**Task 1: Data Model Design**

**Design a psql data model to represent shared resources with the following attributes:**

**Resource ID**

**Resource Name**

**Category (either 'shared' or 'exclusive')**

**Linked Resources (a list of linked resource IDs, if any)**

### Created a data model

CREATE TABLE resources (

resource\_id SERIAL PRIMARY KEY,

resource\_name VARCHAR(255) NOT NULL,

category VARCHAR(10) CHECK (category IN ('shared', 'exclusive')) NOT NULL,

linked\_resources INTEGER[] DEFAULT '{}'::INTEGER[]

);

### Inserted the attribute values

INSERT INTO public.resources (resource\_name, category, linked\_resources)

VALUES

('Resource3', 'shared', '{4}'),

('Resource4', 'exclusive', NULL),

('Resource5', 'shared', '{6, 7}'),

('Resource6', 'exclusive', NULL),

('Resource7', 'shared', '{8, 9}'),

('Resource8', 'exclusive', NULL),

('Resource9', 'shared', '{10}'),

('Resource10', 'exclusive', NULL),

('Resource11', 'shared', '{12, 13}'),

('Resource12', 'exclusive', NULL),

('Resource13', 'shared', '{14}'),

('Resource14', 'exclusive', NULL),

('Resource15', 'shared', '{16, 17}'),

('Resource16', 'exclusive', NULL),

('Resource17', 'shared', '{18}'),

('Resource18', 'exclusive', NULL),

('Resource19', 'shared', '{20}'),

('Resource20', 'exclusive', NULL),

('Resource21', 'shared', '{22, 23}'),

('Resource22', 'exclusive', NULL),

('Resource23', 'shared', '{24}'),

('Resource24', 'exclusive', NULL),

('Resource25', 'shared', '{26, 27}'),

('Resource26', 'exclusive', NULL),

('Resource27', 'shared', '{28}'),

('Resource28', 'exclusive', NULL),

('Resource29', 'shared', '{30}'),

('Resource30', 'exclusive', NULL),

('Resource31', 'shared', '{32, 33}'),

('Resource32', 'exclusive', NULL),

('Resource33', 'shared', '{34}'),

('Resource34', 'exclusive', NULL),

('Resource35', 'shared', '{36, 37}'),

('Resource36', 'exclusive', NULL),

('Resource37', 'shared', '{38}'),

('Resource38', 'exclusive', NULL),

('Resource39', 'shared', '{40}'),

('Resource40', 'exclusive', NULL),

('Resource41', 'shared', '{42, 43}'),

('Resource42', 'exclusive', NULL),

('Resource43', 'shared', '{44}'),

('Resource44', 'exclusive', NULL),

('Resource45', 'shared', '{46, 47}'),

('Resource46', 'exclusive', NULL),

('Resource47', 'shared', '{48}'),

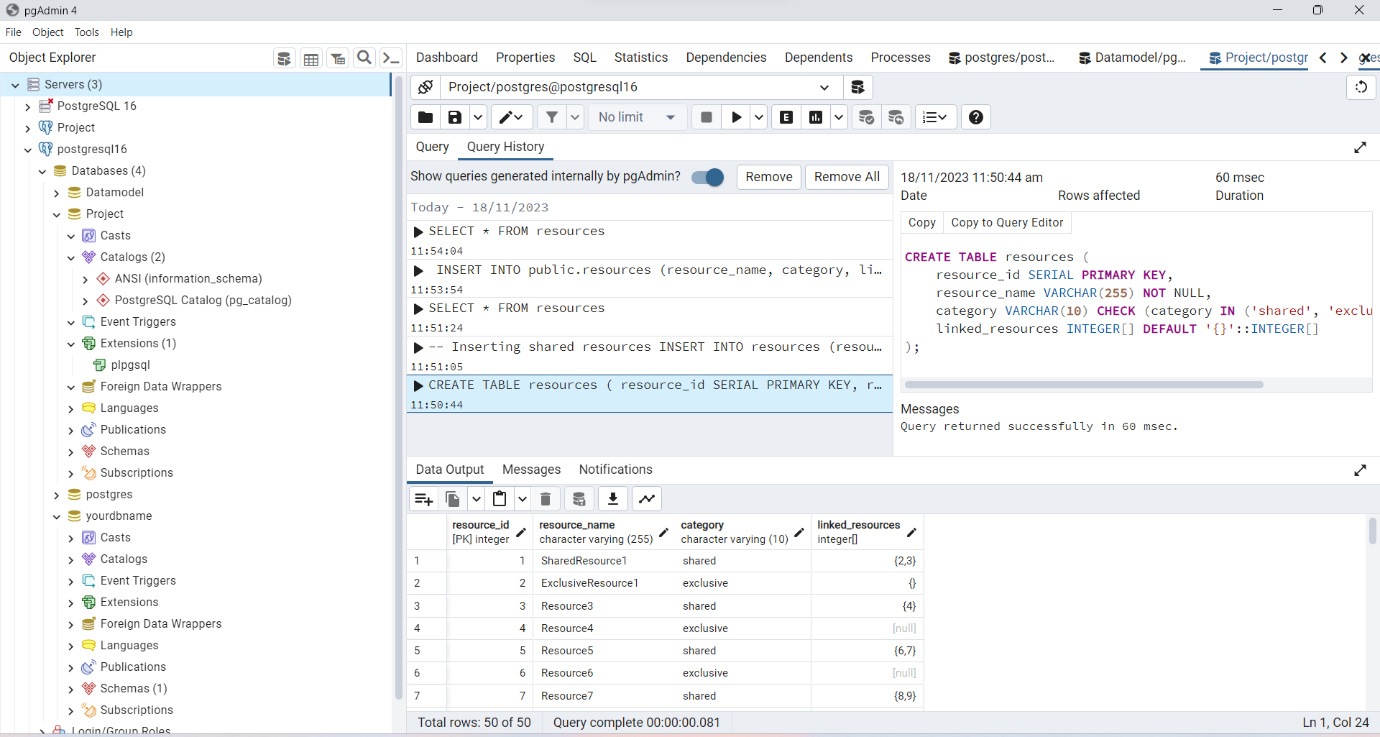
('Resource48', 'exclusive', NULL),

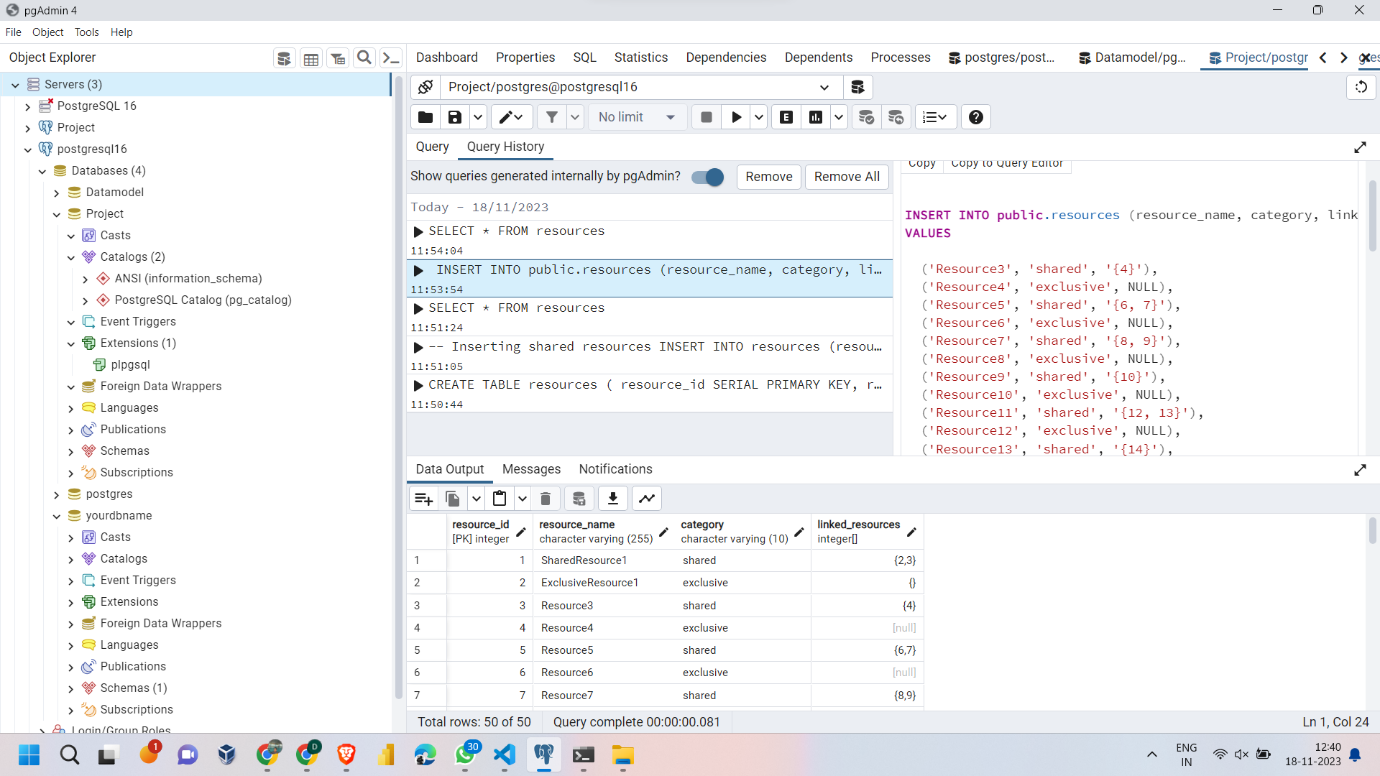
('Resource49', 'shared', '{50}'),

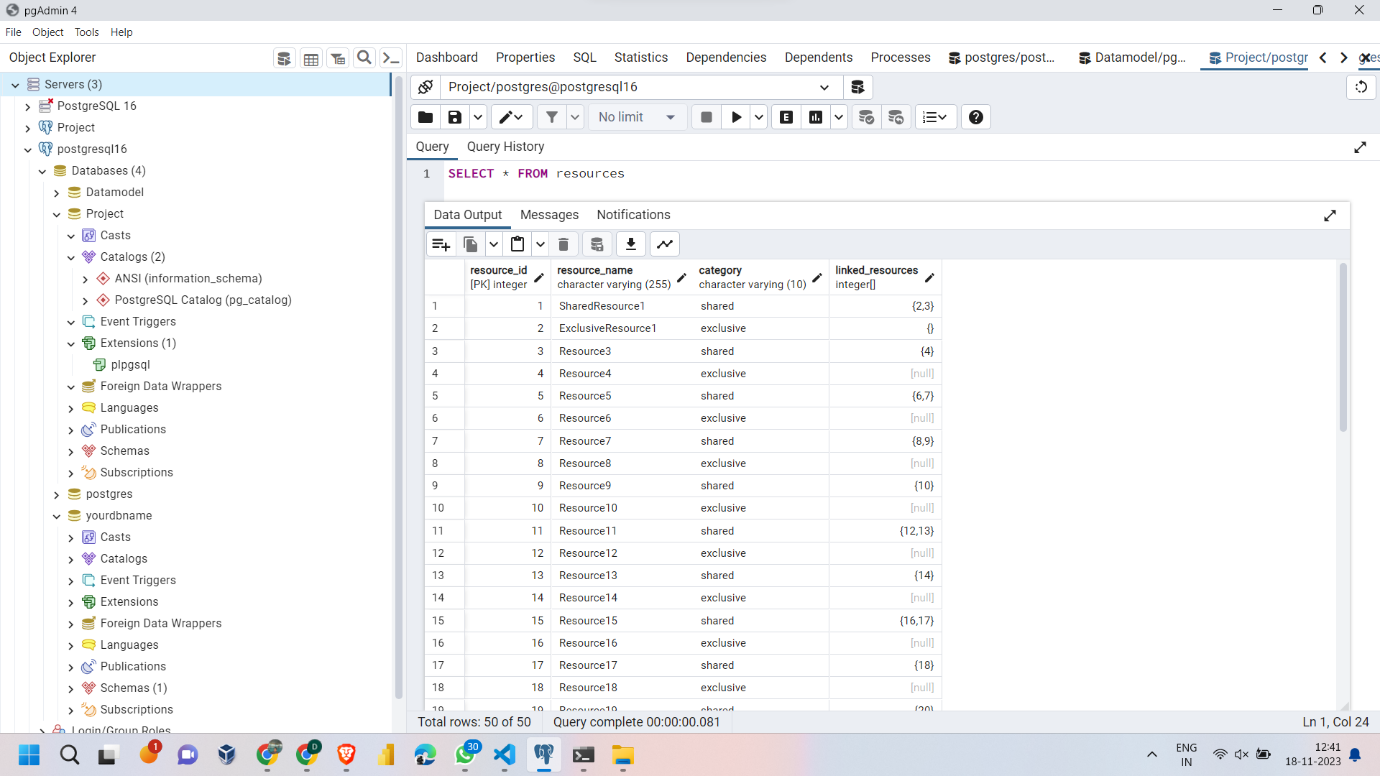
('Resource50', 'exclusive', NULL);

###

SELECT \* FROM resources

****

****

****

**Task 2: Access Control System**

**Implement an access control system that allows devices to request access to shared resources while adhering to the**

**following rules:**

**Devices can request access to shared resources.**

**Exclusive resources can only be accessed by one device at a time.**

**Shared resources can be accessed by multiple devices simultaneously unless they are linked.**

**If one device has access to a shared resource, other devices cannot access linked shared resources until the first**

**device releases its access.**

**Implement a mechanism to prevent deadlocks when multiple devices request access to linked shared resources**

import psycopg2

from contextlib import contextmanager

# **Establish a connection to the PostgreSQL database**

connection = psycopg2.connect(

dbname="Project",

user="postgres",

password="psql@123",

host="localhost",

port="5432"

)

@contextmanager

def get\_cursor():

with connection:

with connection.cursor() as cursor:

yield cursor

# **Function to request access to a resource**

def request\_access(device\_id, resource\_id):

with get\_cursor() as cursor:

cursor.execute("SELECT category FROM resources WHERE resource\_id = %s;", (resource\_id,))

category = cursor.fetchone()[0]

if category == 'exclusive':

# **Check if the resource is already in use**

cursor.execute("SELECT COUNT(\*) FROM resources WHERE resource\_id = %s AND category = 'exclusive';", (resource\_id,))

count = cursor.fetchone()[0]

if count == 0:

# **Grant access to the exclusive resource**

cursor.execute("UPDATE resources SET linked\_resources = array\_append(linked\_resources, %s) WHERE resource\_id = %s;", (device\_id, resource\_id,))

print(f"Device {device\_id} granted access to exclusive resource {resource\_id}.")

else:

print(f"Exclusive resource {resource\_id} is already in use.")

elif category == 'shared':

# **Check if linked resources are available**

cursor.execute("SELECT linked\_resources FROM resources WHERE resource\_id = %s;", (resource\_id,))

linked\_resources = cursor.fetchone()[0]

if not linked\_resources or all(linked\_device == device\_id for linked\_device in linked\_resources):

# **Grant access to the shared resource**

cursor.execute("UPDATE resources SET linked\_resources = array\_append(linked\_resources, %s) WHERE resource\_id = %s;", (device\_id, resource\_id,))

print(f"Device {device\_id} granted access to shared resource {resource\_id}.")

else:

print(f"Device {device\_id} cannot access linked shared resources until the first device releases its access.")

else:

print("Invalid resource category.")

# **Function to release access to a resource**

def release\_access(device\_id, resource\_id):

with get\_cursor() as cursor:

cursor.execute("UPDATE resources SET linked\_resources = array\_remove(linked\_resources, %s) WHERE resource\_id = %s;", (device\_id, resource\_id,))

print(f"Device {device\_id} released access to resource {resource\_id}.")

# Example usage:

for resource\_id in range(1, 51):

request\_access(1, resource\_id)

request\_access(2, resource\_id)

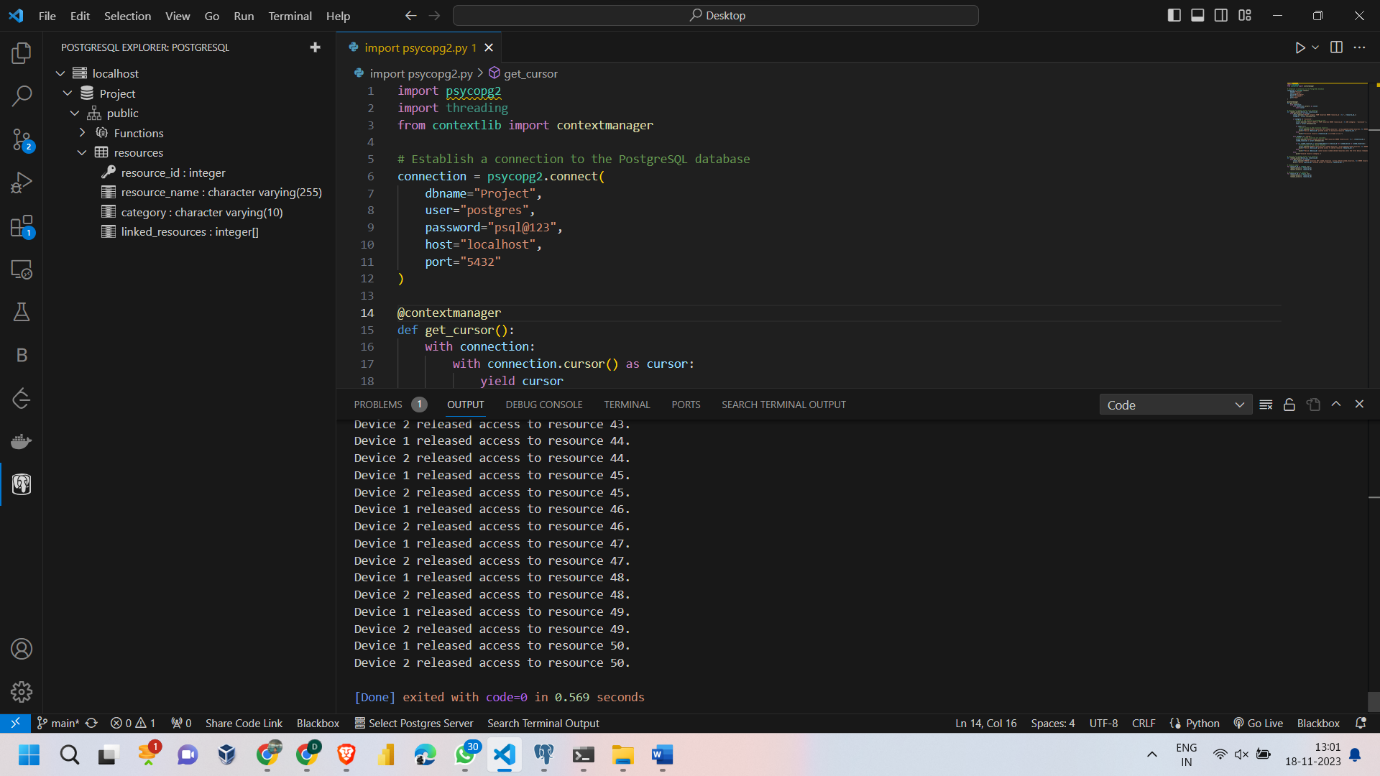
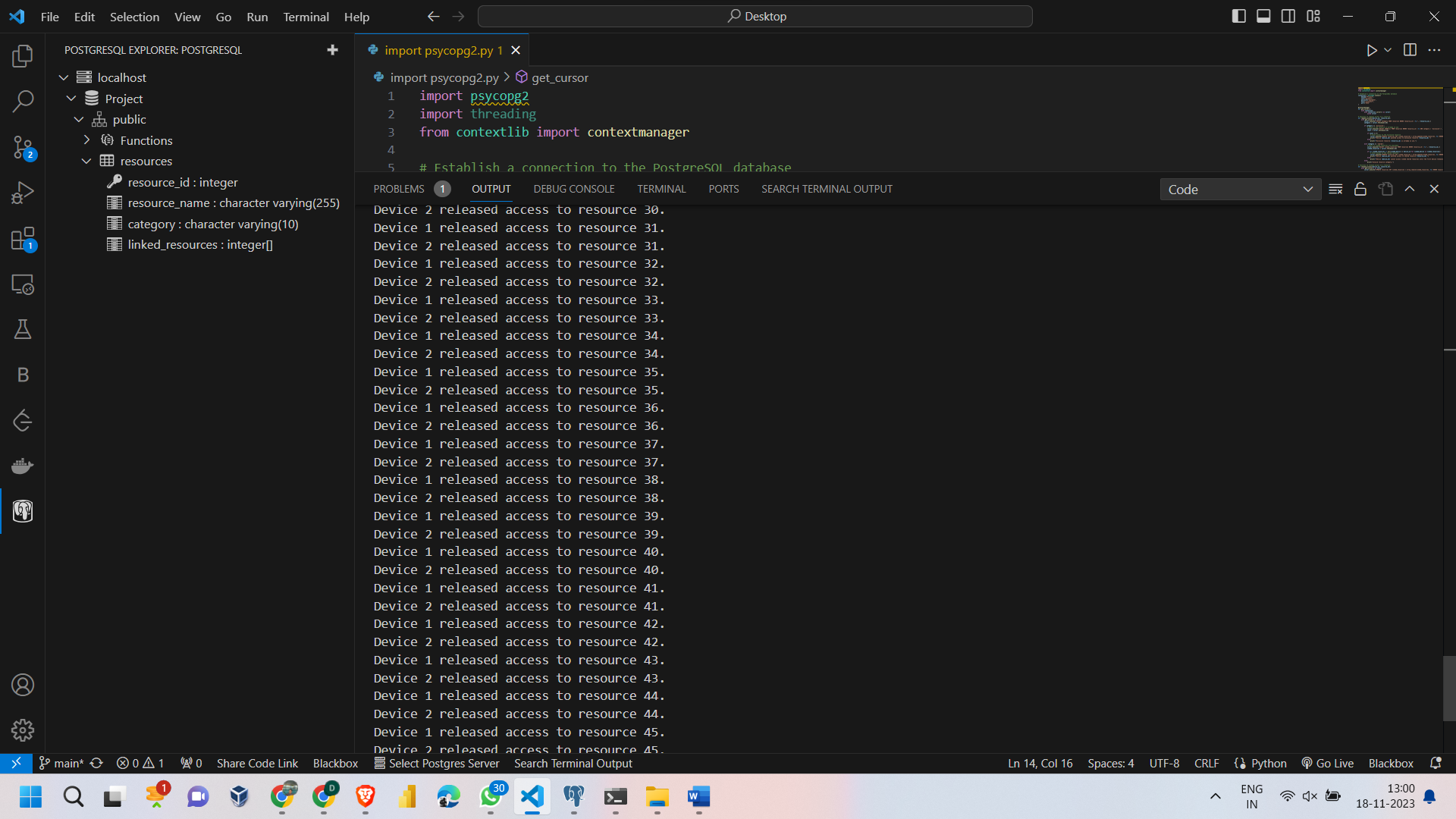
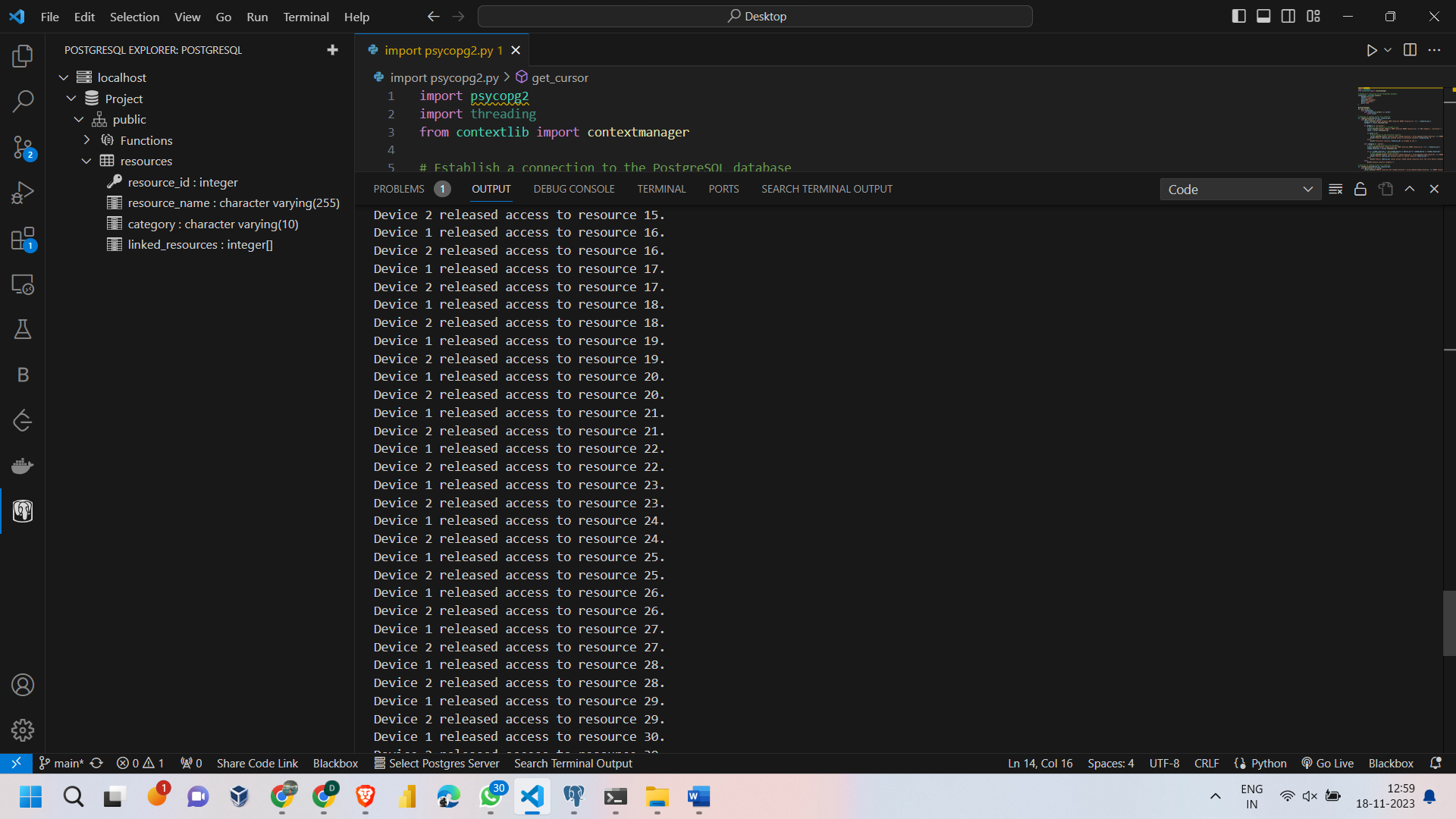
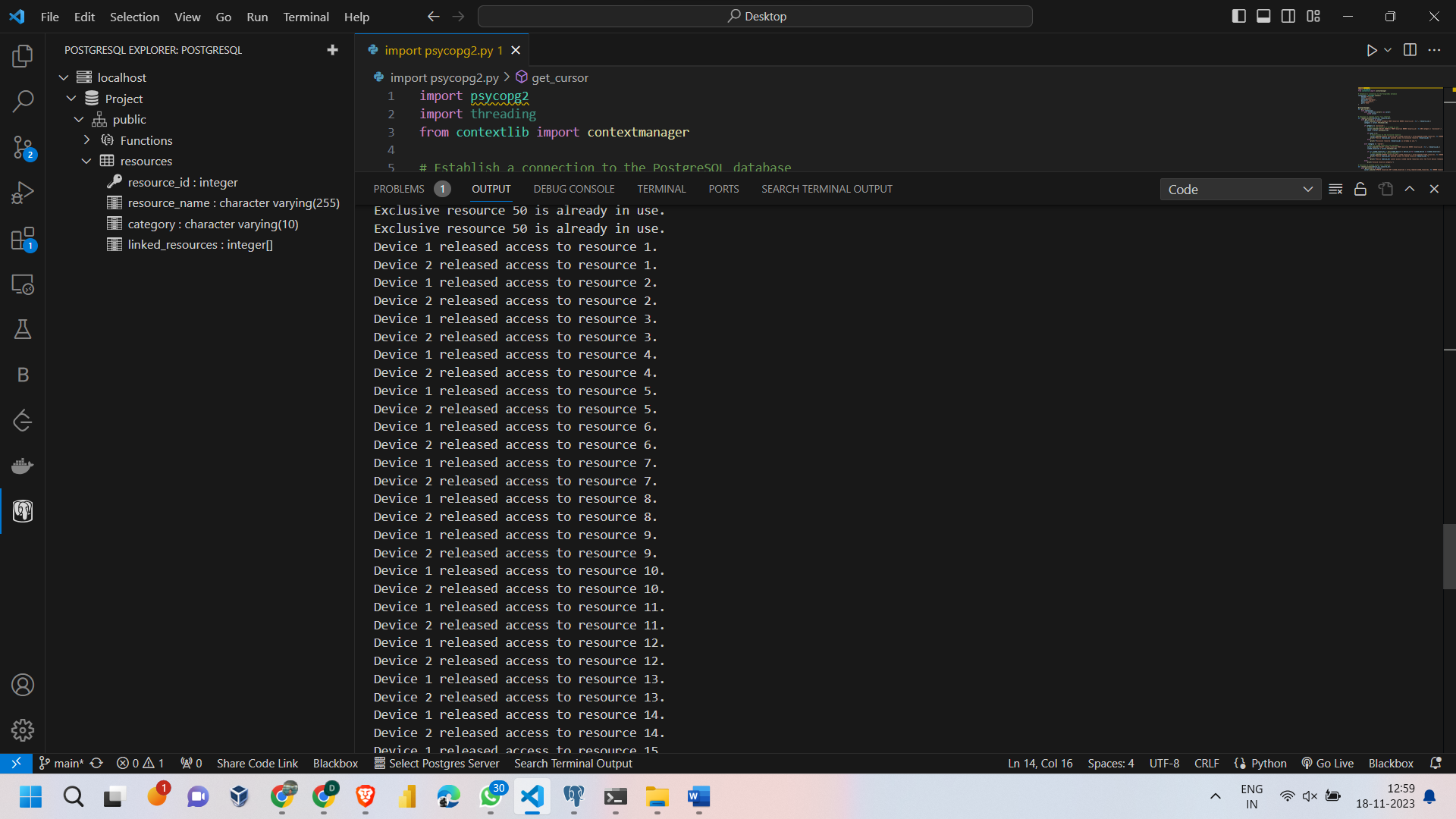
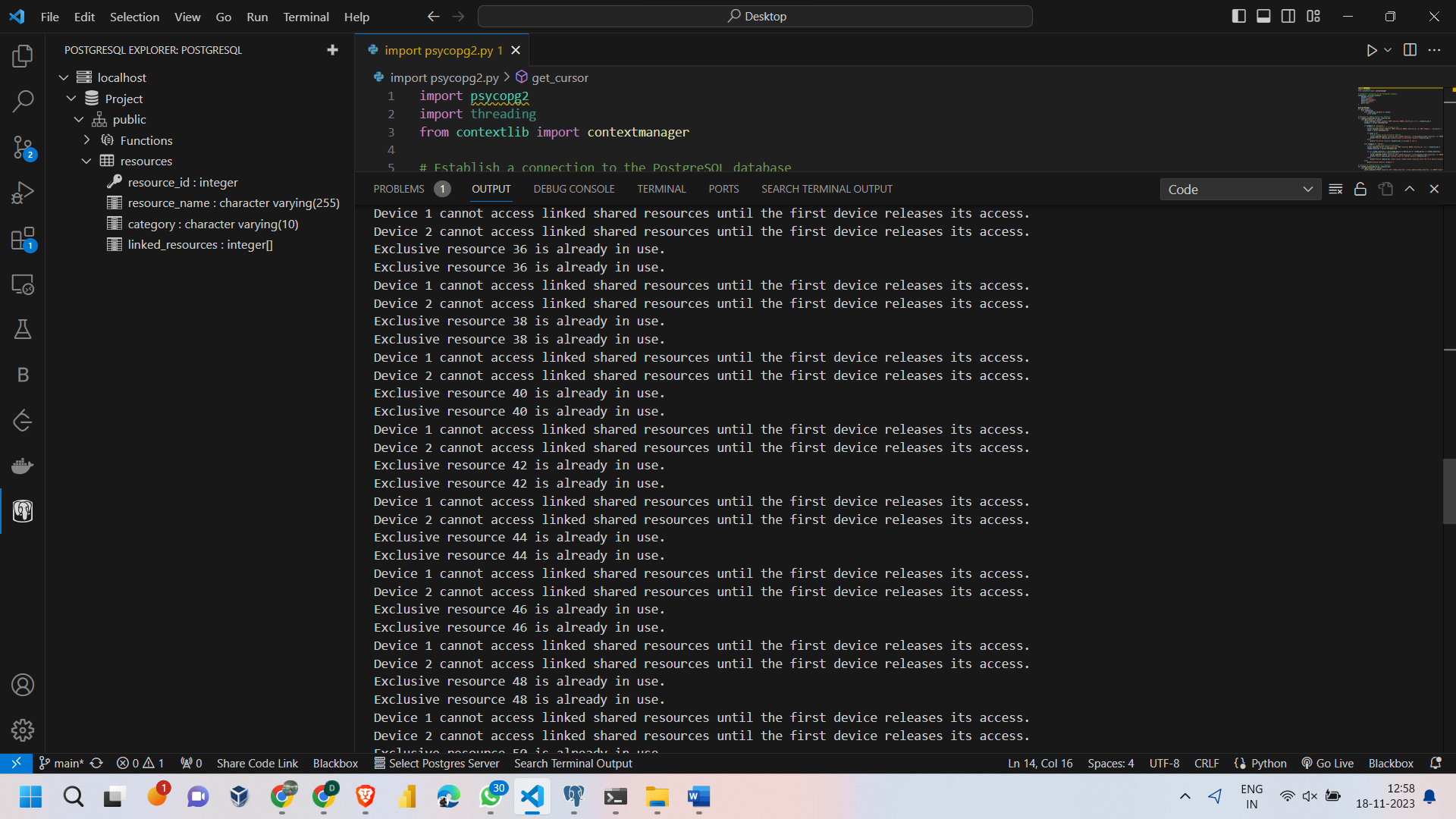
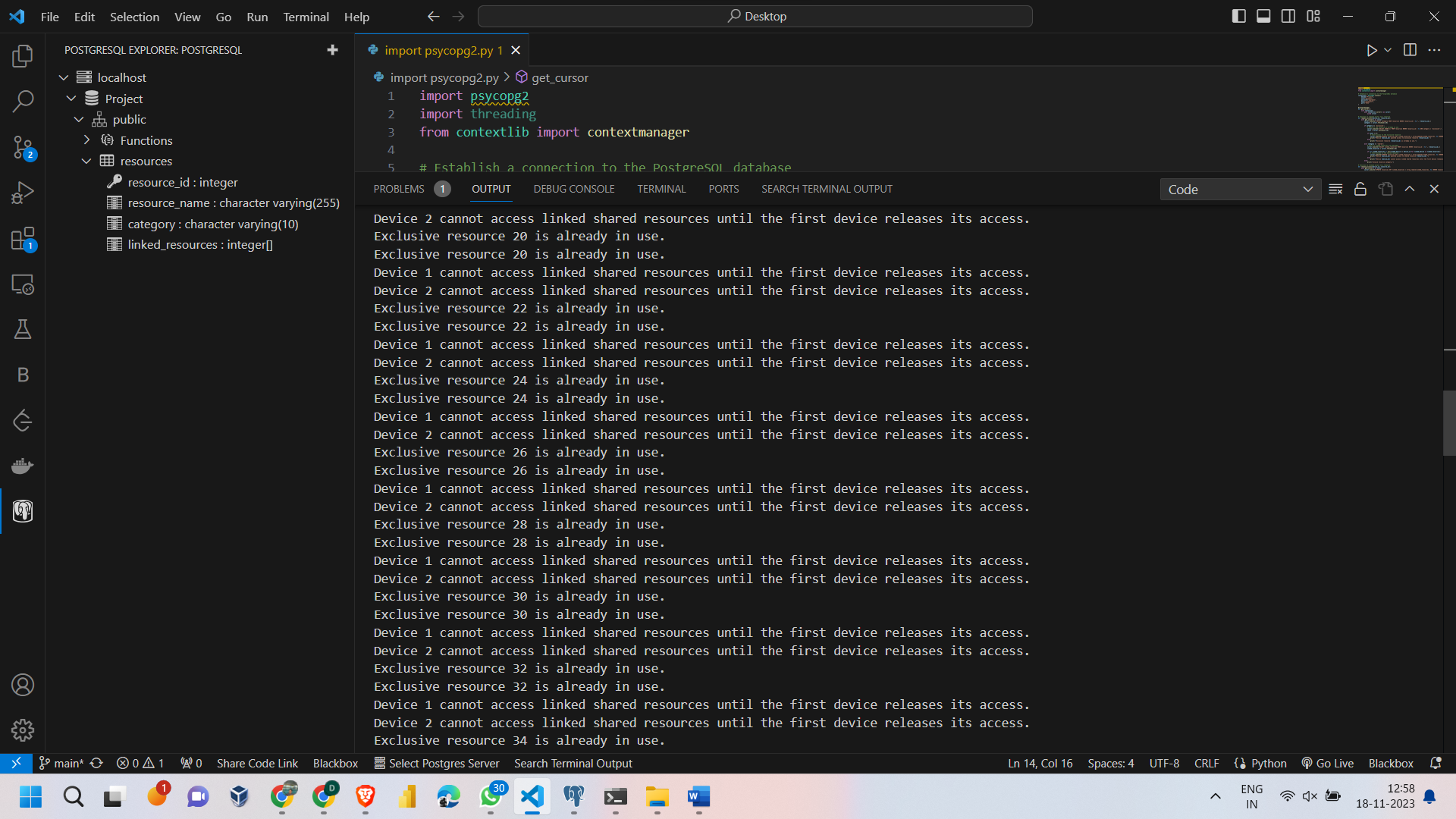
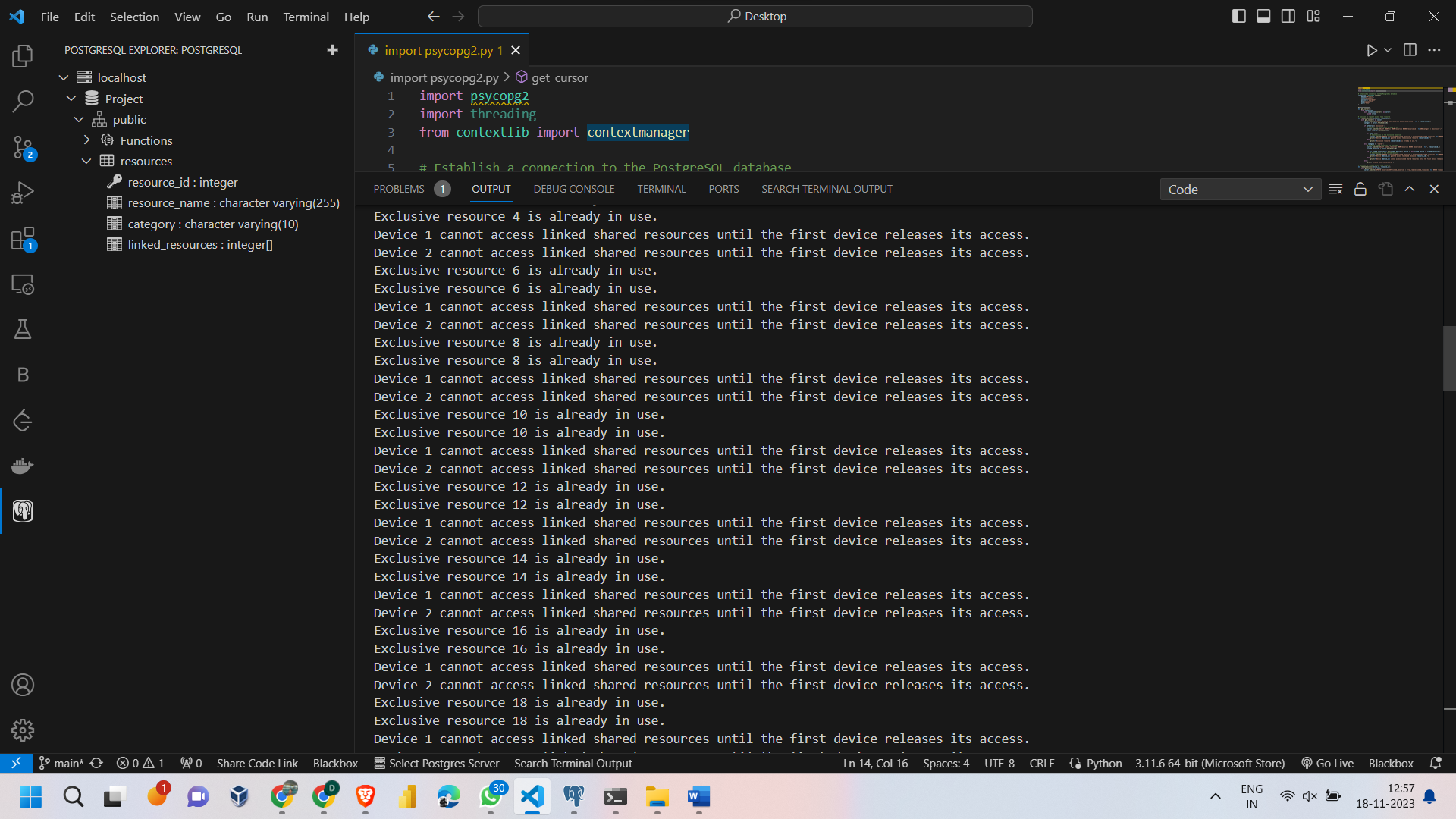
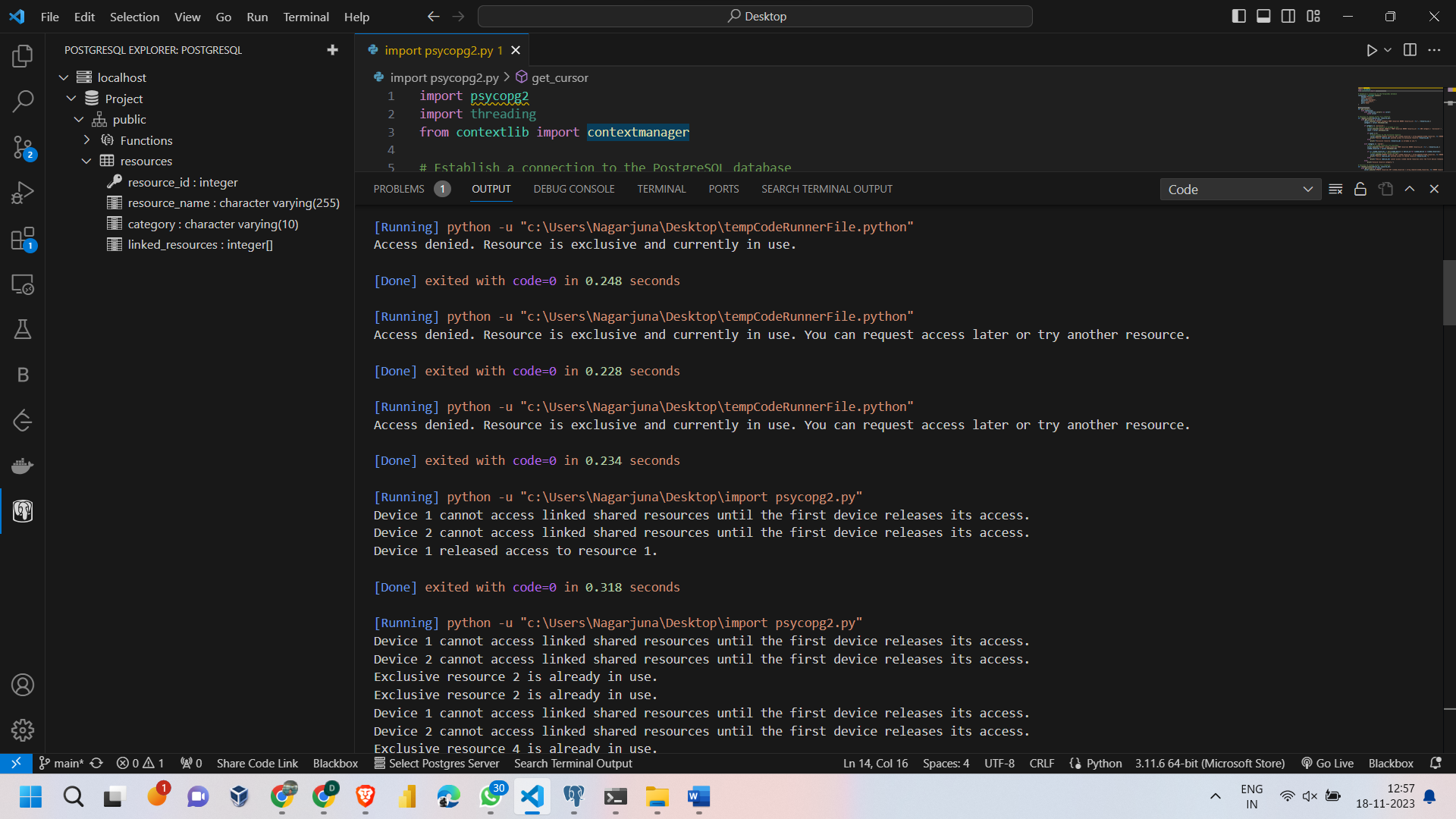
# **Release access to resources**

for resource\_id in range(1, 51):

release\_access(1, resource\_id)

release\_access(2, resource\_id)

**Output:-**



[Running] python -u "c:\Users\Nagarjuna\Desktop\tempCodeRunnerFile.python"

Access denied. Resource is exclusive and currently in use.

[Done] exited with code=0 in 0.248 seconds

[Running] python -u "c:\Users\Nagarjuna\Desktop\tempCodeRunnerFile.python"

Access denied. Resource is exclusive and currently in use. You can request access later or try another resource.

[Done] exited with code=0 in 0.228 seconds

[Running] python -u "c:\Users\Nagarjuna\Desktop\tempCodeRunnerFile.python"

Access denied. Resource is exclusive and currently in use. You can request access later or try another resource.

[Done] exited with code=0 in 0.234 seconds

[Running] python -u "c:\Users\Nagarjuna\Desktop\import psycopg2.py"

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Device 1 released access to resource 1.

[Done] exited with code=0 in 0.318 seconds

[Running] python -u "c:\Users\Nagarjuna\Desktop\import psycopg2.py"

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 2 is already in use.

Exclusive resource 2 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 4 is already in use.

Exclusive resource 4 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 6 is already in use.

Exclusive resource 6 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 8 is already in use.

Exclusive resource 8 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 10 is already in use.

Exclusive resource 10 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 12 is already in use.

Exclusive resource 12 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 14 is already in use.

Exclusive resource 14 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 16 is already in use.

Exclusive resource 16 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 18 is already in use.

Exclusive resource 18 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 20 is already in use.

Exclusive resource 20 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 22 is already in use.

Exclusive resource 22 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 24 is already in use.

Exclusive resource 24 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 26 is already in use.

Exclusive resource 26 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 28 is already in use.

Exclusive resource 28 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 30 is already in use.

Exclusive resource 30 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 32 is already in use.

Exclusive resource 32 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 34 is already in use.

Exclusive resource 34 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 36 is already in use.

Exclusive resource 36 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 38 is already in use.

Exclusive resource 38 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 40 is already in use.

Exclusive resource 40 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 42 is already in use.

Exclusive resource 42 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 44 is already in use.

Exclusive resource 44 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 46 is already in use.

Exclusive resource 46 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 48 is already in use.

Exclusive resource 48 is already in use.

Device 1 cannot access linked shared resources until the first device releases its access.

Device 2 cannot access linked shared resources until the first device releases its access.

Exclusive resource 50 is already in use.

Exclusive resource 50 is already in use.

Device 1 released access to resource 1.

Device 2 released access to resource 1.

Device 1 released access to resource 2.

Device 2 released access to resource 2.

Device 1 released access to resource 3.

Device 2 released access to resource 3.

Device 1 released access to resource 4.

Device 2 released access to resource 4.

Device 1 released access to resource 5.

Device 2 released access to resource 5.

Device 1 released access to resource 6.

Device 2 released access to resource 6.

Device 1 released access to resource 7.

Device 2 released access to resource 7.

Device 1 released access to resource 8.

Device 2 released access to resource 8.

Device 1 released access to resource 9.

Device 2 released access to resource 9.

Device 1 released access to resource 10.

Device 2 released access to resource 10.

Device 1 released access to resource 11.

Device 2 released access to resource 11.

Device 1 released access to resource 12.

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Device 1 released access to resource 13.

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Device 1 released access to resource 47.

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Device 1 released access to resource 48.

Device 2 released access to resource 48.

Device 1 released access to resource 49.

Device 2 released access to resource 49.

Device 1 released access to resource 50.

Device 2 released access to resource 50.

[Done] exited with code=0 in 0.569 seconds