SELECT \"genres\".Name AS GenreName, COUNT(\"tracks\".\"TrackId\") AS TrackCount FROM \"genres\" INNER JOIN \"tracks\" ON \"genres\".GenreId = \"tracks\".GenreId GROUP BY \"genres\".Name"}, {"role": "user", "content": " \n   List all albums and their corresponding artist names \n"}, {"role": "assistant", "content": "SELECT \"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".ArtistId"}, {"role": "user", "content": "what are the top 5 countries that customers come from?"}, {"role": "assistant", "content": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 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 tracks with a name containing \"What\" (case-insensitive)\n"}, {"role": "assistant", "content": " SELECT * FROM \"tracks\" WHERE LOWER(Name) LIKE '%what%'"}, {"role": "user", "content": " \n   List all invoices with a total exceeding $10:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": " \n   List all employees and their reporting manager's name (if any):\n"}, {"role": "assistant", "content": "SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName AS ReportingManager\n   FROM employees e1\n   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID"}, {"role": "user", "content": " \n   Find the total number of invoices per country:\n"}, {"role": "assistant", "content": " SELECT \"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".Country"}, {"role": "user", "content": " \n   Find all invoices since 2010 and the total amount invoiced:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY InvoiceId"}, {"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"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:41:34.40138236Z', 'message': {'role': 'assistant', 'content': ' -- intermediate_sql: Find the distinct artist names\n   SELECT DISTINCT Name AS ArtistName FROM "artists" INNER JOIN "albums" ON "artists".ArtistId = "albums".ArtistId INNER JOIN "tracks" ON "albums".AlbumId = "tracks".AlbumId\n   -- main query: List the top 10 artists based on the number of tracks\n   SELECT ArtistName, COUNT(*) AS TrackCount FROM (\n   SELECT DISTINCT Name AS ArtistName FROM "artists" I

```
NNER JOIN "albums" ON "artists".ArtistId = "albums".ArtistId INNER JOIN "tra
cks" ON "albums".AlbumId = "tracks".AlbumId\n   ) AS t GROUP BY ArtistName O
RDER BY TrackCount DESC LIMIT 10'}, 'done_reason': 'stop', 'done': True, 'to
tal_duration': 85937257023, 'load_duration': 4202805, 'prompt_eval_count': 1
603, 'prompt_eval_duration': 52346574000, 'eval_count': 198, 'eval_duratio
n': 32290791000}
LLM Response:  -- intermediate_sql: Find the distinct artist names
   SELECT DISTINCT Name AS ArtistName FROM "artists" INNER JOIN "albums" ON
"artists".ArtistId = "albums".ArtistId INNER JOIN "tracks" ON "albums".Album
Id = "tracks".AlbumId
   -- main query: List the top 10 artists based on the number of tracks
   SELECT ArtistName, COUNT(*) AS TrackCount FROM (
      SELECT DISTINCT Name AS ArtistName FROM "artists" INNER JOIN "albums"
ON "artists".ArtistId = "albums".ArtistId INNER JOIN "tracks" ON "albums".Al
bumId = "tracks".AlbumId
   ) AS t GROUP BY ArtistName ORDER BY TrackCount DESC LIMIT 10
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 [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
```

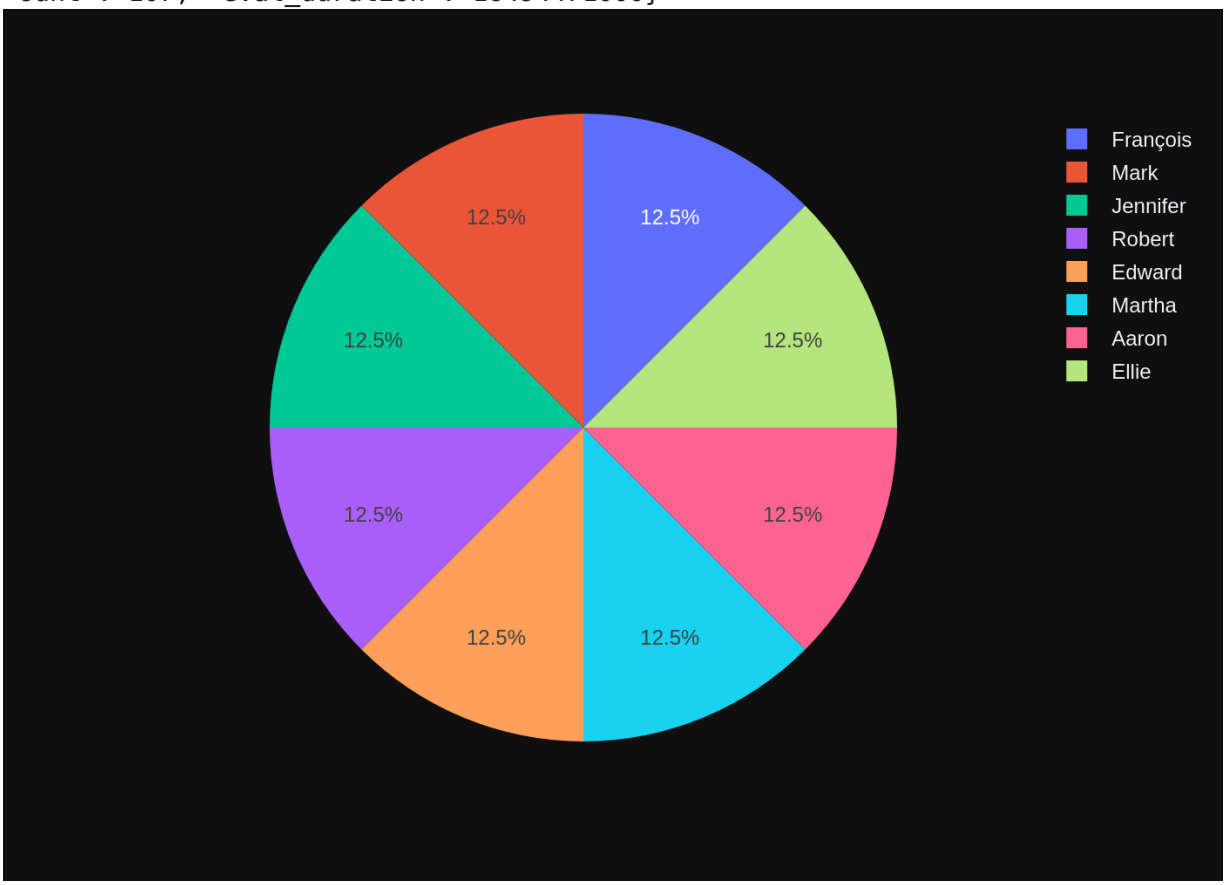
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please help to generate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE INDEX IFK_CustomerSupportRepId ON "customers" (SupportRepId)\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 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 "invoices"\r\n(\r\n   InvoiceId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   CustomerId INTEGER 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_InvoiceCustomerId 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   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) REFERENCES "employees" (EmployeeId) \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 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 sqlite_sequence(name,seq)\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 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_EmployeeReportsTo ON "employees" (ReportsTo)\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 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 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 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 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': ' SELECT Countr

y, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC
\nLIMIT 5'}, {'role': 'user', 'content': ' \n   Find the total number of i
nvoices per country:\n'}, {'role': 'assistant', 'content': ' SELECT "custome
rs".Country, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "customers"
INNER JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GROU
P BY "customers".Country'}, {'role': 'user', 'content': "which table stores
customer's orders"}, {'role': 'assistant', 'content': ' SELECT "customers".C
ustomerId FROM "customers"'}, {'role': 'user', 'content': ' \n   Get the t
otal number of invoices for each customer\n'}, {'role': 'assistant', 'conten
t': ' SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalI
nvoices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "i
nvoices".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'con
tent': 'How many customers are there'}, {'role': 'assistant', 'content': ' S
ELECT COUNT(*) FROM "customers"'}, {'role': 'user', 'content': ' \n   List
all invoices with a total exceeding $10:\n'}, {'role': 'assistant', 'conten
t': ' SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCit
y, BillingState, BillingCountry, BillingPostalCode, Total FROM "invoices" WH
ERE Total > 10'}, {'role': 'user', 'content': " \n   List all employees an
d their reporting manager's name (if any):\n"}, {'role': 'assistant', 'conte
nt': 'SELECT e1.LastName, e1.FirstName, e2.LastName, e2.FirstName AS Reporti
ngManager\n   FROM employees e1\n   LEFT JOIN employees e2 ON e1.ReportsTo =
e2.EmployeeID'}, {'role': 'user', 'content': ' \n   Get the average invoic
e total for each customer:\n'}, {'role': 'assistant', 'content': ' SELECT "c
ustomers".CustomerId, AVG("invoices"."Total") AS AverageInvoiceTotal FROM "c
ustomers" INNER JOIN "invoices" ON "customers".CustomerId = "invoices".Custo
merId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content': 'Can yo
u list all tables in the SQLite database catalog?'}, {'role': 'assistant',
'content': "SELECT name FROM sqlite_master WHERE type='table'"}, {'role': 'u
ser', 'content': ' \n   Find all invoices since 2010 and the total amount
invoiced:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(Tota
l) AS TotalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDat
e) >= \'2010\'\n   GROUP BY InvoiceId'}, {'role': 'user', 'content': ' \n
List all customers from Canada and their email addresses:\n'}]
Info: Ollama parameters:
model=mistral: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_InvoiceCustomerId 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   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) REFERENCES \"employees\" (EmployeeId) \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 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 sqlite_sequence(name,seq)\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 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_EmployeeReportsTo ON \"employees\" (ReportsTo)\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 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 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 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 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": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": " \n   Find the total number of invoices per country:\n"}, {"role": "assistant", "content": " SELECT \"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".Country"}, {"role": "user", "content": "which table stores customer's orders"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId FROM \"customers\""}, {"role": "user", "content": " \n   Get the total number of invoices for each customer \n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": "How many customers are there"}, {"role": "assistant", "content": " SELECT COUNT(*) FROM \"customers\""}, {"role": "user", "content": " \n   List all invoices with a total exceeding $10:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE Total > 10"}, {"rol

e": "user", "content": " \n   List all employees and their reporting manag
er's name (if any):\n"}, {"role": "assistant", "content": "SELECT e1.LastNam
e, e1.FirstName, e2.LastName, e2.FirstName AS ReportingManager\n   FROM empl
oyees e1\n   LEFT JOIN employees e2 ON e1.ReportsTo = e2.EmployeeID"}, {"rol
e": "user", "content": " \n   Get the average invoice total for each custo
mer:\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerI
d, AVG(\"invoices\".\"Total\") AS AverageInvoiceTotal FROM \"customers\" INN
ER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId G
ROUP BY \"customers\".CustomerId"}, {"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   Find all invoices since 2010 and the total amount invoic
ed:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, SUM(Total) AS
TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >=
'2010'\n   GROUP BY InvoiceId"}, {"role": "user", "content": " \n   List
all customers from Canada and their email addresses:\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:42:42.611774926Z',
'message': {'role': 'assistant', 'content': ' SELECT FirstName, LastName, Em
ail FROM "customers" WHERE Country = \'Canada\''}, 'done_reason': 'stop', 'd
one': True, 'total_duration': 68169097880, 'load_duration': 4074085, 'prompt
_eval_count': 1911, 'prompt_eval_duration': 63391739000, 'eval_count': 22,
'eval_duration': 3476184000}
LLM Response: SELECT FirstName, LastName, Email FROM "customers" WHERE Coun
try = 'Canada'
 SELECT FirstName, LastName, Email FROM "customers" WHERE Country = 'Canada'
  FirstName LastName   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: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, Email F
ROM \"customers\" WHERE Country = 'Canada'\n\nThe following is information a
bout the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n First
Name   object\nLastName   object\nEmail   object\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:latest', 'created_at': '2024-08-01T19:43:04.959384127Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nfig = px.bar("FirstName", "LastName", data=df, barmode="group")\nfi

```
g.update_layout(title="Canadian Customers\' Email Distribution")\nif df.shap
e[0] == 1:\n    fig = px.scatter(x=\'LastName\', y=\'Email\', data=df)\n
fig.update_layout(title="Email of a Canadian Customer")\n```'}, 'done_reaso
n': 'stop', 'done': True, 'total_duration': 22322902617, 'load_duration': 30
40425, 'prompt_eval_count': 188, 'prompt_eval_duration': 5736259000, 'eval_c
ount': 107, 'eval_duration': 16494471000}
```



Out[33]:

```
(' SELECT FirstName, LastName, Email FROM "customers" WHERE Country = \'Can
ada\'',
   FirstName  LastName                  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({
     'data': [{'domain': {'x': [0.0, 1.0], 'y': [0.0, 1.0]},
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               'labels': array(['François', 'Mark', 'Jennifer', 'Robert',
'Edward', 'Martha', 'Aaron',
                                'Ellie'], dtype=object),
               'legendgroup': '',
               'name': '',
               'showlegend': True,
               'type': 'pie'}],
     'layout': {'legend': {'tracegroupgap': 0}, 'margin': {'t': 60}, 'templ
ate': '...'}
 }))
```

In [34]:
```
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
```

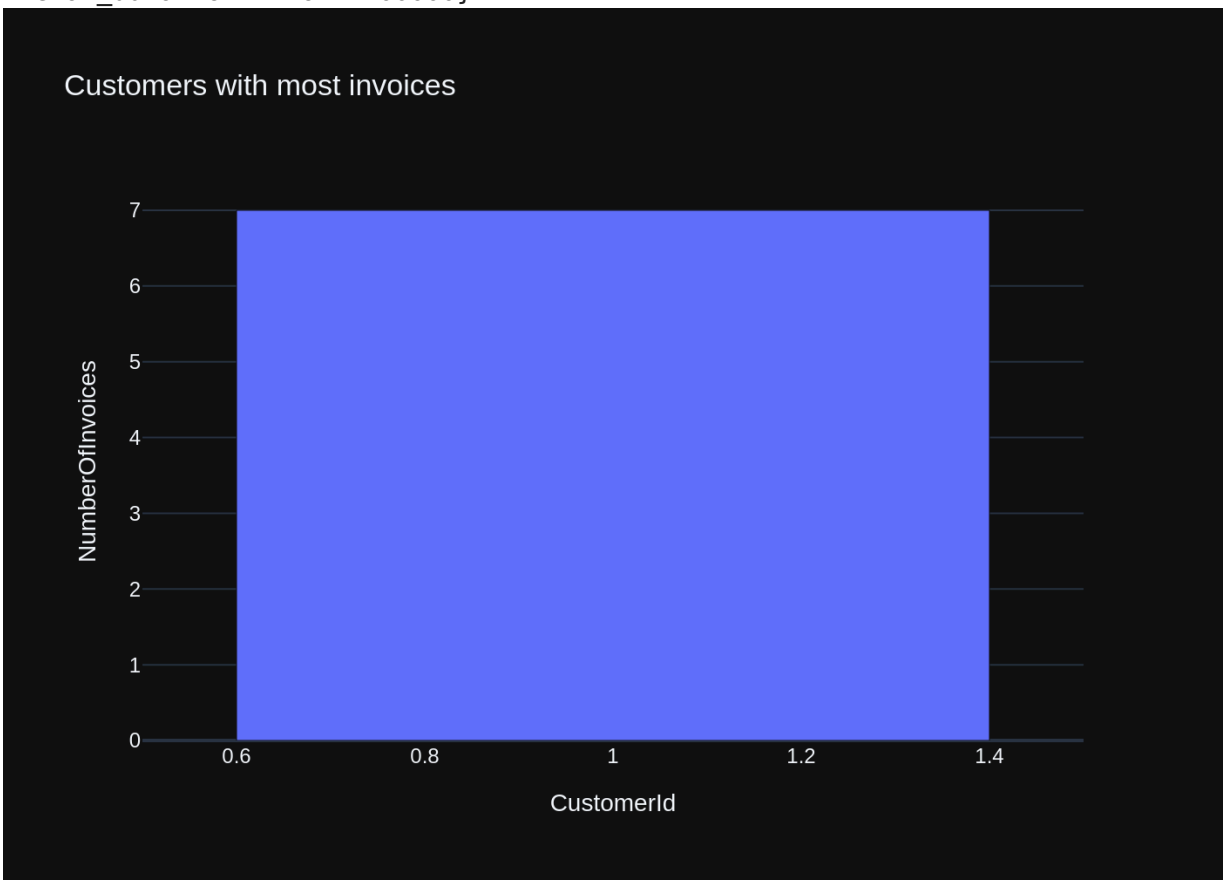
```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoices"\r\n(\r\n    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 "customers".CustomerId, COUNT("invoices"."InvoiceId") AS Total
Invoices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId =
"invoices".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'c
ontent': ' \n   Find the total number of invoices per country:\n'}, {'rol
e': 'assistant', 'content': ' SELECT "customers".Country, COUNT("invoice
s"."InvoiceId") AS TotalInvoices FROM "customers" INNER JOIN "invoices" ON
"customers".CustomerId = "invoices".CustomerId GROUP BY "customers".Countr
y'}, {'role': 'user', 'content': ' \n   List all invoices with a total exc
eeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, Invoic
eDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountr
y, BillingPostalCode, Total FROM "invoices" WHERE Total > 10'}, {'role': 'us
er', 'content': ' \n   Get the average invoice total for each custome
r:\n'}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId, AV
G("invoices"."Total") AS AverageInvoiceTotal FROM "customers" INNER JOIN "in
voices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customer
s".CustomerId'}, {'role': 'user', 'content': ' \n   Find all invoices sinc
e 2010 and the total amount invoiced:\n'}, {'role': 'assistant', 'content':
' SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM "invoices"\n   WHERE
strftime(\'%Y\', InvoiceDate) >= \'2010\'\n   GROUP BY InvoiceId'}, {'role':
'user', 'content': ' \n   Find the top 5 most expensive tracks (based on u
nit price):\n'}, {'role': 'assistant', 'content': ' SELECT "tracks".Name, "t
racks".UnitPrice\n   FROM "tracks"\n   ORDER BY "tracks".UnitPrice DESC\n
LIMIT 5'}, {'role': 'user', 'content': 'what are the top 5 countries that cu
stomers come from?'}, {'role': 'assistant', 'content': ' SELECT Country, COU
NT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT
5'}, {'role': 'user', 'content': "which table stores customer's orders"},
{'role': 'assistant', 'content': ' SELECT "customers".CustomerId FROM "custo
mers"'}, {'role': 'user', 'content': 'How many customers are there'}, {'rol
e': 'assistant', 'content': ' SELECT COUNT(*) FROM "customers"'}, {'role':
'user', 'content': ' \n   List all customers from Canada and their email
addresses:\n'}, {'role': 'assistant', 'content': ' SELECT FirstName, LastNam
e, Email FROM "customers" WHERE Country = \'Canada\''}, {'role': 'user', 'co
ntent': ' \n   Find the customer with the most invoices \n'}]
Info: Ollama parameters:
model=mistral: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 \"customers\".CustomerId, COUNT(\"inv
oices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LEFT JOIN \"invoi
ces\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"custo
mers\".CustomerId"}, {"role": "user", "content": " \n   Find the total num
ber of invoices per country:\n"}, {"role": "assistant", "content": " SELECT
\"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FR
OM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"inv
oices\".CustomerId GROUP BY \"customers\".Country"}, {"role": "user", "conte
nt": " \n   List all invoices with a total exceeding $10:\n"}, {"role": "a
ssistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAd
dress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total F
ROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": " \n   Ge
t the average invoice total for each customer:\n"}, {"role": "assistant", "c
ontent": " SELECT \"customers\".CustomerId, AVG(\"invoices\".\"Total\") AS A
verageInvoiceTotal FROM \"customers\" INNER JOIN \"invoices\" ON \"customers
\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"},

{"role": "user", "content": " \n   Find all invoices since 2010 and the to
tal amount invoiced:\n"}, {"role": "assistant", "content": " SELECT InvoiceI
d, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y',
InvoiceDate) >= '2010'\n   GROUP BY InvoiceId"}, {"role": "user", "content":
" \n   Find the top 5 most expensive tracks (based on unit price):\n"},
{"role": "assistant", "content": " SELECT \"tracks\".Name, \"tracks\".UnitPr
ice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n   LIMIT
5"}, {"role": "user", "content": "what are the top 5 countries that customer
s come from?"}, {"role": "assistant", "content": " SELECT Country, COUNT(*)
AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"},
{"role": "user", "content": "which table stores customer's orders"}, {"rol
e": "assistant", "content": " SELECT \"customers\".CustomerId FROM \"custome
rs\""}, {"role": "user", "content": "How many customers are there"}, {"rol
e": "assistant", "content": " SELECT COUNT(*) FROM \"customers\""}, {"role":
"user", "content": " \n   List all customers from Canada and their email
addresses:\n"}, {"role": "assistant", "content": " SELECT FirstName, LastNam
e, Email FROM \"customers\" WHERE Country = 'Canada'"}, {"role": "user", "co
ntent": " \n   Find the customer with the most invoices \n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:44:24.856522247Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId
AS CustomerId, COUNT("invoices"."InvoiceId") AS NumberOfInvoices FROM "custo
mers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId
GROUP BY "customers".CustomerId ORDER BY NumberOfInvoices DESC LIMIT 1'}, 'd
one_reason': 'stop', 'done': True, 'total_duration': 79805273910, 'load_dura
tion': 4214388, 'prompt_eval_count': 1947, 'prompt_eval_duration': 648816510
00, 'eval_count': 83, 'eval_duration': 13606861000}
LLM Response: SELECT "customers".CustomerId AS CustomerId, COUNT("invoice
s"."InvoiceId") AS NumberOfInvoices FROM "customers" LEFT JOIN "invoices" ON
"customers".CustomerId = "invoices".CustomerId GROUP BY "customers".Customer
Id ORDER BY NumberOfInvoices DESC LIMIT 1
 SELECT "customers".CustomerId AS CustomerId, COUNT("invoices"."InvoiceId")
AS NumberOfInvoices FROM "customers" LEFT JOIN "invoices" ON "customers".Cus
tomerId = "invoices".CustomerId GROUP BY "customers".CustomerId ORDER BY Num
berOfInvoices DESC LIMIT 1
   CustomerId NumberOfInvoices
0   1   7
Info: Ollama parameters:
model=mistral: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 \"customers\".CustomerId AS CustomerId, COUN
T(\"invoices\".\"InvoiceId\") AS NumberOfInvoices FROM \"customers\" LEFT JO
IN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP
BY \"customers\".CustomerId ORDER BY NumberOfInvoices DESC LIMIT 1\n\nThe fo
llowing is information about the resulting pandas DataFrame 'df': \nRunning
df.dtypes gives:\n CustomerId   int64\nNumberOfInvoices   int64\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:latest', 'created_at': '2024-08-01T19:44:49.369792795Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nif df.shape[0] > 1:\n   fig = px.bar(df, x="CustomerId", y="Number
OfInvoices")\nelse:\n   fig = px.bar(df, x="CustomerId", y="NumberOfInvoice
s", title="Indicator for most invoiced customer")\nfig.update_layout(title=
\'Customers with most invoices\')\nfig.show()\n```'}, 'done_reason': 'stop',
'done': True, 'total_duration': 24488327047, 'load_duration': 3694201, 'prom
pt_eval_count': 252, 'prompt_eval_duration': 7683117000, 'eval_count': 108,
'eval_duration': 16714100000}



Out[34]:
```
(' SELECT "customers".CustomerId AS CustomerId, COUNT("invoices"."InvoiceI
d") AS NumberOfInvoices FROM "customers" LEFT JOIN "invoices" ON "customer
s".CustomerId = "invoices".CustomerId GROUP BY "customers".CustomerId ORDER
BY NumberOfInvoices DESC LIMIT 1',
    CustomerId  NumberOfInvoices
 0           1                7,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'CustomerId=%{x}<br>NumberOfInvoices=%{y}<e
xtra></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array([1]),
               'xaxis': 'x',
               'y': array([7]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'template': '...',
                'title': {'text': 'Customers with most invoices'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'CustomerId'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'NumberOfInvoices'}}}
 }))
```

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': '
SELECT "customers".CustomerId AS CustomerId, COUNT("invoices"."InvoiceId") A
S NumberOfInvoices FROM "customers" LEFT JOIN "invoices" ON "customers".Cust
omerId = "invoices".CustomerId GROUP BY "customers".CustomerId ORDER BY Numb
erOfInvoices DESC LIMIT 1'}, {'role': 'user', 'content': '  \n    Find the t
op 5 most expensive tracks (based on unit price):\n'}, {'role': 'assistant',
'content': ' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n
ORDER BY "tracks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user', 'content':
'  \n    Find all invoices since 2010 and the total amount invoiced:\n'},
{'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(Total) AS TotalAmou
nt\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\'\n
```

GROUP BY InvoiceId'}, {'role': 'user', 'content': ' \n   Get the total num
ber of invoices for each customer\n'}, {'role': 'assistant', 'content': ' SE
LECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoices
FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoice
s".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'content':
' \n   List all invoices with a total exceeding $10:\n'}, {'role': 'assist
ant', 'content': ' SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddres
s, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM
"invoices" WHERE Total > 10'}, {'role': 'user', 'content': ' \n   Find the
total number of invoices per country:\n'}, {'role': 'assistant', 'content':
' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalInvoices
FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "invoice
s".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'content': '
\n   Get the average invoice total for each customer:\n'}, {'role': 'assist
ant', 'content': ' SELECT "customers".CustomerId, AVG("invoices"."Total") AS
AverageInvoiceTotal FROM "customers" INNER JOIN "invoices" ON "customers".Cu
stomerId = "invoices".CustomerId GROUP BY "customers".CustomerId'}, {'role':
'user', 'content': ' \n   List all albums and their corresponding artist n
ames \n'}, {'role': 'assistant', 'content': 'SELECT "albums".AlbumId, "arti
sts".Name AS ArtistName FROM "albums" INNER JOIN "artists" ON "albums".Artis
tId = "artists".ArtistId'}, {'role': 'user', 'content': ' \n   List all ge
nres and the number of tracks in each genre:\n'}, {'role': 'assistant', 'con
tent': ' SELECT "genres".Name AS GenreName, COUNT("tracks"."TrackId") AS Tra
ckCount FROM "genres" INNER JOIN "tracks" ON "genres".GenreId = "tracks".Gen
reId GROUP BY "genres".Name'}, {'role': 'user', 'content': 'what are the top
5 countries that customers come from?'}, {'role': 'assistant', 'content': '
SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER B
Y Count DESC\nLIMIT 5'}, {'role': 'user', 'content': ' \n   Find the cust
omer who bought the most albums in total quantity (across all invoices):
\n'}]
Info: Ollama parameters:
model=mistral: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 \"customers\".CustomerId AS CustomerId, COUNT(\"i
nvoices\".\"InvoiceId\") AS NumberOfInvoices FROM \"customers\" LEFT JOIN
\"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY
\"customers\".CustomerId ORDER BY NumberOfInvoices DESC LIMIT 1"}, {"role":
"user", "content": " \n   Find the top 5 most expensive tracks (based on u
nit price):\n"}, {"role": "assistant", "content": " SELECT \"tracks\".Name,
\"tracks\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice D
ESC\n   LIMIT 5"}, {"role": "user", "content": " \n   Find all invoices si
nce 2010 and the total amount invoiced:\n"}, {"role": "assistant", "conten
t": " SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n
WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY InvoiceId"}, {"rol
e": "user", "content": " \n   Get the total number of invoices for each cu
stomer\n"}, {"role": "assistant", "content": " SELECT \"customers\".Customer
Id, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LE
FT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId G
ROUP BY \"customers\".CustomerId"}, {"role": "user", "content": " \n   Lis
t all invoices with a total exceeding $10:\n"}, {"role": "assistant", "conte
nt": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCit
y, BillingState, BillingCountry, BillingPostalCode, Total FROM \"invoices\"
WHERE Total > 10"}, {"role": "user", "content": " \n   Find the total numb
er of invoices per country:\n"}, {"role": "assistant", "content": " SELECT
\"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FR
OM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"inv
oices\".CustomerId GROUP BY \"customers\".Country"}, {"role": "user", "conte
nt": " \n   Get the average invoice total for each customer:\n"}, {"role":
"assistant", "content": " SELECT \"customers\".CustomerId, AVG(\"invoices
\".\"Total\") AS AverageInvoiceTotal FROM \"customers\" INNER JOIN \"invoice
s\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"custome
rs\".CustomerId"}, {"role": "user", "content": " \n   List all albums and
their corresponding artist names \n"}, {"role": "assistant", "content": "SE
LECT \"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" INNE

```
R JOIN \"artists\" ON \"albums\".ArtistId = \"artists\".ArtistId"}, {"role":
"user", "content": "  \n    List all genres and the number of tracks in each
genre:\n"}, {"role": "assistant", "content": " SELECT \"genres\".Name AS Gen
reName, COUNT(\"tracks\".\"TrackId\") AS TrackCount FROM \"genres\" INNER JO
IN \"tracks\" ON \"genres\".GenreId = \"tracks\".GenreId GROUP BY \"genres
\".Name"}, {"role": "user", "content": "what are the top 5 countries that cu
stomers come from?"}, {"role": "assistant", "content": " SELECT Country, COU
NT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT
5"}, {"role": "user", "content": "  \n     Find the customer who bought the
most albums in total quantity (across all invoices): \n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:46:09.569484477Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId,
COUNT("albums"."AlbumId") AS TotalAlbumsPurchased FROM "invoice_items" INNER
JOIN "tracks" ON "invoice_items".TrackId = "tracks".TrackId INNER JOIN "albu
ms" ON "tracks".AlbumId = "albums".AlbumId GROUP BY "customers".CustomerId O
RDER BY TotalAlbumsPurchased DESC LIMIT 1'}, 'done_reason': 'stop', 'done':
True, 'total_duration': 80070039897, 'load_duration': 3005297, 'prompt_eval_
count': 1825, 'prompt_eval_duration': 60425688000, 'eval_count': 109, 'eval_
duration': 18355417000}
LLM Response:  SELECT "customers".CustomerId, COUNT("albums"."AlbumId") AS T
otalAlbumsPurchased FROM "invoice_items" INNER JOIN "tracks" ON "invoice_ite
ms".TrackId = "tracks".TrackId INNER JOIN "albums" ON "tracks".AlbumId = "al
bums".AlbumId GROUP BY "customers".CustomerId ORDER BY TotalAlbumsPurchased
DESC LIMIT 1
 SELECT "customers".CustomerId, COUNT("albums"."AlbumId") AS TotalAlbumsPurc
hased FROM "invoice_items" INNER JOIN "tracks" ON "invoice_items".TrackId =
"tracks".TrackId INNER JOIN "albums" ON "tracks".AlbumId = "albums".AlbumId
GROUP BY "customers".CustomerId ORDER BY TotalAlbumsPurchased DESC LIMIT 1
Couldn't run sql:  Execution failed on sql ' SELECT "customers".CustomerId,
COUNT("albums"."AlbumId") AS TotalAlbumsPurchased FROM "invoice_items" INNER
JOIN "tracks" ON "invoice_items".TrackId = "tracks".TrackId INNER JOIN "albu
ms" ON "tracks".AlbumId = "albums".AlbumId GROUP BY "customers".CustomerId O
RDER BY TotalAlbumsPurchased DESC LIMIT 1': no such column: customers.Custom
erId
```

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
```

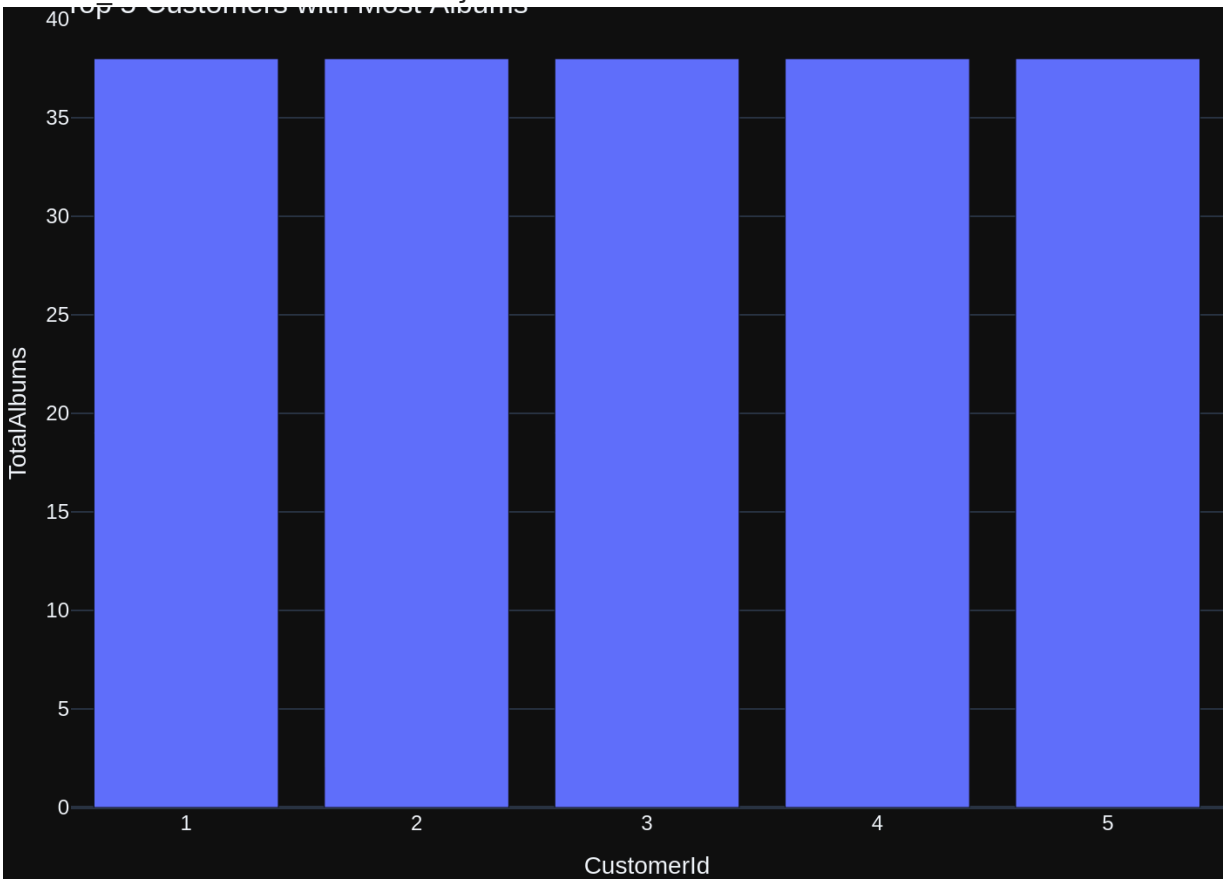
```
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please
help to generate a SQL query to answer the question. Your response should ON
LY be based on the given context and follow the response guidelines and form
at instructions. \n===Tables \nCREATE TABLE "invoice_items"\r\n(\r\n    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    F
ind the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'as
sistant', 'content': ' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tr
acks"\n   ORDER BY "tracks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user',
'content': '  \n     Find the customer with the most invoices \n'}, {'role':
'assistant', 'content': ' SELECT "customers".CustomerId AS CustomerId, COUNT
("invoices"."InvoiceId") AS NumberOfInvoices FROM "customers" LEFT JOIN "inv
oices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customer
s".CustomerId ORDER BY NumberOfInvoices DESC LIMIT 1'}, {'role': 'user', 'co
ntent': '  \n    List all invoices with a total exceeding $10:\n'}, {'role':
'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, CustomerId, Billing
Address, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total
```

FROM "invoices" WHERE Total > 10'}, {'role': 'user', 'content': ' \n   Fin
d the total number of invoices per country:\n'}, {'role': 'assistant', 'cont
ent': ' SELECT "customers".Country, COUNT("invoices"."InvoiceId") AS TotalIn
voices FROM "customers" INNER JOIN "invoices" ON "customers".CustomerId = "i
nvoices".CustomerId GROUP BY "customers".Country'}, {'role': 'user', 'conten
t': ' \n   Find all invoices since 2010 and the total amount invoice
d:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(Total) AS T
otalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDate) >=
\'2010\'\n   GROUP BY InvoiceId'}, {'role': 'user', 'content': 'what are the
top 5 countries that customers come from?'}, {'role': 'assistant', 'conten
t': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nO
RDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content': ' \n   Get the
total number of invoices for each customer\n'}, {'role': 'assistant', 'conte
nt': ' SELECT "customers".CustomerId, COUNT("invoices"."InvoiceId") AS Total
Invoices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId =
"invoices".CustomerId GROUP BY "customers".CustomerId'}, {'role': 'user', 'c
ontent': ' \n   Get the average invoice total for each customer:\n'}, {'ro
le': 'assistant', 'content': ' SELECT "customers".CustomerId, AVG("invoice
s"."Total") AS AverageInvoiceTotal FROM "customers" INNER JOIN "invoices" ON
"customers".CustomerId = "invoices".CustomerId GROUP BY "customers".Customer
Id'}, {'role': 'user', 'content': ' \n   List all albums and their corresp
onding artist names \n'}, {'role': 'assistant', 'content': 'SELECT "album
s".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN "artists"
ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'content': '
\n   List all genres and the number of tracks in each genre:\n'}, {'role':
'assistant', 'content': ' SELECT "genres".Name AS GenreName, COUNT("track
s"."TrackId") AS TrackCount FROM "genres" INNER JOIN "tracks" ON "genres".Ge
nreId = "tracks".GenreId GROUP BY "genres".Name'}, {'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'}]
Info: Ollama parameters:
model=mistral: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 top 5 most expensive tracks (based on unit pric
e):\n"}, {"role": "assistant", "content": " SELECT \"tracks\".Name, \"tracks
\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n
LIMIT 5"}, {"role": "user", "content": " \n   Find the customer with the
most invoices \n"}, {"role": "assistant", "content": " SELECT \"customers\".
CustomerId AS CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS NumberOfInvoi
ces FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId =
\"invoices\".CustomerId GROUP BY \"customers\".CustomerId ORDER BY NumberOfI
nvoices DESC LIMIT 1"}, {"role": "user", "content": " \n   List all invoic
es with a total exceeding $10:\n"}, {"role": "assistant", "content": " SELEC
T InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingSt
ate, BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE Total
> 10"}, {"role": "user", "content": " \n   Find the total number of invoic
es per country:\n"}, {"role": "assistant", "content": " SELECT \"customers
\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"custom
ers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".Cus
tomerId GROUP BY \"customers\".Country"}, {"role": "user", "content": " \n
Find all invoices since 2010 and the total amount invoiced:\n"}, {"role": "a
ssistant", "content": " SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM
\"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY In
voiceId"}, {"role": "user", "content": "what are the top 5 countries that cu
stomers come from?"}, {"role": "assistant", "content": " SELECT Country, COU
NT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT
5"}, {"role": "user", "content": " \n   Get the total number of invoices f
or each customer\n"}, {"role": "assistant", "content": " SELECT \"customers
\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"cus
tomers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".C
ustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": "
\n   Get the average invoice total for each customer:\n"}, {"role": "assist
ant", "content": " SELECT \"customers\".CustomerId, AVG(\"invoices\".\"Total
\") AS AverageInvoiceTotal FROM \"customers\" INNER JOIN \"invoices\" ON \"c

ustomers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".Custo
merId"}, {"role": "user", "content": " \n   List all albums and their corr
esponding artist names \n"}, {"role": "assistant", "content": "SELECT \"alb
ums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" INNER JOIN \"a
rtists\" ON \"albums\".ArtistId = \"artists\".ArtistId"}, {"role": "user",
"content": " \n   List all genres and the number of tracks in each genr
e:\n"}, {"role": "assistant", "content": " SELECT \"genres\".Name AS GenreNa
me, COUNT(\"tracks\".\"TrackId\") AS TrackCount FROM \"genres\" INNER JOIN
\"tracks\" ON \"genres\".GenreId = \"tracks\".GenreId GROUP BY \"genres\".Na
me"}, {"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"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:47:40.511824866Z',
'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId,
COUNT(DISTINCT "tracks"."TrackId") AS TotalAlbums FROM "customers" LEFT JOIN
"invoices" ON "customers".CustomerId = "invoices".CustomerId LEFT JOIN "invo
ice_items" ON "invoices".InvoiceId = "invoice_items".InvoiceId LEFT JOIN "tr
acks" ON "invoice_items".TrackId = "tracks".TrackId GROUP BY "customers".Cus
tomerId ORDER BY TotalAlbums DESC LIMIT 5'}, 'done_reason': 'stop', 'done':
True, 'total_duration': 90862844144, 'load_duration': 3466716, 'prompt_eval_
count': 1845, 'prompt_eval_duration': 66481364000, 'eval_count': 134, 'eval_
duration': 23086684000}
LLM Response: SELECT "customers".CustomerId, COUNT(DISTINCT "tracks"."Track
Id") AS TotalAlbums FROM "customers" LEFT JOIN "invoices" ON "customers".Cus
tomerId = "invoices".CustomerId LEFT JOIN "invoice_items" ON "invoices".Invo
iceId = "invoice_items".InvoiceId LEFT JOIN "tracks" ON "invoice_items".Trac
kId = "tracks".TrackId GROUP BY "customers".CustomerId ORDER BY TotalAlbums
DESC LIMIT 5
 SELECT "customers".CustomerId, COUNT(DISTINCT "tracks"."TrackId") AS TotalA
lbums FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "inv
oices".CustomerId LEFT JOIN "invoice_items" ON "invoices".InvoiceId = "invoi
ce_items".InvoiceId LEFT JOIN "tracks" ON "invoice_items".TrackId = "track
s".TrackId GROUP BY "customers".CustomerId ORDER BY TotalAlbums DESC LIMIT 5
   CustomerId TotalAlbums
0   1   38
1   2   38
2   3   38
3   4   38
4   5   38
Info: Ollama parameters:
model=mistral: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 \"customer
s\".CustomerId, COUNT(DISTINCT \"tracks\".\"TrackId\") AS TotalAlbums FROM
\"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoice
s\".CustomerId LEFT JOIN \"invoice_items\" ON \"invoices\".InvoiceId = \"inv
oice_items\".InvoiceId LEFT JOIN \"tracks\" ON \"invoice_items\".TrackId =
\"tracks\".TrackId GROUP BY \"customers\".CustomerId ORDER BY TotalAlbums DE
SC LIMIT 5\n\nThe following is information about the resulting pandas DataFr

ame 'df': \nRunning df.dtypes gives:\n CustomerId   int64\nTotalAlbums
int64\ndtype: object"}, {"role": "user", "content": "Can you generate the Py
thon plotly code to chart the results of the dataframe? Assume the data is i
n a pandas dataframe called 'df'. If there is only one value in the datafram
e, use an Indicator. Respond with only Python code. Do not answer with any e
xplanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:48:26.094245674Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nfig = px.bar(df, x="CustomerId", y="TotalAlbums", title="Top 5 Cust
omers with Most Albums")\nfig.update_layout(margin=dict(l=0, r=0, t=0, b=0))
\nif df.shape[0] == 1:\n   fig = px.bar(df, y="TotalAlbums", title="Top Cus
tomer with Most Albums")\n   fig.update_layout(margin=dict(l=0, r=0, t=0, b
=0), shape_traces=[dict(type="indicator", mode="gauge+number", value=df["Tot
alAlbums"].iloc[0], title=dict(text=\'\' + df["CustomerId"].iloc[0] +
\'\', font=dict(size=16)))])\nfig.show()\n```'}, 'done_reason': 'stop',
'done': True, 'total_duration': 45554501884, 'load_duration': 3210607, 'prom
pt_eval_count': 332, 'prompt_eval_duration': 11230366000, 'eval_count': 211,
'eval_duration': 34227427000}



Out[36]:
```
(' SELECT "customers".CustomerId, COUNT(DISTINCT "tracks"."TrackId") AS Tot
alAlbums FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId =
"invoices".CustomerId LEFT JOIN "invoice_items" ON "invoices".InvoiceId =
"invoice_items".InvoiceId LEFT JOIN "tracks" ON "invoice_items".TrackId =
"tracks".TrackId GROUP BY "customers".CustomerId ORDER BY TotalAlbums DESC
LIMIT 5',
    CustomerId  TotalAlbums
 0           1           38
 1           2           38
 2           3           38
 3           4           38
 4           5           38,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'CustomerId=%{x}<br>TotalAlbums=%{y}<extra>
</extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array([1, 2, 3, 4, 5]),
               'xaxis': 'x',
               'y': array([38, 38, 38, 38, 38]),
               'yaxis': 'y'}],
     'layout': {'barmode': 'relative',
                'legend': {'tracegroupgap': 0},
                'margin': {'b': 0, 'l': 0, 'r': 0, 't': 0},
                'template': '...',
                'title': {'text': 'Top 5 Customers with Most Albums'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'CustomerId'}},
                'yaxis': {'anchor': 'x', 'domain': [0.0, 1.0], 'title': {'t
ext': 'TotalAlbums'}}}
 }))
```

```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
```

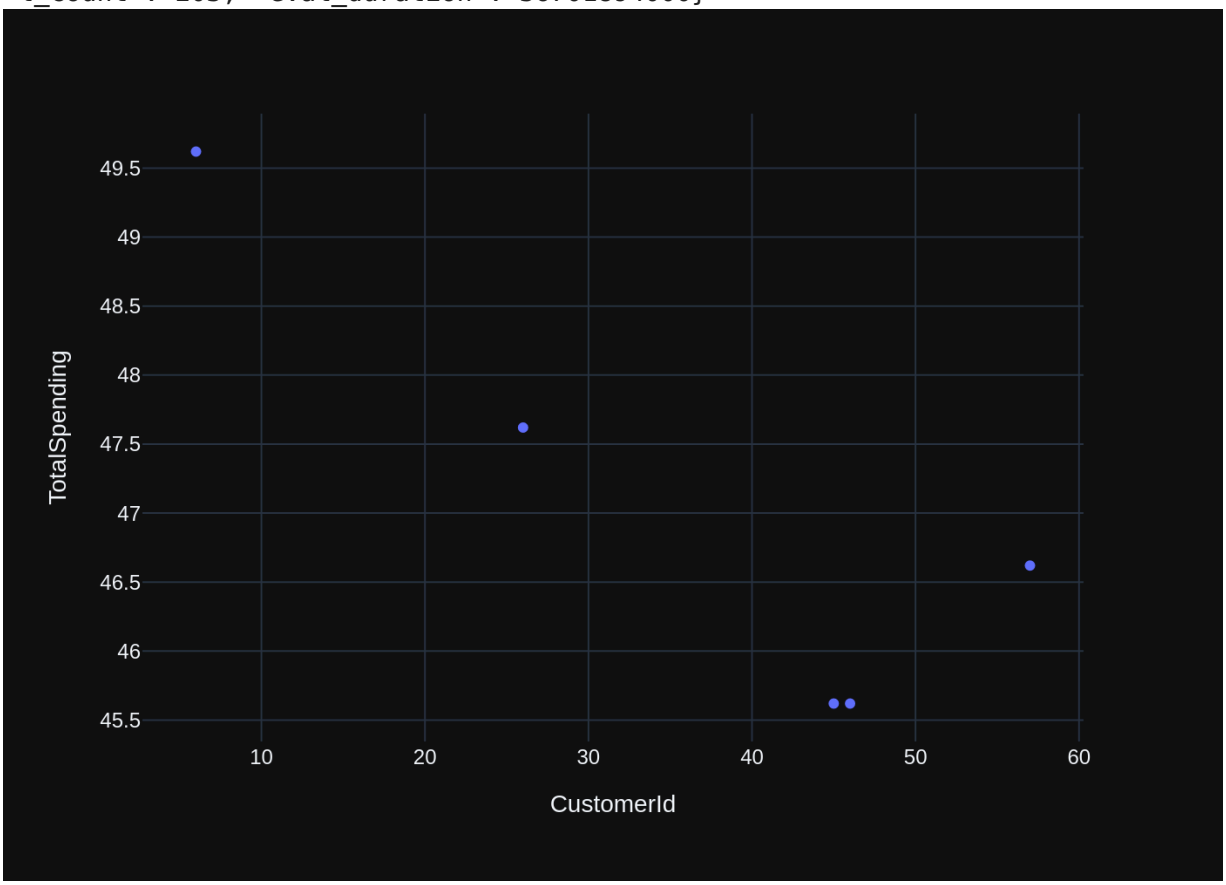
ery with a comment saying intermediate_sql \n3. If the provided context is i
nsufficient, please explain why it can\'t be generated. \n4. Please use the
most relevant table(s). \n5. If the question has been asked and answered bef
ore, please repeat the answer exactly as it was given before. \n'}, {'role':
'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
"customers".CustomerId, COUNT(DISTINCT "tracks"."TrackId") AS TotalAlbums FR
OM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".C
ustomerId LEFT JOIN "invoice_items" ON "invoices".InvoiceId = "invoice_item
s".InvoiceId LEFT JOIN "tracks" ON "invoice_items".TrackId = "tracks".TrackI
d GROUP BY "customers".CustomerId ORDER BY TotalAlbums DESC LIMIT 5'}, {'rol
e': 'user', 'content': ' \n   Get the average invoice total for each custo
mer:\n'}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId,
AVG("invoices"."Total") AS AverageInvoiceTotal FROM "customers" INNER JOIN
"invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "custo
mers".CustomerId'}, {'role': 'user', 'content': ' \n   Find the customer
with the most invoices \n'}, {'role': 'assistant', 'content': ' SELECT "cust
omers".CustomerId AS CustomerId, COUNT("invoices"."InvoiceId") AS NumberOfIn
voices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "in
voices".CustomerId GROUP BY "customers".CustomerId ORDER BY NumberOfInvoices
DESC LIMIT 1'}, {'role': 'user', 'content': ' \n   Find the top 5 most exp
ensive tracks (based on unit price):\n'}, {'role': 'assistant', 'content': '
SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n   ORDER BY "tra
cks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user', 'content': 'what are the
top 5 countries that customers come from?'}, {'role': 'assistant', 'conten
t': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nO
RDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content': ' \n   Find all
invoices since 2010 and the total amount invoiced:\n'}, {'role': 'assistan
t', 'content': ' SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM "invoi
ces"\n   WHERE strftime(\'%Y\', InvoiceDate) >= \'2010\'\n   GROUP BY Invoic
eId'}, {'role': 'user', 'content': ' \n   List all invoices with a total e
xceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, Invo
iceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCount
ry, BillingPostalCode, Total FROM "invoices" WHERE Total > 10'}, {'role': 'u
ser', 'content': ' \n   Find the total number of invoices per countr
y:\n'}, {'role': 'assistant', 'content': ' SELECT "customers".Country, COUNT
("invoices"."InvoiceId") AS TotalInvoices FROM "customers" INNER JOIN "invoi
ces" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".
Country'}, {'role': 'user', 'content': ' \n   Get the total number of invo
ices for each customer\n'}, {'role': 'assistant', 'content': ' SELECT "custo
mers".CustomerId, COUNT("invoices"."InvoiceId") AS TotalInvoices FROM "custo
mers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId
GROUP BY "customers".CustomerId'}, {'role': 'user', 'content': 'How many cus
tomers are there'}, {'role': 'assistant', 'content': ' SELECT COUNT(*) FROM
"customers"'}, {'role': 'user', 'content': ' \n   Find the top 5 customer
s who spent the most money overall, \n   \n   Hint: order total can be f
ound on invoices table, calculation using invoice_items detail table is unne
cessary \n'}]
Info: Ollama parameters:
model=mistral: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 asked and answered before, 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 quantity (across all invoices):\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId, COUNT(DISTINCT \"tracks\".\"TrackId\") AS TotalAlbums FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId LEFT JOIN \"invoice_items\" ON \"invoices\".InvoiceId = \"invoice_items\".InvoiceId LEFT JOIN \"tracks\" ON \"invoice_items\".TrackId = \"tracks\".TrackId GROUP BY \"customers\".CustomerId ORDER BY TotalAlbums DESC LIMIT 5"}, {"role": "user", "content": " \n Get the average invoice total for each customer:\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId, AVG(\"invoices\".\"Total\") AS AverageInvoiceTotal FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": " \n   Find the customer with the most invoices \n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId AS CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS NumberOfInvoices FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId ORDER BY NumberOfInvoices DESC LIMIT 1"}, {"role": "user", "content": " \n   Find the top 5 most expensive tracks (based on unit price):\n"}, {"role": "assistant", "content": " SELECT \"tracks\".Name, \"tracks\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n   LIMIT 5"}, {"role": "user", "content": "what are the top 5 countries that customers come from?"}, {"role": "assistant", "content": " SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5"}, {"role": "user", "content": " \n   Find all invoices since 2010 and the total amount invoiced:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, SUM(Total) AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >= '2010'\n   GROUP BY InvoiceId"}, {"role": "user", "content": " \n   List all invoices with a total exceeding $10:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": " \n   Find the total number of invoices per country:\n"}, {"role": "assistant", "content": " SELECT \"customers\".Country, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" INNER JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".Country"}, {"role": "user", "content": " \n   Get the total number of invoices for each customer\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS TotalInvoices FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId"}, {"role": "user", "content": "How many customers are there"}, {"role": "assistant", "content": " SELECT COUNT(*) FROM \"customers\""}, {"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"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:49:58.291935065Z', 'message': {'role': 'assistant', 'content': ' SELECT "customers".CustomerId, "customers".Company, SUM("invoices"."Total") as TotalSpending\n   FROM customers\n   INNER JOIN invoices ON customers.CustomerId = invoices.CustomerId\nGROUP BY "customers".CustomerId, "customers".Company\n   ORDER BY TotalSpending DESC\n   LIMIT 5;'}, 'done_reason': 'stop', 'done': True, 'total_duration': 92096136537, 'load_duration': 4796943, 'prompt_eval_count': 2036, 'promp

```
t_eval_duration': 75319317000, 'eval_count': 89, 'eval_duration': 1571247500
0}
LLM Response:  SELECT "customers".CustomerId, "customers".Company, SUM("invo
ices"."Total") as TotalSpending
   FROM customers
   INNER JOIN invoices ON customers.CustomerId = invoices.CustomerId
   GROUP BY "customers".CustomerId, "customers".Company
   ORDER BY TotalSpending DESC
   LIMIT 5;
Info: Output from LLM:  SELECT "customers".CustomerId, "customers".Company,
SUM("invoices"."Total") as TotalSpending
   FROM customers
   INNER JOIN invoices ON customers.CustomerId = invoices.CustomerId
   GROUP BY "customers".CustomerId, "customers".Company
   ORDER BY TotalSpending DESC
   LIMIT 5;
Extracted SQL: SELECT "customers".CustomerId, "customers".Company, SUM("invo
ices"."Total") as TotalSpending
   FROM customers
   INNER JOIN invoices ON customers.CustomerId = invoices.CustomerId
   GROUP BY "customers".CustomerId, "customers".Company
   ORDER BY TotalSpending DESC
   LIMIT 5
SELECT "customers".CustomerId, "customers".Company, SUM("invoices"."Total")
as TotalSpending
   FROM customers
   INNER JOIN invoices ON customers.CustomerId = invoices.CustomerId
   GROUP BY "customers".CustomerId, "customers".Company
   ORDER BY TotalSpending DESC
   LIMIT 5
   CustomerId Company  TotalSpending
0           6    None          49.62
1          26    None          47.62
2          57    None          46.62
3          45    None          45.62
4          46    None          45.62
Info: Ollama parameters:
model=mistral: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 \"customers\".CustomerId, \"customers\".Company, SUM(\"invo
ices\".\"Total\") as TotalSpending\n   FROM customers\n   INNER JOIN invoice
s ON customers.CustomerId = invoices.CustomerId\n   GROUP BY \"customers\".C
ustomerId, \"customers\".Company\n   ORDER BY TotalSpending DESC\n   LIMIT 5
\n\nThe following is information about the resulting pandas DataFrame 'df':
\nRunning df.dtypes gives:\n CustomerId         int64\nCompany           obj
ect\nTotalSpending    float64\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:latest', 'created_at': '2024-08-01T19:50:45.893923842Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\nfig = px.bar("CustomerId", "TotalSpending", data=df, title="Top 5 C
ustomers by Total Spending")\nfig.update_layout(showlegend=False)\nif len(d
f) == 1:\n   fig = go.Indicator(\n   value=df["TotalSpending"].iloc
[0],\n   title={"text": "Total Spending", "font": {"size": 24}},\n
mode="number+value+gauge+bottom",\n   gauge={\n   "bar": {"col
or": "#1a8cd9"},\n   "threshold": {\n   "line": {"colo
r": "red"},\n   "thickness": 0.5,\n   "value": df
["TotalSpending"].iloc[0]\n   }\n   }\n   )\n```'}, 'done_rea
son': 'stop', 'done': True, 'total_duration': 47580453728, 'load_duration':
3684519, 'prompt_eval_count': 291, 'prompt_eval_duration': 10787522000, 'eva
l_count': 203, 'eval_duration': 36701894000}



Out[37]:
```
('SELECT "customers".CustomerId, "customers".Company, SUM("invoices"."Tota
l") as TotalSpending\n   FROM customers\n   INNER JOIN invoices ON customer
s.CustomerId = invoices.CustomerId\n   GROUP BY "customers".CustomerId, "cu
stomers".Company\n   ORDER BY TotalSpending DESC\n   LIMIT 5',
    CustomerId Company  TotalSpending
 0           6    None          49.62
 1          26    None          47.62
 2          57    None          46.62
 3          45    None          45.62
 4          46    None          45.62,
 Figure({
     'data': [{'hovertemplate': 'CustomerId=%{x}<br>TotalSpending=%{y}<extr
a></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'symbol': 'circle'},
               'mode': 'markers',
               'name': '',
               'orientation': 'v',
               'showlegend': False,
               'type': 'scatter',
               'x': array([ 6, 26, 57, 45, 46]),
               'xaxis': 'x',
               'y': array([49.62, 47.62, 46.62, 45.62, 45.62]),
               'yaxis': 'y'}],
     'layout': {'legend': {'tracegroupgap': 0},
                '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': 'TotalSpending'}}}
 }))
```

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
```

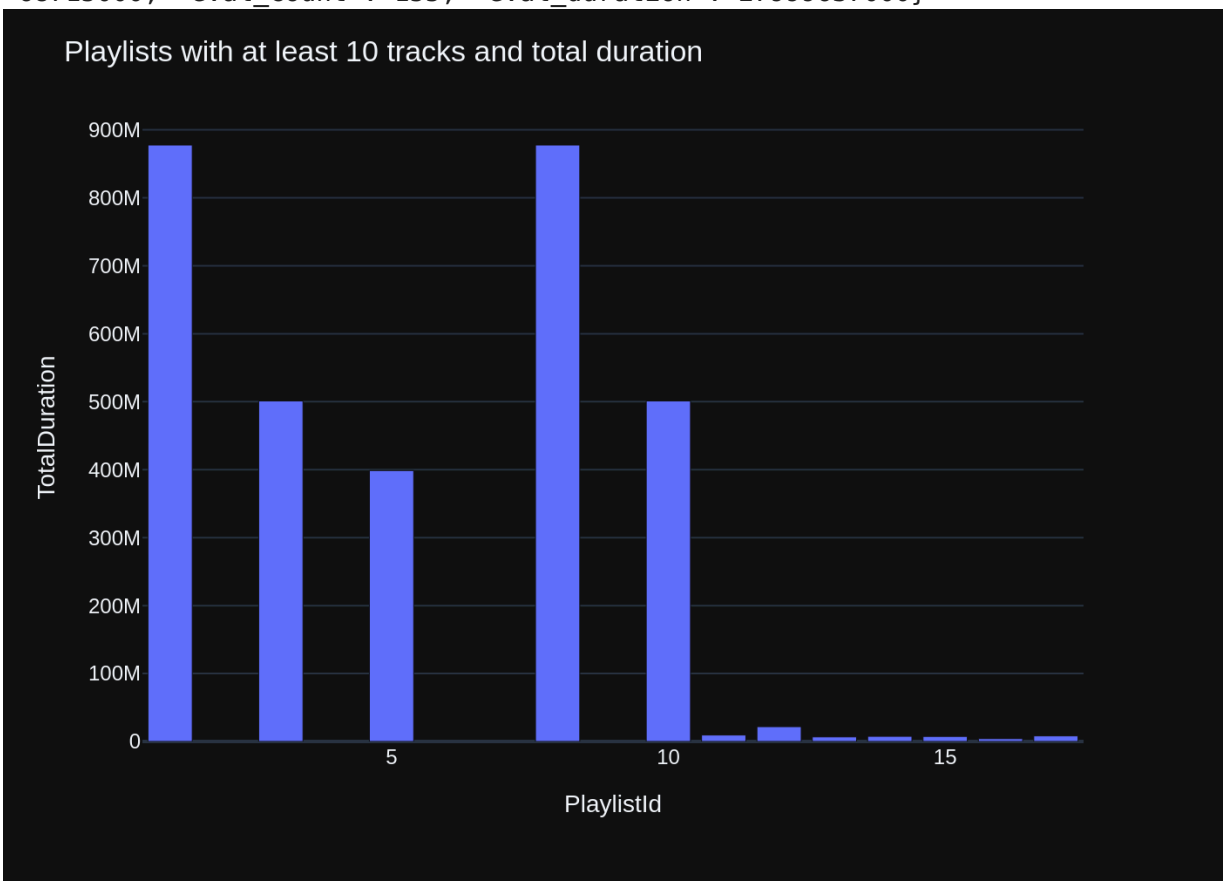
SQL Prompt: [{'role': 'system', 'content': 'You are a SQLite expert. Please help to generate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \nCREATE INDEX IFK_PlaylistTrackTrackId ON "playlist_track" (TrackId)\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 "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 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 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 "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_TrackGenreId ON "tracks" (GenreId)\n\nCREATE INDEX IFK_TrackAlbumId ON "tracks" (AlbumId)\n\nCREATE INDEX IFK_TrackMediaTypeId ON "tracks" (MediaTypeId)\n\nCREATE INDEX IFK_AlbumArtistId ON "albums" (ArtistId)\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 KEY (ArtistId) REFERENCES "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 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. 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 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   List all genres and the number of tracks in each genre:\n'}, {'role': 'assistant', 'content': ' SELECT "genres".Name AS GenreName, COUNT("tracks"."TrackId") AS TrackCount FROM "genres" INNER JOIN "tracks" ON "genres".GenreId = "tracks".GenreId GROUP BY "genres".Name'}, {'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 quantity (across all invoices):\n'}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId, COUNT(DISTINCT "tracks"."TrackId") AS TotalAlbums FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId LEFT JOIN "invoice_items" ON "invoices".InvoiceId = "invoice_items".InvoiceId LEFT JOIN "tracks" ON "invoice_items".TrackId = "tracks".TrackId GROUP BY "customers".CustomerId ORDER BY TotalAlbums DESC LIMIT 5'}, {'role': 'user', 'content': ' \n   Find the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'assistant', 'content': ' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n   ORDER BY "tracks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user', 'content': ' \n   Find all tracks with a name containing "What" (case-insensitive)\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LO

WER(Name) LIKE \'%what%\''}, {'role': 'user', 'content': ' \n   List all a
lbums and their corresponding artist names \n'}, {'role': 'assistant', 'con
tent': 'SELECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums"
INNER JOIN "artists" ON "albums".ArtistId = "artists".ArtistId'}, {'role':
'user', 'content': ' \n   Find all invoices since 2010 and the total amoun
t invoiced:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, SUM(To
tal) AS TotalAmount\n   FROM "invoices"\n   WHERE strftime(\'%Y\', InvoiceDa
te) >= \'2010\'\n   GROUP BY InvoiceId'}, {'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': ' \n   List all invoices with a total exceeding $10:\n'},
{'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, CustomerI
d, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalC
ode, Total 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'}, {'role': 'assistant', 'content': 'SE
LECT "customers".CustomerId, "customers".Company, SUM("invoices"."Total") as
TotalSpending\n   FROM customers\n   INNER JOIN invoices ON customers.Custom
erId = invoices.CustomerId\n   GROUP BY "customers".CustomerId, "customers".
Company\n   ORDER BY TotalSpending DESC\n   LIMIT 5'}, {'role': 'user', 'con
tent': ' \n   Find the customer with the most invoices \n'}, {'role': 'as
sistant', 'content': ' SELECT "customers".CustomerId AS CustomerId, COUNT("i
nvoices"."InvoiceId") AS NumberOfInvoices FROM "customers" LEFT JOIN "invoic
es" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".C
ustomerId ORDER BY NumberOfInvoices DESC LIMIT 1'}, {'role': 'user', 'conten
t': ' \n   Get all playlists containing at least 10 tracks and the total
duration of those tracks:\n'}]
Info: Ollama parameters:
model=mistral: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   List all
genres and the number of tracks in each genre:\n"}, {"role": "assistant", "c
ontent": " SELECT \"genres\".Name AS GenreName, COUNT(\"tracks\".\"TrackId
\") AS TrackCount FROM \"genres\" INNER JOIN \"tracks\" ON \"genres\".GenreI
d = \"tracks\".GenreId GROUP BY \"genres\".Name"}, {"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 \"customers\".C
ustomerId, COUNT(DISTINCT \"tracks\".\"TrackId\") AS TotalAlbums FROM \"cust
omers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".Cu
stomerId LEFT JOIN \"invoice_items\" ON \"invoices\".InvoiceId = \"invoice_i
tems\".InvoiceId LEFT JOIN \"tracks\" ON \"invoice_items\".TrackId = \"track
s\".TrackId GROUP BY \"customers\".CustomerId ORDER BY TotalAlbums DESC LIMI
T 5"}, {"role": "user", "content": " \n   Find the top 5 most expensive tr
acks (based on unit price):\n"}, {"role": "assistant", "content": " SELECT
\"tracks\".Name, \"tracks\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tra
cks\".UnitPrice DESC\n   LIMIT 5"}, {"role": "user", "content": " \n   Fin
d all tracks with a name containing \"What\" (case-insensitive)\n"}, {"rol
e": "assistant", "content": " SELECT * FROM \"tracks\" WHERE LOWER(Name) LIK
E '%what%'"}, {"role": "user", "content": " \n   List all albums and their
corresponding artist names \n"}, {"role": "assistant", "content": "SELECT
\"albums\".AlbumId, \"artists\".Name AS ArtistName FROM \"albums\" INNER JOI
N \"artists\" ON \"albums\".ArtistId = \"artists\".ArtistId"}, {"role": "use
r", "content": " \n   Find all invoices since 2010 and the total amount in
voiced:\n"}, {"role": "assistant", "content": " SELECT InvoiceId, SUM(Total)
AS TotalAmount\n   FROM \"invoices\"\n   WHERE strftime('%Y', InvoiceDate) >
= '2010'\n   GROUP BY InvoiceId"}, {"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   List all invoices with a total exceeding $10:\n"}, {"rol
e": "assistant", "content": " SELECT InvoiceId, InvoiceDate, CustomerId, Bil
lingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, T
otal FROM \"invoices\" WHERE Total > 10"}, {"role": "user", "content": " \n
Find the top 5 customers who spent the most money overall, \n   \n   Hin
t: order total can be found on invoices table, calculation using invoice_ite
ms detail table is unnecessary \n"}, {"role": "assistant", "content": "SELEC
T \"customers\".CustomerId, \"customers\".Company, SUM(\"invoices\".\"Total
\") as TotalSpending\n   FROM customers\n   INNER JOIN invoices ON customer
s.CustomerId = invoices.CustomerId\n   GROUP BY \"customers\".CustomerId,
\"customers\".Company\n   ORDER BY TotalSpending DESC\n   LIMIT 5"}, {"rol
e": "user", "content": " \n   Find the customer with the most invoices

\n"}, {"role": "assistant", "content": " SELECT \"customers\".CustomerId AS CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS NumberOfInvoices FROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"invoices\".CustomerId GROUP BY \"customers\".CustomerId ORDER BY NumberOfInvoices DESC LIMIT 1"}, {"role": "user", "content": " \n   Get all playlists containing at least 10 tracks and the total duration of those tracks:\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:52:20.731005893Z', 'message': {'role': 'assistant', 'content': ' SELECT "playlists".PlaylistId AS PlaylistId, SUM(tracks."Milliseconds") AS TotalDuration FROM "playlists" LEFT JOIN "playlist_track" ON "playlists".PlaylistId = "playlist_track".PlaylistId INNER JOIN "tracks" ON "playlist_track".TrackId = "tracks".TrackId GROUP BY "playlists".PlaylistId HAVING COUNT(DISTINCT "tracks".TrackId) >= 10'}, 'done_reason': 'stop', 'done': True, 'total_duration': 94744777784, 'load_duration': 3291166, 'prompt_eval_count': 1765, 'prompt_eval_duration': 72119023000, 'eval_count': 116, 'eval_duration': 21283994000}
LLM Response: SELECT "playlists".PlaylistId AS PlaylistId, SUM(tracks."Milliseconds") AS TotalDuration FROM "playlists" LEFT JOIN "playlist_track" ON "playlists".PlaylistId = "playlist_track".PlaylistId INNER JOIN "tracks" ON "playlist_track".TrackId = "tracks".TrackId GROUP BY "playlists".PlaylistId HAVING COUNT(DISTINCT "tracks".TrackId) >= 10
 SELECT "playlists".PlaylistId AS PlaylistId, SUM(tracks."Milliseconds") AS TotalDuration FROM "playlists" LEFT JOIN "playlist_track" ON "playlists".PlaylistId = "playlist_track".PlaylistId INNER JOIN "tracks" ON "playlist_track".TrackId = "tracks".TrackId GROUP BY "playlists".PlaylistId HAVING COUNT(DISTINCT "tracks".TrackId) >= 10
    PlaylistId TotalDuration
0   1   877683083
1   3   501094957
2   5   398705153
3   8   877683083
4   10   501094957
5   11   9486559
6   12   21770592
7   13   6755730
8   14   7575051
9   15   7439811
10   16   4122018
11   17   8206312
Info: Ollama parameters:
model=mistral:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "The following is a pandas DataFrame that contains the results of the query that answers the question the user asked: '\n   Get all playlists containing at least 10 tracks and the total duration of those tracks:\n'\n\nThe DataFrame was produced using this query: SELECT \"playlists\".PlaylistId AS PlaylistId, SUM(tracks.\"Milliseconds\") AS TotalDuration FROM \"playlists\" LEFT JOIN \"playlist_track\" ON \"playlists\".PlaylistId = \"playlist_track\".PlaylistId INNER JOIN \"tracks\" ON \"playlist_track\".TrackId = \"tracks\".TrackId GROUP BY \"playlists\".PlaylistId HAVING COUNT(DISTINCT \"tracks\".TrackId) >= 10\n\nThe following is information about the resulting pandas DataFrame 'df': \nRunning df.dtypes gives:\n PlaylistId   int64\nTotalDuration   int64\ndtype: object"}, {"role": "user", "content": "Can you generate the Python plotly code to chart the resul

ts of the dataframe? Assume the data is in a pandas dataframe called 'df'. I
f there is only one value in the dataframe, use an Indicator. Respond with o
nly Python code. Do not answer with any explanations -- just the code."}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:53:01.316852346Z',
'message': {'role': 'assistant', 'content': '```python\nimport plotly.expres
s as px\n\nfig = px.bar(df, x="PlaylistId", y="TotalDuration")\nfig.update_l
ayout(title=\'Playlists with at least 10 tracks and total duration\')\nfig.w
rite_image(\'playlists_duration.png\')\n\nif df.shape[0] == 1:\n   fig = p
x.bar(df, x="PlaylistId", y="TotalDuration")\n   fig.update_layout(title=
\'Playlist with at least 10 tracks and total duration\',\n
showlegend=False)\n   fig.write_image(\'single_playlist_duration.png\')\n``
`'}, 'done_reason': 'stop', 'done': True, 'total_duration': 40564023283, 'lo
ad_duration': 3421395, 'prompt_eval_count': 292, 'prompt_eval_duration': 124
68715000, 'eval_count': 155, 'eval_duration': 27999637000}



Out[38]:
```
(' SELECT "playlists".PlaylistId AS PlaylistId, SUM(tracks."Milliseconds")
AS TotalDuration FROM "playlists" LEFT JOIN "playlist_track" ON "playlist
s".PlaylistId = "playlist_track".PlaylistId INNER JOIN "tracks" ON "playlis
t_track".TrackId = "tracks".TrackId GROUP BY "playlists".PlaylistId HAVING
COUNT(DISTINCT "tracks".TrackId) >= 10',
     PlaylistId  TotalDuration
 0            1      877683083
 1            3      501094957
 2            5      398705153
 3            8      877683083
 4           10      501094957
 5           11        9486559
 6           12       21770592
 7           13        6755730
 8           14        7575051
 9           15        7439811
 10          16        4122018
 11          17        8206312,
 Figure({
     'data': [{'alignmentgroup': 'True',
               'hovertemplate': 'PlaylistId=%{x}<br>TotalDuration=%{y}<extr
a></extra>',
               'legendgroup': '',
               'marker': {'color': '#636efa', 'pattern': {'shape': ''}},
               'name': '',
               'offsetgroup': '',
               'orientation': 'v',
               'showlegend': False,
               'textposition': 'auto',
               'type': 'bar',
               'x': array([ 1,  3,  5,  8, 10, 11, 12, 13, 14, 15, 16, 1
7]),
               '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': '...',
                'title': {'text': 'Playlists with at least 10 tracks and to
tal duration'},
                'xaxis': {'anchor': 'y', 'domain': [0.0, 1.0], 'title': {'t
ext': 'PlaylistId'}},
                '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    List all genres and th
e number of tracks in each genre:\n'}, {'role': 'assistant', 'content': ' SE
LECT "genres".Name AS GenreName, COUNT("tracks"."TrackId") AS TrackCount FRO
M "genres" INNER JOIN "tracks" ON "genres".GenreId = "tracks".GenreId GROUP
BY "genres".Name'}, {'role': 'user', 'content': '  \n    List all albums and
their corresponding artist names  \n'}, {'role': 'assistant', 'content': 'SE
LECT "albums".AlbumId, "artists".Name AS ArtistName FROM "albums" INNER JOIN
"artists" ON "albums".ArtistId = "artists".ArtistId'}, {'role': 'user', 'con
tent': '  \n     Get all playlists containing at least 10 tracks and the tot
al duration of those tracks:\n'}, {'role': 'assistant', 'content': ' SELECT
"playlists".PlaylistId AS PlaylistId, SUM(tracks."Milliseconds") AS TotalDur
ation FROM "playlists" LEFT JOIN "playlist_track" ON "playlists".PlaylistId
= "playlist_track".PlaylistId INNER JOIN "tracks" ON "playlist_track".TrackI
d = "tracks".TrackId GROUP BY "playlists".PlaylistId HAVING COUNT(DISTINCT
"tracks".TrackId) >= 10'}, {'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 quantity (across all invoices):\n'}, {'rol
e': 'assistant', 'content': ' SELECT "customers".CustomerId, COUNT(DISTINCT
```

"tracks"."TrackId") AS TotalAlbums FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId LEFT JOIN "invoice_items" ON "invoices".InvoiceId = "invoice_items".InvoiceId LEFT JOIN "tracks" ON "invoice_items".TrackId = "tracks".TrackId GROUP BY "customers".CustomerId ORDER BY TotalAlbums DESC LIMIT 5'}, {'role': 'user', 'content': ' \n   Find the top 5 most expensive tracks (based on unit price):\n'}, {'role': 'assistant', 'content': ' SELECT "tracks".Name, "tracks".UnitPrice\n   FROM "tracks"\n   ORDER BY "tracks".UnitPrice DESC\n   LIMIT 5'}, {'role': 'user', 'content': ' \n   Find all tracks with a name containing "What" (case-insensitive)\n'}, {'role': 'assistant', 'content': ' SELECT * FROM "tracks" WHERE LOWER(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': 'what are the top 5 countries that customers come from?'}, {'role': 'assistant', 'content': ' SELECT Country, COUNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMIT 5'}, {'role': 'user', 'content': ' \n   Find the customer with the most invoices \n'}, {'role': 'assistant', 'content': ' SELECT "customers".CustomerId AS CustomerId, COUNT("invoices"."InvoiceId") AS NumberOfInvoices FROM "customers" LEFT JOIN "invoices" ON "customers".CustomerId = "invoices".CustomerId GROUP BY "customers".CustomerId ORDER BY NumberOfInvoices DESC LIMIT 1'}, {'role': 'user', 'content': ' \n   List all invoices with a total exceeding $10:\n'}, {'role': 'assistant', 'content': ' SELECT InvoiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState, BillingCountry, BillingPostalCode, Total 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 parameters:
model=mistral:latest,
options={},
keep_alive=None
Info: Prompt Content:
[{"role": "system", "content": "You are a SQLite expert. Please help to generate a SQL query to answer the question. Your response should ONLY be based on the given context and follow the response guidelines and format instructions. \n===Tables \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 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 \"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_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 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 INDEX IFK_TrackMediaTypeId ON \"tracks\" (MediaTypeId)\n\nCREATE TABLE \"genres\"\r\n(\r\n   GenreId INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,\r\n   Name NVARCHAR(120)\r\n)\n\nCREATE INDEX IFK_PlaylistTrackTrackId ON \"playlist_track\" (TrackId)\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 \"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 (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   List al
l genres and the number of tracks in each genre:\n"}, {"role": "assistant",
"content": " SELECT \"genres\".Name AS GenreName, COUNT(\"tracks\".\"TrackId
\") AS TrackCount FROM \"genres\" INNER JOIN \"tracks\" ON \"genres\".GenreI
d = \"tracks\".GenreId GROUP BY \"genres\".Name"}, {"role": "user", "conten
t": " \n   List all albums and their corresponding artist names \n"}, {"r
ole": "assistant", "content": "SELECT \"albums\".AlbumId, \"artists\".Name A
S ArtistName FROM \"albums\" INNER JOIN \"artists\" ON \"albums\".ArtistId =
\"artists\".ArtistId"}, {"role": "user", "content": " \n   Get all playli
sts containing at least 10 tracks and the total duration of those track
s:\n"}, {"role": "assistant", "content": " SELECT \"playlists\".PlaylistId A
S PlaylistId, SUM(tracks.\"Milliseconds\") AS TotalDuration FROM \"playlists
\" LEFT JOIN \"playlist_track\" ON \"playlists\".PlaylistId = \"playlist_tra
ck\".PlaylistId INNER JOIN \"tracks\" ON \"playlist_track\".TrackId = \"trac
ks\".TrackId GROUP BY \"playlists\".PlaylistId HAVING COUNT(DISTINCT \"track
s\".TrackId) >= 10"}, {"role": "user", "content": " \n   Hint: album quant
ity is found in invoice_items, \n   \n   Find the top 5 customers who boug
ht the most albums in total quantity (across all invoices):\n"}, {"role": "a
ssistant", "content": " SELECT \"customers\".CustomerId, COUNT(DISTINCT \"tr
acks\".\"TrackId\") AS TotalAlbums FROM \"customers\" LEFT JOIN \"invoices\"
ON \"customers\".CustomerId = \"invoices\".CustomerId LEFT JOIN \"invoice_it
ems\" ON \"invoices\".InvoiceId = \"invoice_items\".InvoiceId LEFT JOIN \"tr
acks\" ON \"invoice_items\".TrackId = \"tracks\".TrackId GROUP BY \"customer
s\".CustomerId ORDER BY TotalAlbums DESC LIMIT 5"}, {"role": "user", "conten
t": " \n   Find the top 5 most expensive tracks (based on unit pric
e):\n"}, {"role": "assistant", "content": " SELECT \"tracks\".Name, \"tracks
\".UnitPrice\n   FROM \"tracks\"\n   ORDER BY \"tracks\".UnitPrice DESC\n
LIMIT 5"}, {"role": "user", "content": " \n   Find all tracks with a name
containing \"What\" (case-insensitive)\n"}, {"role": "assistant", "content":
" SELECT * FROM \"tracks\" WHERE LOWER(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": "what are the top 5 countries that c
ustomers come from?"}, {"role": "assistant", "content": " SELECT Country, CO
UNT(*) AS Count\nFROM customers\nGROUP BY Country\nORDER BY Count DESC\nLIMI
T 5"}, {"role": "user", "content": " \n   Find the customer with the most
invoices \n"}, {"role": "assistant", "content": " SELECT \"customers\".Custo
merId AS CustomerId, COUNT(\"invoices\".\"InvoiceId\") AS NumberOfInvoices F
ROM \"customers\" LEFT JOIN \"invoices\" ON \"customers\".CustomerId = \"inv
oices\".CustomerId GROUP BY \"customers\".CustomerId ORDER BY NumberOfInvoic
es DESC LIMIT 1"}, {"role": "user", "content": " \n   List all invoices wi
th a total exceeding $10:\n"}, {"role": "assistant", "content": " SELECT Inv
oiceId, InvoiceDate, CustomerId, BillingAddress, BillingCity, BillingState,

```
BillingCountry, BillingPostalCode, Total FROM \"invoices\" WHERE Total > 1
0"}, {"role": "user", "content": "  \n     Identify artists who have albums
with tracks appearing in multiple genres:\n\n\n"}]
Info: Ollama Response:
{'model': 'mistral:latest', 'created_at': '2024-08-01T19:55:30.142518845Z',
'message': {'role': 'assistant', 'content': ' -- Find distinct genre names f
or each track\n   SELECT DISTINCT "tracks"."GenreId", "genres"."Name" AS Gen
reName FROM "tracks" INNER JOIN "genres" ON "tracks"."GenreId" = "genres"."G
enreId"\n\n   -- Count the number of unique albums for each artist and find
artists with more than one album in multiple genres\n   SELECT "artists".Art
istId, COUNT(DISTINCT "albums"."AlbumId") AS TotalAlbums FROM "artists" LEFT
JOIN "albums" ON "artists".ArtistId = "albums".ArtistId GROUP BY "artists".A
rtistId HAVING TotalAlbums > 1\n\n   -- Join the intermediate_sql and final
query to find artists who have albums with tracks appearing in multiple genr
es\n   SELECT "artists"."Name", "TotalAlbums" FROM (SELECT "artists".ArtistI
d, COUNT(DISTINCT "albums"."AlbumId") AS TotalAlbums FROM "artists" LEFT JOI
N "albums" ON "artists".ArtistId = "albums".ArtistId GROUP BY "artists".Arti
stId HAVING TotalAlbums > 1) AS SubQuery INNER JOIN (SELECT DISTINCT "track
s"."GenreId", COUNT(DISTINCT "albums"."AlbumId") AS GenreCount FROM "tracks"
INNER JOIN "albums" ON "tracks"."AlbumId" = "albums".AlbumId GROUP BY "track
s"."GenreId" HAVING GenreCount > 1) AS GenreCount WHERE SubQuery.ArtistId =
GenreCount.ArtistId'}, 'done_reason': 'stop', 'done': True, 'total_duratio
n': 148702912646, 'load_duration': 3879318, 'prompt_eval_count': 1730, 'prom
pt_eval_duration': 71035158000, 'eval_count': 418, 'eval_duration': 76343363
000}
LLM Response:  -- Find distinct genre names for each track
   SELECT DISTINCT "tracks"."GenreId", "genres"."Name" AS GenreName FROM "tr
acks" INNER JOIN "genres" ON "tracks"."GenreId" = "genres"."GenreId"

   -- Count the number of unique albums for each artist and find artists wit
h more than one album in multiple genres
   SELECT "artists".ArtistId, COUNT(DISTINCT "albums"."AlbumId") AS TotalAlb
ums FROM "artists" LEFT JOIN "albums" ON "artists".ArtistId = "albums".Artis
tId GROUP BY "artists".ArtistId HAVING TotalAlbums > 1

   -- Join the intermediate_sql and final query to find artists who have alb
ums with tracks appearing in multiple genres
   SELECT "artists"."Name", "TotalAlbums" FROM (SELECT "artists".ArtistId, C
OUNT(DISTINCT "albums"."AlbumId") AS TotalAlbums FROM "artists" LEFT JOIN "a
lbums" ON "artists".ArtistId = "albums".ArtistId GROUP BY "artists".ArtistId
HAVING TotalAlbums > 1) AS SubQuery INNER JOIN (SELECT DISTINCT "tracks"."Ge
nreId", COUNT(DISTINCT "albums"."AlbumId") AS GenreCount FROM "tracks" INNER
JOIN "albums" ON "tracks"."AlbumId" = "albums".AlbumId GROUP BY "tracks"."Ge
nreId" HAVING GenreCount > 1) AS GenreCount WHERE SubQuery.ArtistId = GenreC
ount.ArtistId
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
```

Check completion time

In [ ]:

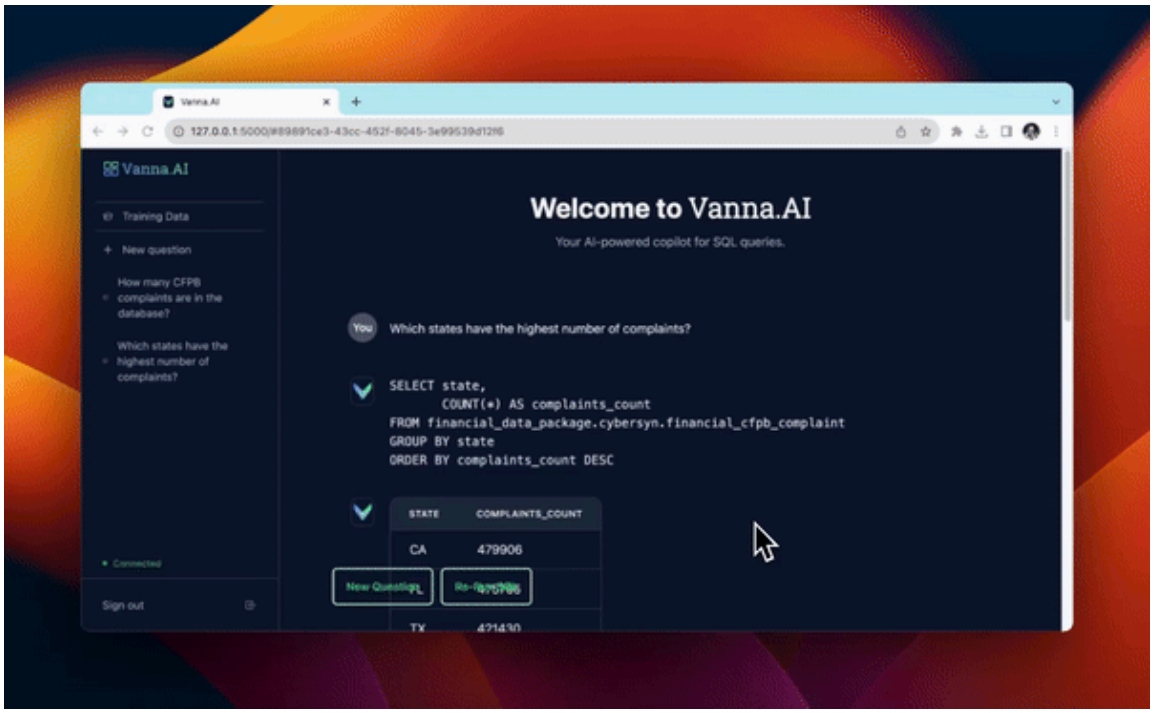
In [40]:
```
ts_stop = time()

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

```
test running on 'ducklover1' with 'mistral' LLM took : 2289.66 sec
```

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

```
2024-08-01 15:55:30.159143
```

Launch the User Interface



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