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AKURDI PUNE

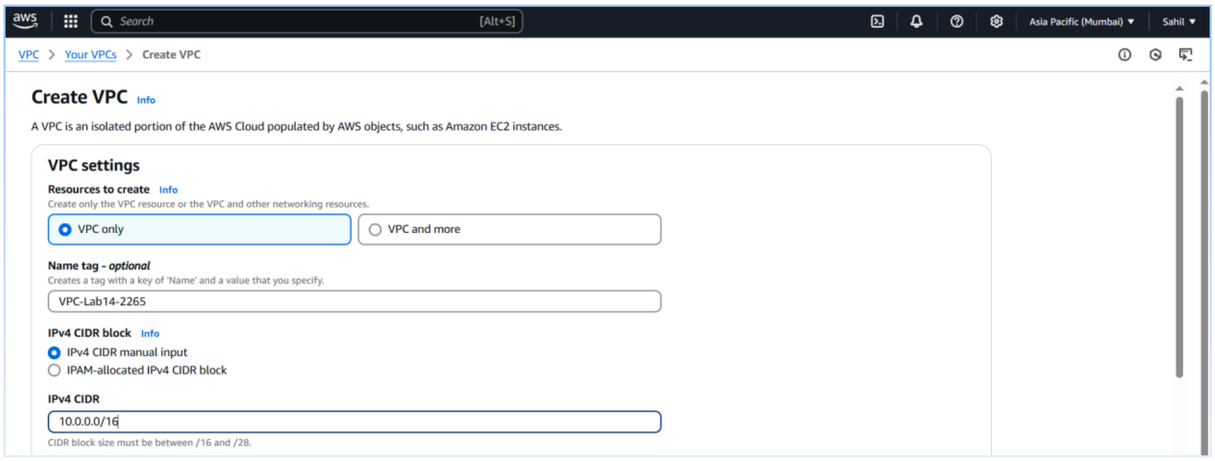
School of Computer Science, Engineering and Applications (SCSEA)
B. Tech TY (CCSA)
Subject: Cloud Architecture And Protocol

Name of the Student: **Sahil S. Mandawgade** **PRN:** **20220802265**

Title of Practical: **14. Deploying a secure AWS RDS Instance and connecting via Lambda & MySQL workbench.**

Step 1: Create a VPC with Private Subnet.

- Login to the AWS management console and go to VPC.
- Create a private VPC (VPC with Private Subnet).
  - Select 'VPC only'.
  - Name it as 'VPC-Lab14-2265'.
  - Set IPv4 CIDR Block as '10.0.0.0/16'.
  - Click on 'Create VPC'.



Create VPC Info

A VPC is an isolated portion of the AWS Cloud populated by AWS objects, such as Amazon EC2 instances.

VPC settings

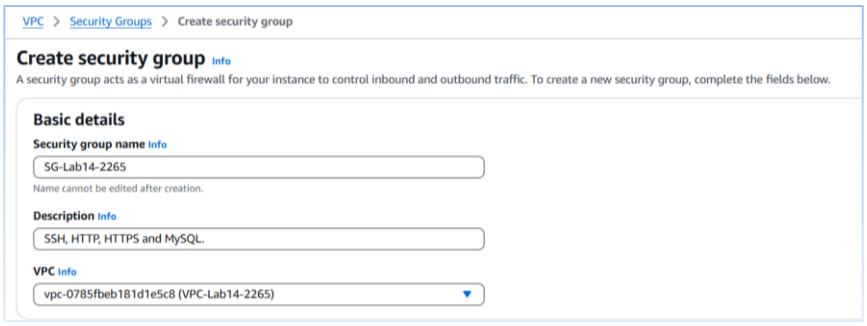
Resources to create Info
Create only the VPC resource or the VPC and other networking resources.
[✓ VPC only] VPC and more

Name tag - *optional*
Creates a tag with a key of 'Name' and a value that you specify.
VPC-Lab14-2265

IPv4 CIDR block Info
[✓ IPv4 CIDR manual input] IPAM-allocated IPv4 CIDR block

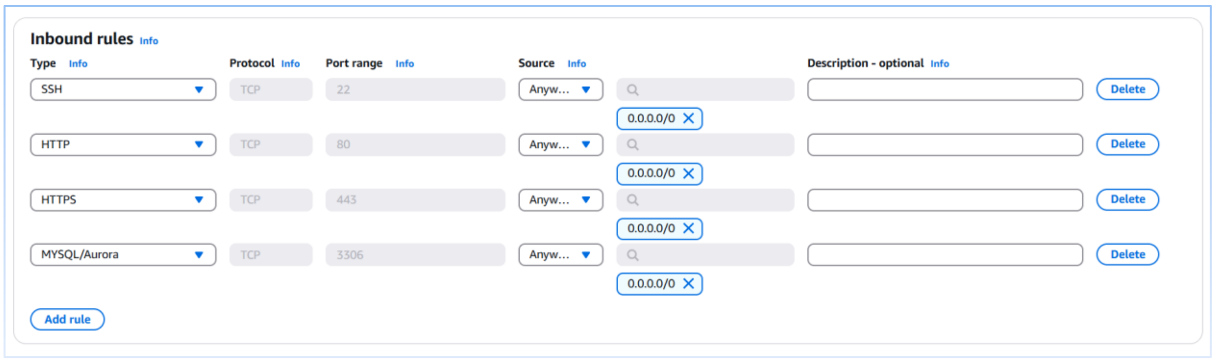
IPv4 CIDR
10.0.0.0/16
CIDR block size must be between /16 and /28.

- Now, create a security group for our private VPC.
  - Go to Security groups – Click on 'Create security group'.
  - Name it as 'SG-Lab14-2265' and add description.
  - Select our VPC i.e. 'VPC-Lab14-2265'.
  - Add Inbound rules-
    - Type – SSH, HTTP, HTTPS and MySQL/Aurora
    - Source – 'Anywhere IPv4' for all rules.


VPC > Security Groups > Create security group

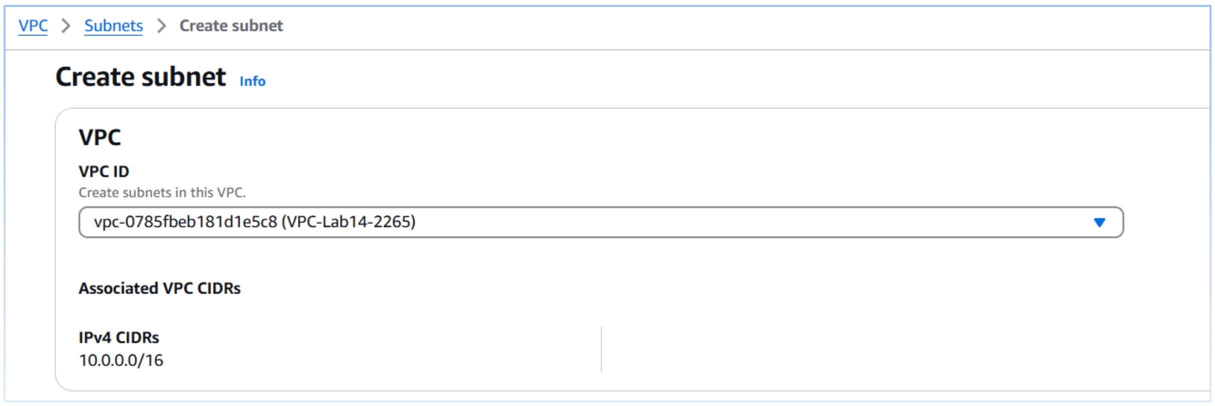
Create security group Info
A security group acts as a virtual firewall for your instance to control inbound and outbound traffic. To create a new security group, complete the fields below.

Basic details
Security group name: SG-Lab14-2265
Name cannot be edited after creation.
Description: SSH, HTTP, HTTPS and MySQL.
VPC: vpc-0785fbeb181d1e5c8 (VPC-Lab14-2265)


Inbound rules

Type	Protocol	Port range	Source		Description - optional
SSH	TCP	22	Anyw...	0.0.0.0/0	
HTTP	TCP	80	Anyw...	0.0.0.0/0	
HTTPS	TCP	443	Anyw...	0.0.0.0/0	
MYSQL/Aurora	TCP	3306	Anyw...	0.0.0.0/0	

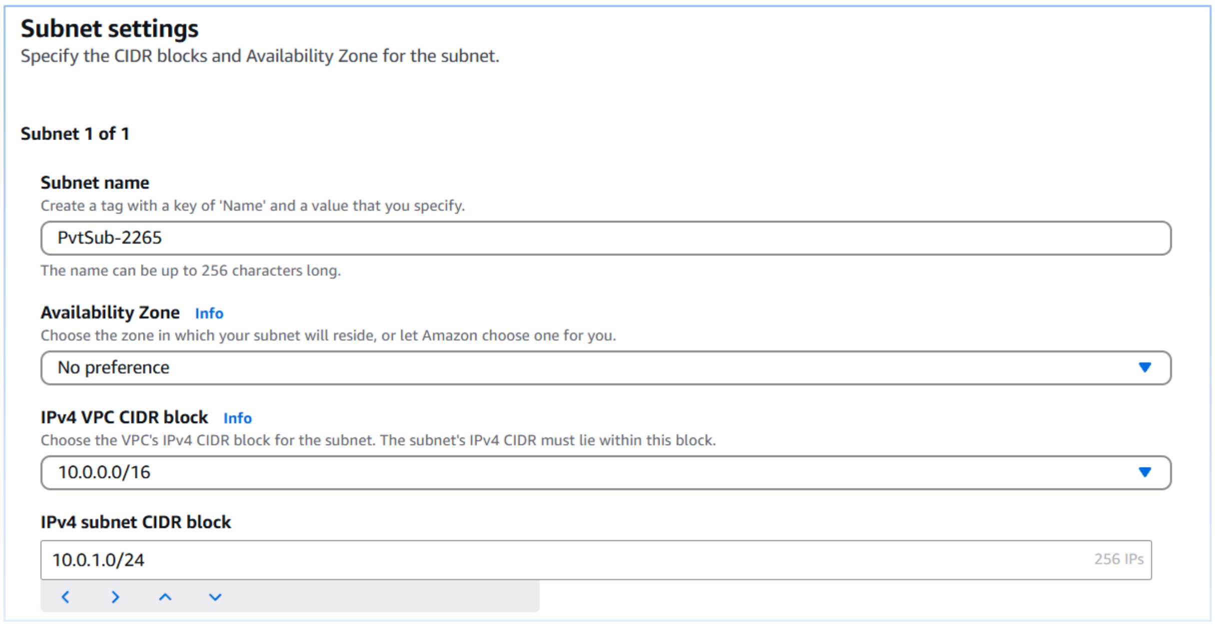
- Now, go to the subnet section and create a subnet for our private VPC.
  - Select VPC i.e. 'VPC-Lab14-2265'.
  - Set subnet name as 'PvtSub-2265'.
  - Set IPv4 subnet CIDR block as '10.0.1.0/24'.
  - Click on 'Create subnet'.


VPC > Subnets > Create subnet

Create subnet Info

VPC
VPC ID
Create subnets in this VPC.
vpc-0785fbeb181d1e5c8 (VPC-Lab14-2265)

Associated VPC CIDRs
IPv4 CIDRs
10.0.0.0/16



Subnet settings
Specify the CIDR blocks and Availability Zone for the subnet.

Subnet 1 of 1

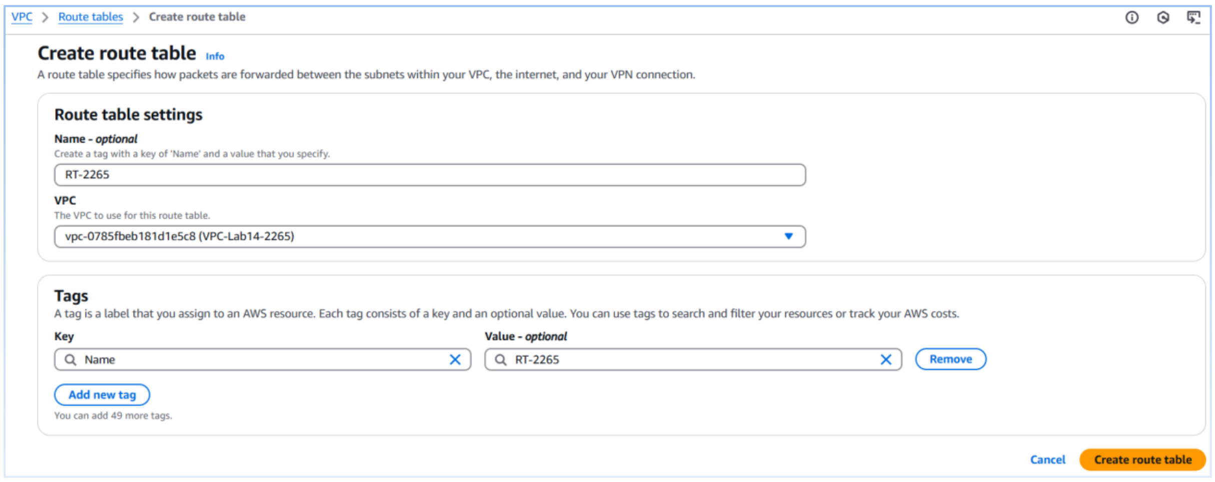
Subnet name
Create a tag with a key of 'Name' and a value that you specify.
PvtSub-2265
The name can be up to 256 characters long.

Availability Zone Info
Choose the zone in which your subnet will reside, or let Amazon choose one for you.
No preference

IPv4 VPC CIDR block Info
Choose the VPC's IPv4 CIDR block for the subnet. The subnet's IPv4 CIDR must lie within this block.
10.0.0.0/16

IPv4 subnet CIDR block
10.0.1.0/24 256 IPs

- Now, go to the route table section and create a route table for our subnet.
  - Set name as ‘RT-2265’.
  - Select our VPC i.e. ‘VPC-Lab14-2265’.
  - Click on ‘Create route table’.



Create route table Info
A route table specifies how packets are forwarded between the subnets within your VPC, the internet, and your VPN connection.

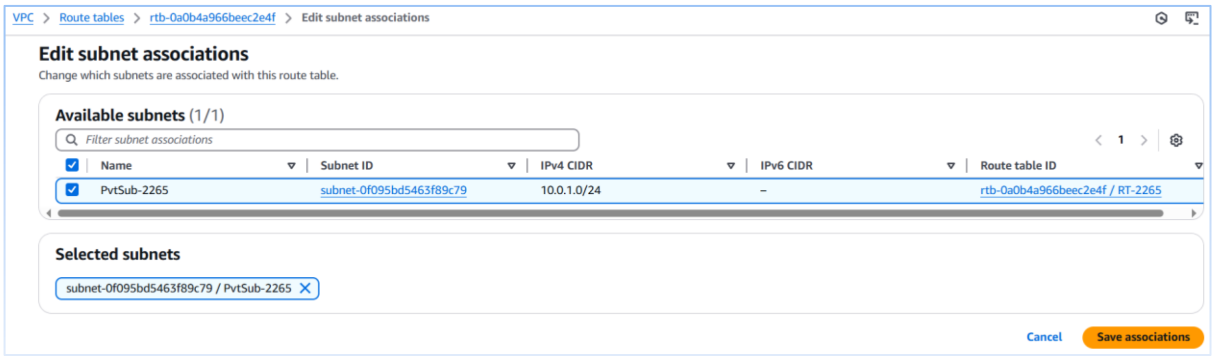
Route table settings
Name - *optional*
Create a tag with a key of 'Name' and a value that you specify.
RT-2265
VPC
The VPC to use for this route table.
vpc-0785fbeb181d1e5c8 (VPC-Lab14-2265)

Tags
A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

Key	Value - *optional*
Name	RT-2265

- Now, associate the subnet to this route table.
  - Go to ‘Subnet associations’ tab.

- Click on 'Edit subnet associations'.
- Select the subnet (PvtSub-2265) and click on 'Save associations'.


VPC > Route tables > rtb-0a0b4a966beec2e4f > Edit subnet associations

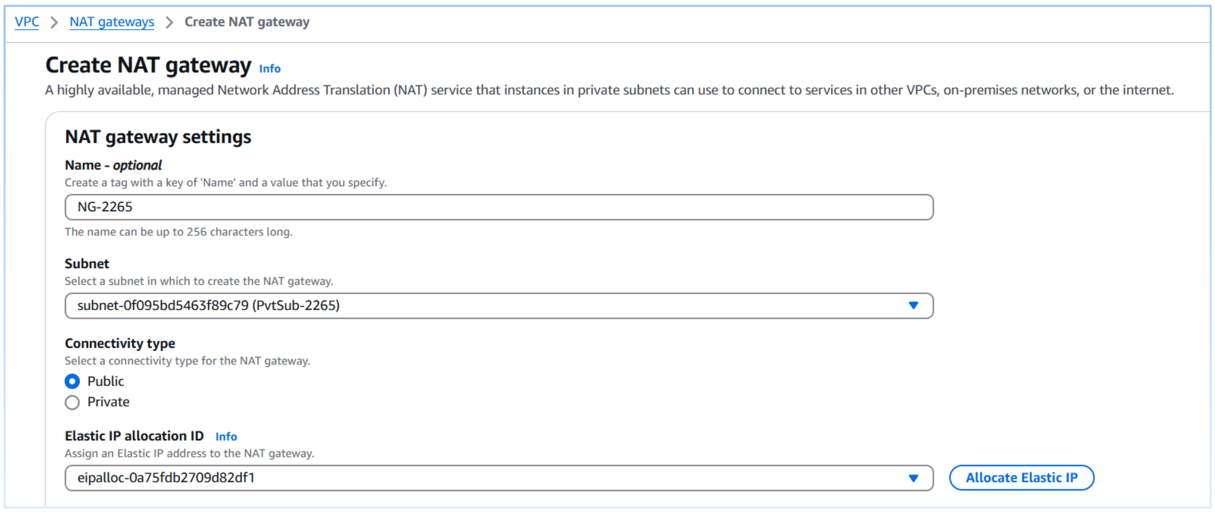
Edit subnet associations
Change which subnets are associated with this route table.

Available subnets (1/1)

✓	Name	Subnet ID	IPv4 CIDR	IPv6 CIDR	Route table ID
✓	PvtSub-2265	subnet-0f095bd5463f89c79	10.0.1.0/24	–	rtb-0a0b4a966beec2e4f / RT-2265

Selected subnets
subnet-0f095bd5463f89c79 / PvtSub-2265

- Now, go to the 'NAT gateways' section and create a NAT gateway for our VPC.
  - Set name of NAT Gateway as 'NG-2265'
  - Select our subnet i.e. 'PvtSub-2265'.
  - Click on 'Allocate Elastic IP'.
  - Click on 'Create NAT gateway'.


VPC > NAT gateways > Create NAT gateway

Create NAT gateway Info
A highly available, managed Network Address Translation (NAT) service that instances in private subnets can use to connect to services in other VPCs, on-premises networks, or the internet.

NAT gateway settings

Name - *optional*
Create a tag with a key of 'Name' and a value that you specify.
NG-2265
The name can be up to 256 characters long.

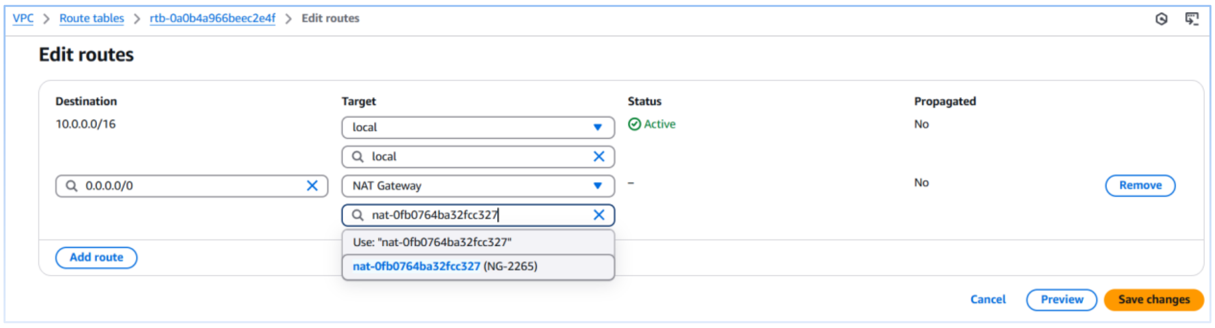
Subnet
Select a subnet in which to create the NAT gateway.
subnet-0f095bd5463f89c79 (PvtSub-2265)

Connectivity type
Select a connectivity type for the NAT gateway.
[✓ Public]
Private

Elastic IP allocation ID Info
Assign an Elastic IP address to the NAT gateway.
eipalloc-0a75fdb2709d82df1

- Now, go to the private route table and edit the route for the NAT gateway.
  - Go to 'Routes' tab of the route table 'RT-2265'.
  - Click on 'Edit routes'.
  - Click on 'Add route'.

- Set Destination as '0.0.0.0/0' and Target as 'NAT Gateway' and select our NAT Gateway i.e. 'NG-2265'.
- Click on 'Save changes'.



VPC > Route tables > rtb-0a0b4a966beec2e4f > Edit routes

Edit routes

Destination	Target	Status	Propagated	
10.0.0.0/16	local	Active	No	
0.0.0.0/0	NAT Gateway nat-0fb0764ba32fcc327	-	No	Remove

Use: "nat-0fb0764ba32fcc327"
nat-0fb0764ba32fcc327 (NG-2265)

Step 2: Deploy RDS.

- Go to RDS and go to 'Databases' tab.
- Click on 'Create database'.
- Choose DB creation method as 'Standard create'.
- Select Engine type as 'MySQL'.
- In Templates, select **'Free tier'**.

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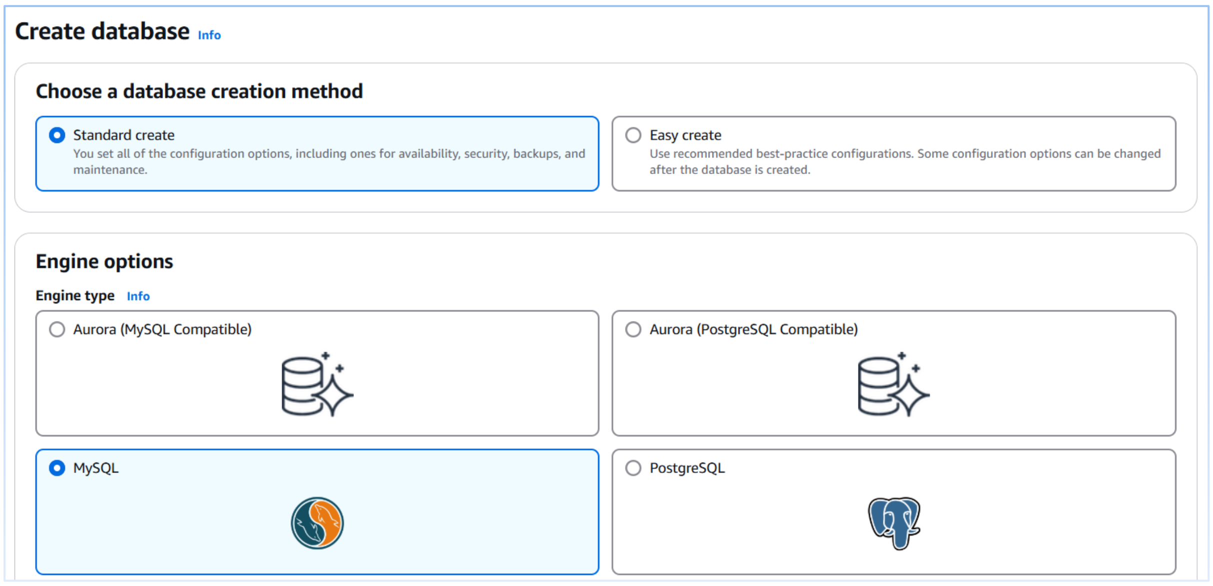


Create database Info

Choose a database creation method

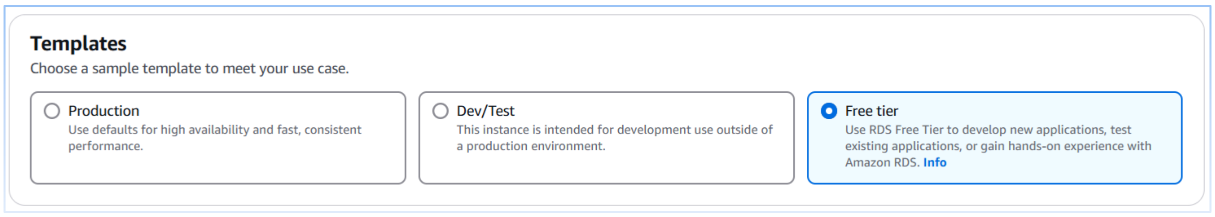
[✓ Standard create] You set all of the configuration options, including ones for availability, security, backups, and maintenance.

Easy create — Use recommended best-practice configurations. Some configuration options can be changed after the database is created.

Engine options

Engine type Info

Aurora (MySQL Compatible) | Aurora (PostgreSQL Compatible) | [✓ MySQL] | PostgreSQL



Templates

Choose a sample template to meet your use case.

Production — Use defaults for high availability and fast, consistent performance.

Dev/Test — This instance is intended for development use outside of a production environment.

[✓ Free tier] Use RDS Free Tier to develop new applications, test existing applications, or gain hands-on experience with Amazon RDS. Info

- Set DB instance identifier (name) as ‘sahilrds-2265’.
- Set Master username – admin.
- Under Credentials management, select ‘Self managed’.
- Set master password and remember it.

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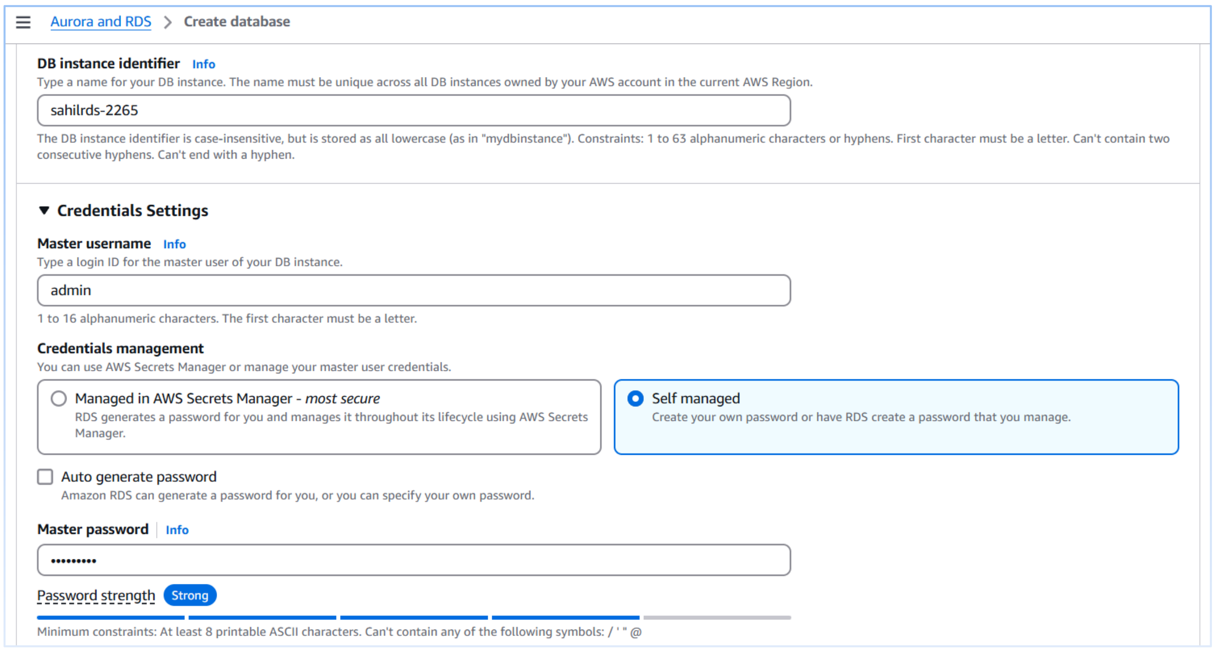

Aurora and RDS > Create database

DB instance identifier Info
Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.
sahilrds-2265
The DB instance identifier is case-insensitive, but is stored as all lowercase (as in "mydbinstance"). Constraints: 1 to 63 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.

▼ Credentials Settings

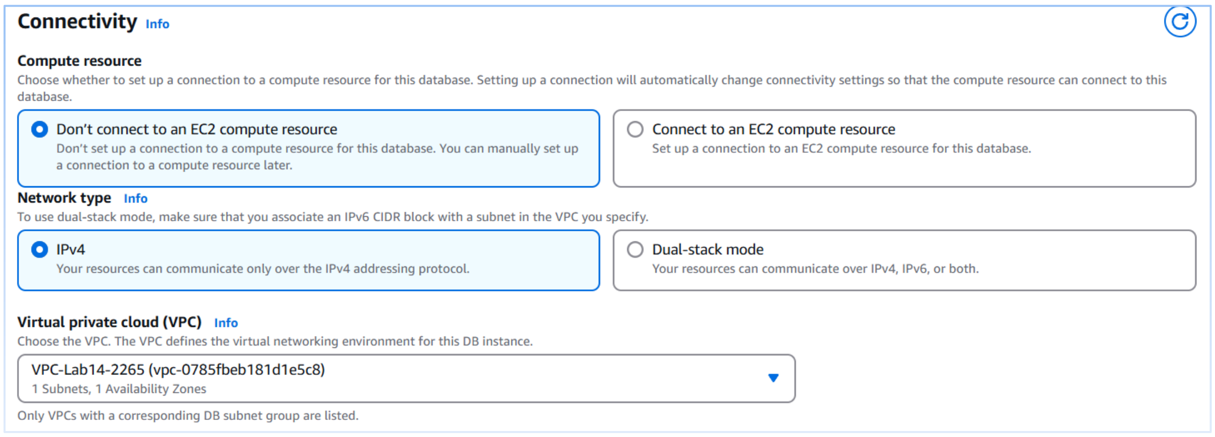
Master username Info
Type a login ID for the master user of your DB instance.
admin
1 to 16 alphanumeric characters. The first character must be a letter.

Credentials management
You can use AWS Secrets Manager or manage your master user credentials.
- ○ Managed in AWS Secrets Manager - *most secure* — RDS generates a password for you and manages it throughout its lifecycle using AWS Secrets Manager.
- ● Self managed — Create your own password or have RDS create a password that you manage.

☐ Auto generate password
Amazon RDS can generate a password for you, or you can specify your own password.

Master password Info
•••••••••
Password strength Strong
Minimum constraints: At least 8 printable ASCII characters. Can't contain any of the following symbols: / ' " @

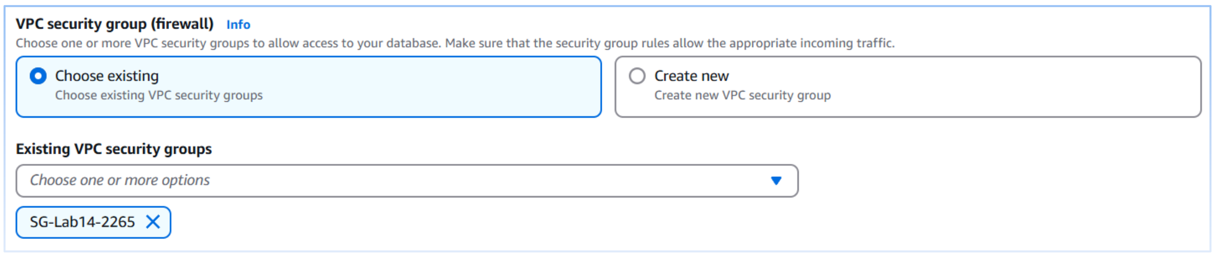
- Now, under Connectivity, select the private VPC that we created earlier.
- Under 'Existing VPC security groups', select the Security group that we created earlier.
- **Untick Backup, Encryption and Maintenance** : Untick Enable automated backups, Enable encryption and Enable auto minor version upgrade.
- Click on 'Create database'.


Connectivity Info

Compute resource
Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.
- ● Don't connect to an EC2 compute resource — Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.
- ○ Connect to an EC2 compute resource — Set up a connection to an EC2 compute resource for this database.

Network type Info
To use dual-stack mode, make sure that you associate an IPv6 CIDR block with a subnet in the VPC you specify.
- ● IPv4 — Your resources can communicate only over the IPv4 addressing protocol.
- ○ Dual-stack mode — Your resources can communicate over IPv4, IPv6, or both.

Virtual private cloud (VPC) Info
Choose the VPC. The VPC defines the virtual networking environment for this DB instance.
VPC-Lab14-2265 (vpc-0785fbeb181d1e5c8)
1 Subnets, 1 Availability Zones
Only VPCs with a corresponding DB subnet group are listed.

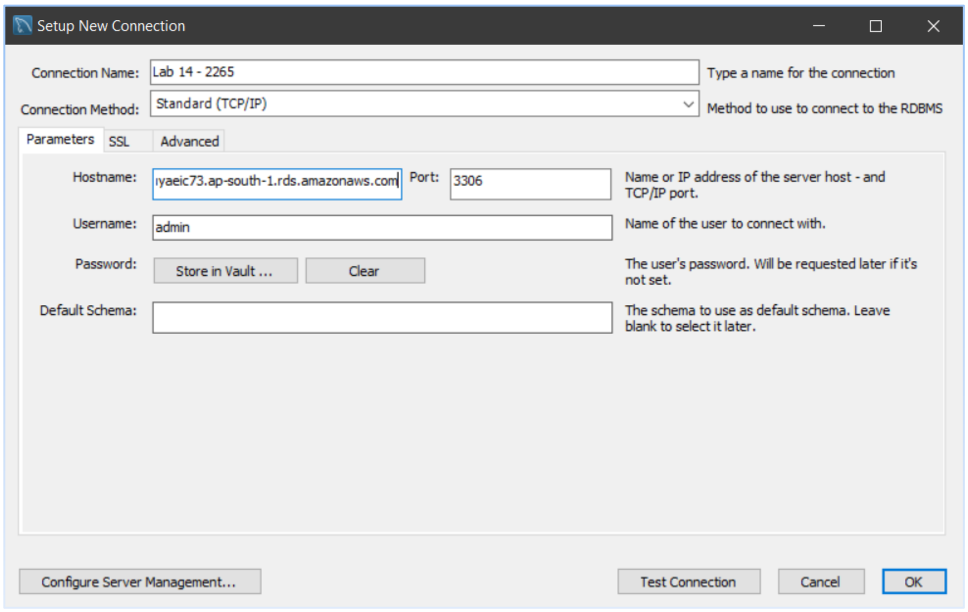

VPC security group (firewall) Info
Choose one or more VPC security groups to allow access to your database. Make sure that the security group rules allow the appropriate incoming traffic.

[✓ Choose existing] Choose existing VPC security groups
Create new — Create new VPC security group

Existing VPC security groups
Choose one or more options
SG-Lab14-2265

Step 3: Set up MySQL Workbench.

- Copy the Endpoint URL of the database and paste it in the MySQL workbench to establish connection and create table for our database.
  - Set connection name.
  - Paste the endpoint URL in the Hostname section.
  - Change username (admin).
  - Click on 'Store in Vault..' to enter the password.
  - Create a Database table in the connection we created.
  - Make a table of Student database.


Setup New Connection

Connection Name: Lab 14 - 2265 — Type a name for the connection
Connection Method: Standard (TCP/IP) — Method to use to connect to the RDBMS

Parameters | SSL | Advanced

Hostname: ıyaeic73.ap-south-1.rds.amazonaws.com Port: 3306 — Name or IP address of the server host - and TCP/IP port.
Username: admin — Name of the user to connect with.
Password: Store in Vault ... Clear — The user's password. Will be requested later if it's not set.
Default Schema: — The schema to use as default schema. Leave blank to select it later.

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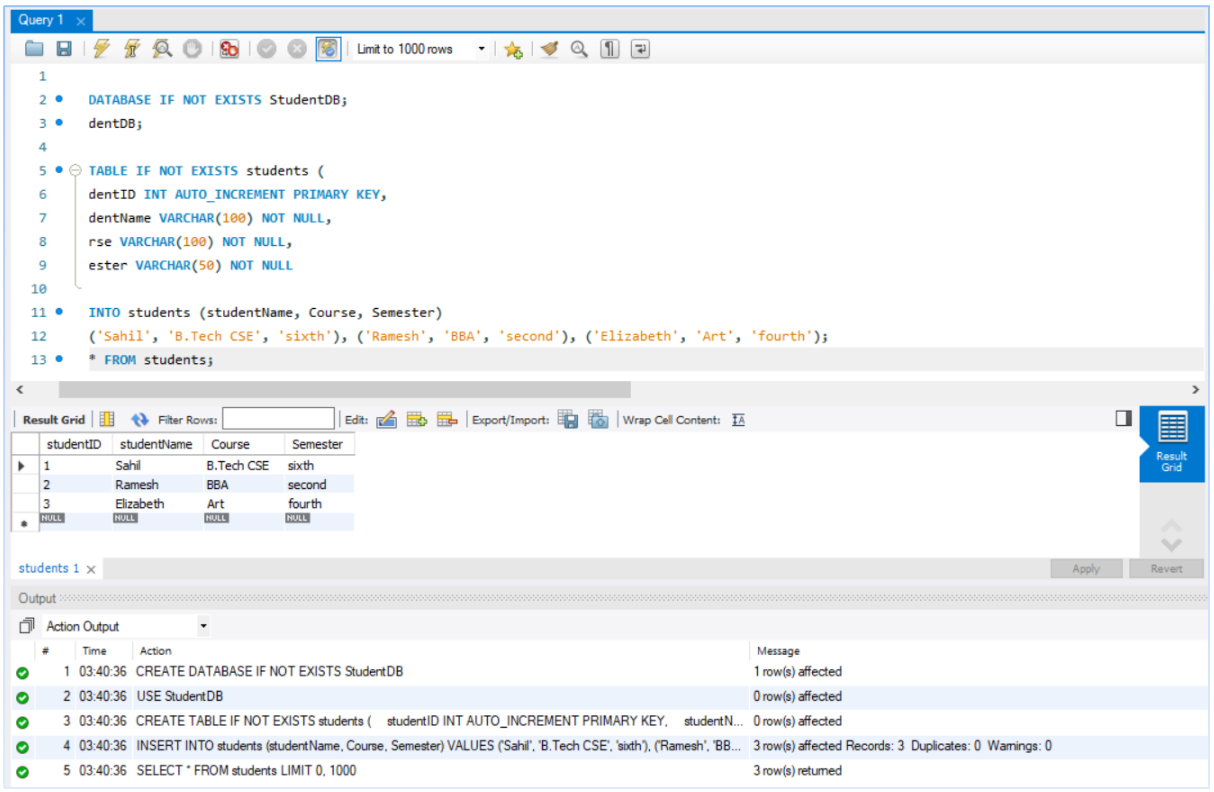


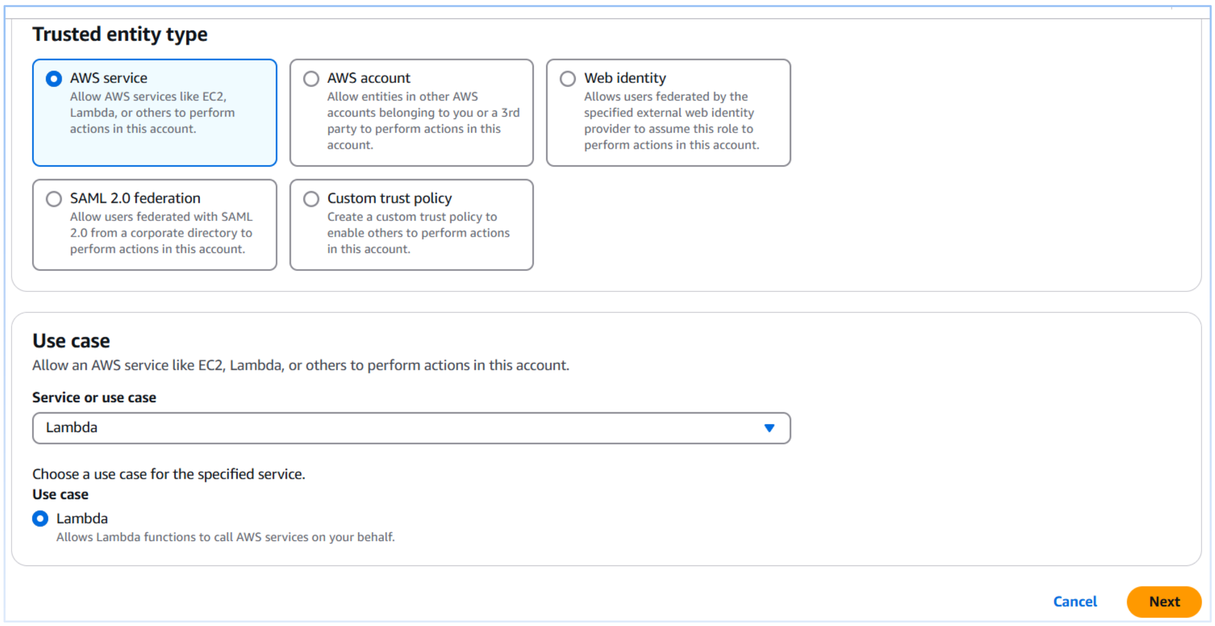
```
DATABASE IF NOT EXISTS StudentDB;
dentDB;

TABLE IF NOT EXISTS students (
dentID INT AUTO_INCREMENT PRIMARY KEY,
dentName VARCHAR(100) NOT NULL,
rse VARCHAR(100) NOT NULL,
ester VARCHAR(50) NOT NULL

INTO students (studentName, Course, Semester)
('Sahil', 'B.Tech CSE', 'sixth'), ('Ramesh', 'BBA', 'second'), ('Elizabeth', 'Art', 'fourth');
* FROM students;
```

studentID	studentName	Course	Semester
1	Sahil	B.Tech CSE	sixth
2	Ramesh	BBA	second
3	Elizabeth	Art	fourth
NULL	NULL	NULL	NULL

```
#  Time      Action                                                                                              Message
1  03:40:36  CREATE DATABASE IF NOT EXISTS StudentDB                                                             1 row(s) affected
2  03:40:36  USE StudentDB                                                                                       0 row(s) affected
3  03:40:36  CREATE TABLE IF NOT EXISTS students (   studentID INT AUTO_INCREMENT PRIMARY KEY,   studentN...     0 row(s) affected
4  03:40:36  INSERT INTO students (studentName, Course, Semester) VALUES ('Sahil', 'B.Tech CSE', 'sixth'), ('Ramesh', 'BB...  3 row(s) affected Records: 3  Duplicates: 0  Warnings: 0
5  03:40:36  SELECT * FROM students LIMIT 0, 1000                                                                3 row(s) returned
```

Step 4: Create an IAM role for Lambda function.

- Go to IAM and click on ‘Create role’.
- Select Trusted entity type as ‘AWS service’ and Use case as ‘Lambda’.
- Click on ‘Next’.



Trusted entity type

- [✓ AWS service] Allow AWS services like EC2, Lambda, or others to perform actions in this account.
- AWS account: Allow entities in other AWS accounts belonging to you or a 3rd party to perform actions in this account.
- Web identity: Allows users federated by the specified external web identity provider to assume this role to perform actions in this account.
- SAML 2.0 federation: Allow users federated with SAML 2.0 from a corporate directory to perform actions in this account.
- Custom trust policy: Create a custom trust policy to enable others to perform actions in this account.

Use case

Allow an AWS service like EC2, Lambda, or others to perform actions in this account.

Service or use case: Lambda

Choose a use case for the specified service.

Use case: [✓ Lambda] Allows Lambda functions to call AWS services on your behalf.

- Add Permissions :
  - AmazonEC2FullAccess
  - AmazonRDSDataFullAccess
  - AWSLambda_FullAccess
  - CloudWatchFullAccess
- Name the role as **'rds-lambda-2265'** , review and create role for the lambda function.

Step 5: Create and deploy a Lambda function.

- Go to Lambda, click on 'Create function'.
- Select 'Author from scratch'.
- Set name as 'LambdaforRDS2265' and select Runtime as 'Python'.
- Under 'Change default execution role', select 'Use an existing role' and select our IAM role created earlier.
- Click on 'Create function'.

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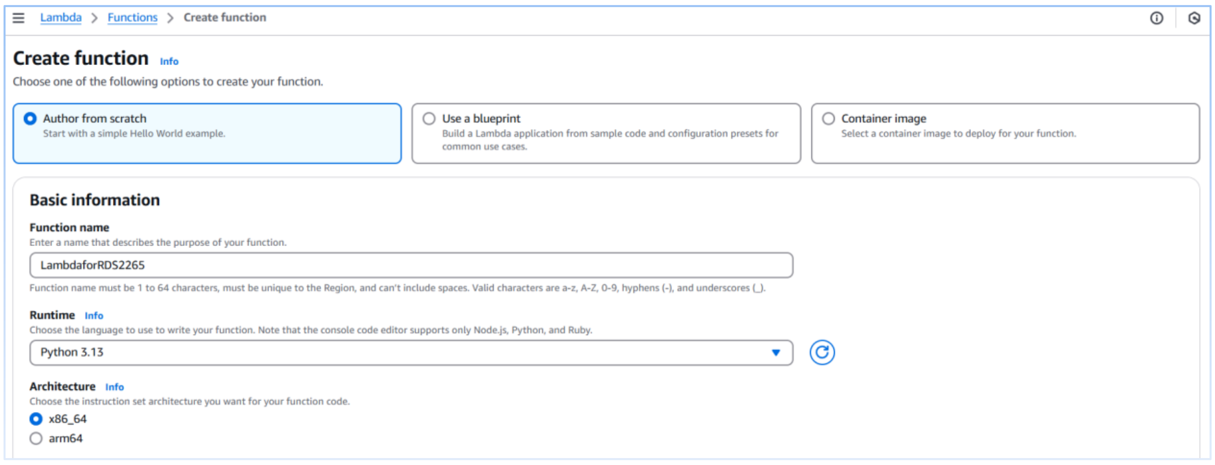

Lambda > Functions > Create function

Create function Info
Choose one of the following options to create your function.

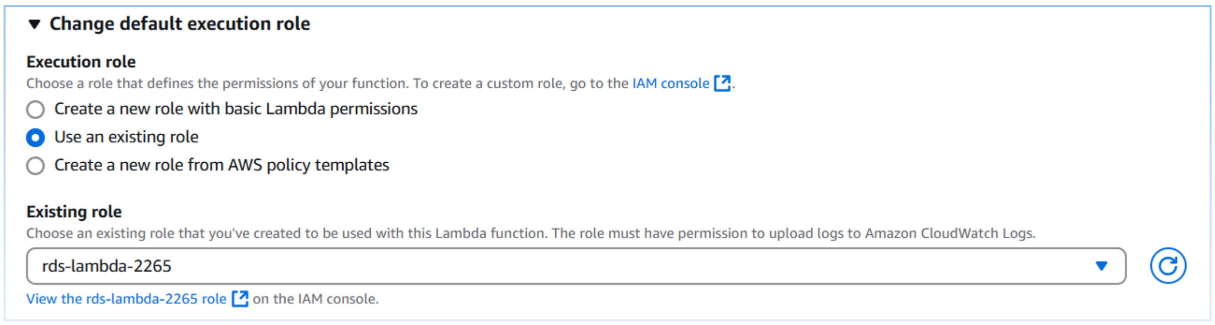
[✓ Author from scratch] — Start with a simple Hello World example.
Use a blueprint — Build a Lambda application from sample code and configuration presets for common use cases.
Container image — Select a container image to deploy for your function.

Basic information

Function name
Enter a name that describes the purpose of your function.
LambdaforRDS2265
Function name must be 1 to 64 characters, must be unique to the Region, and can't include spaces. Valid characters are a-z, A-Z, 0-9, hyphens (-), and underscores (_).

Runtime Info
Choose the language to use to write your function. Note that the console code editor supports only Node.js, Python, and Ruby.
Python 3.13

Architecture Info
Choose the instruction set architecture you want for your function code.
[✓ x86_64]
arm64

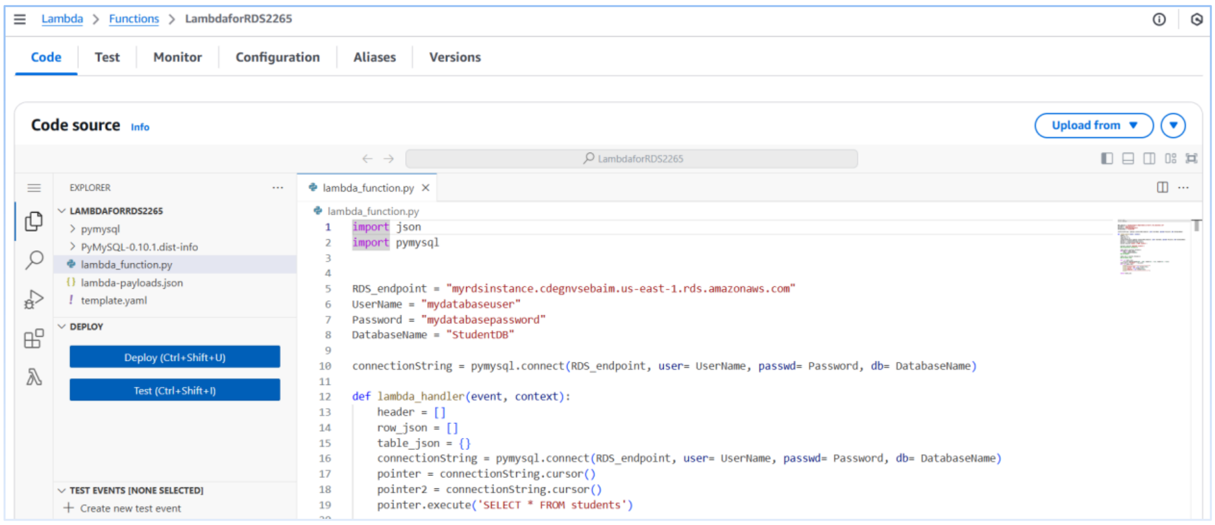

Change default execution role

Execution role
Choose a role that defines the permissions of your function. To create a custom role, go to the IAM console.
Create a new role with basic Lambda permissions
[✓ Use an existing role]
Create a new role from AWS policy templates

Existing role
Choose an existing role that you've created to be used with this Lambda function. The role must have permission to upload logs to Amazon CloudWatch Logs.
rds-lambda-2265
View the rds-lambda-2265 role on the IAM console.

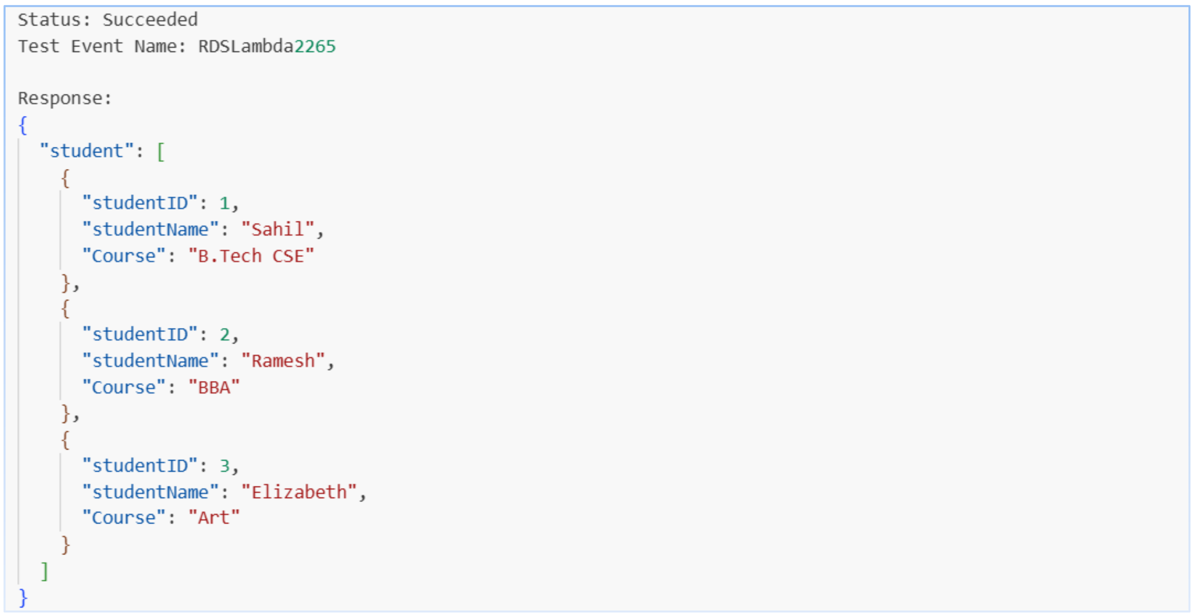
- In the code section, upload the code (.zip file) with necessary configurations that fetches the data from the database and displays it for us.
    - Necessary configurations (changes):
        - RDS_endpoint
        - UserName
        - Password
        - DatabaseName

- Deploy and test the lambda function to get the output.

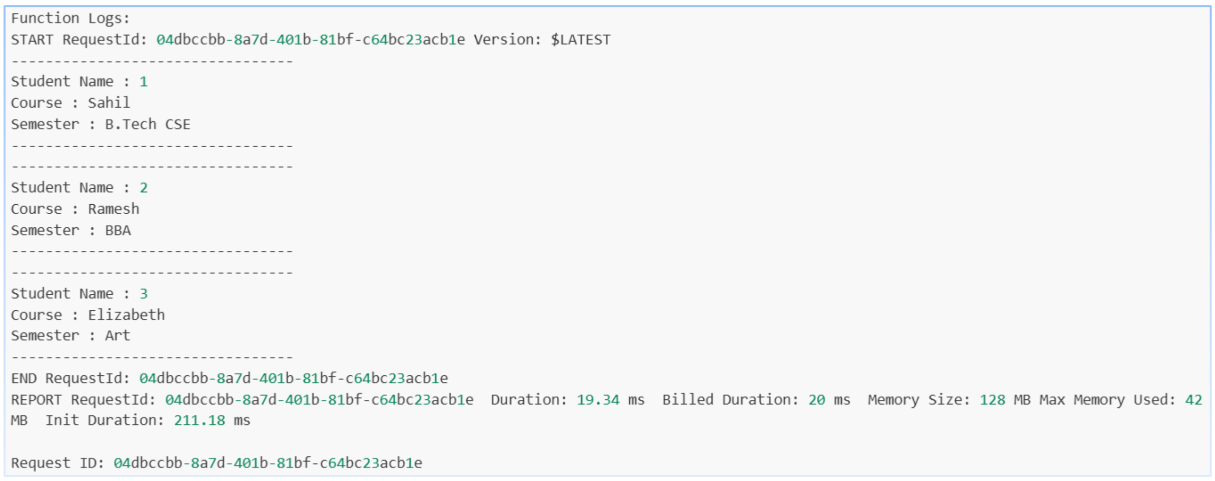


```python
import json
import pymysql


RDS_endpoint = "myrdsinstance.cdegnvsebaim.us-east-1.rds.amazonaws.com"
UserName = "mydatabaseuser"
Password = "mydatabasepassword"
DatabaseName = "StudentDB"

connectionString = pymysql.connect(RDS_endpoint, user= UserName, passwd= Password, db= DatabaseName)

def lambda_handler(event, context):
    header = []
    row_json = []
    table_json = {}
    connectionString = pymysql.connect(RDS_endpoint, user= UserName, passwd= Password, db= DatabaseName)
    pointer = connectionString.cursor()
    pointer2 = connectionString.cursor()
    pointer.execute('SELECT * FROM students')
```

- Here is the Output that we will receive from the above code.

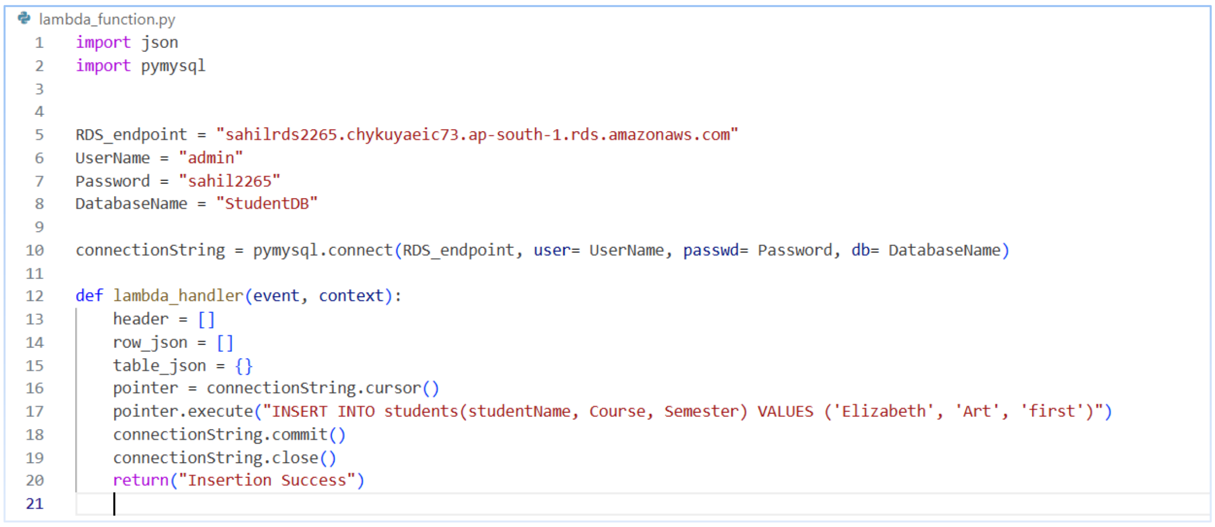


```
Status: Succeeded
Test Event Name: RDSLambda2265

Response:
{
  "student": [
    {
      "studentID": 1,
      "studentName": "Sahil",
      "Course": "B.Tech CSE"
    },
    {
      "studentID": 2,
      "studentName": "Ramesh",
      "Course": "BBA"
    },
    {
      "studentID": 3,
      "studentName": "Elizabeth",
      "Course": "Art"
    }
  ]
}
```



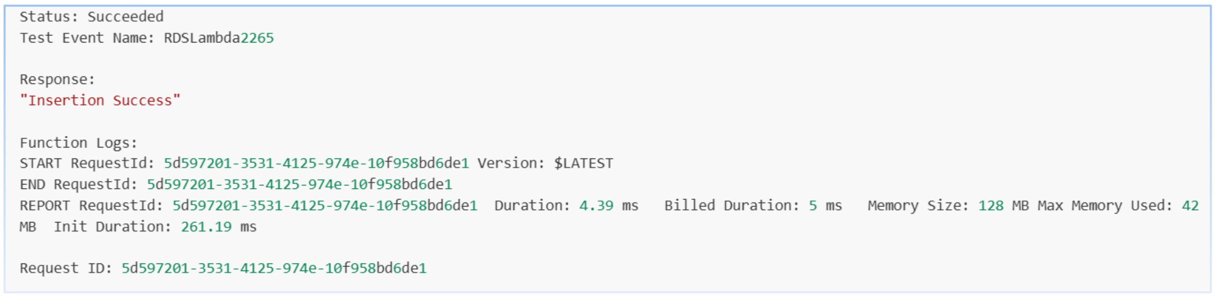
```
Function Logs:
START RequestId: 04dbccbb-8a7d-401b-81bf-c64bc23acb1e Version: $LATEST
--------------------------------
Student Name : 1
Course : Sahil
Semester : B.Tech CSE
--------------------------------
--------------------------------
Student Name : 2
Course : Ramesh
Semester : BBA
--------------------------------
--------------------------------
Student Name : 3
Course : Elizabeth
Semester : Art
--------------------------------
END RequestId: 04dbccbb-8a7d-401b-81bf-c64bc23acb1e
REPORT RequestId: 04dbccbb-8a7d-401b-81bf-c64bc23acb1e  Duration: 19.34 ms  Billed Duration: 20 ms  Memory Size: 128 MB Max Memory Used: 42
MB  Init Duration: 211.18 ms

Request ID: 04dbccbb-8a7d-401b-81bf-c64bc23acb1e
```

- Now, change the code to one which inserts the data to the database.



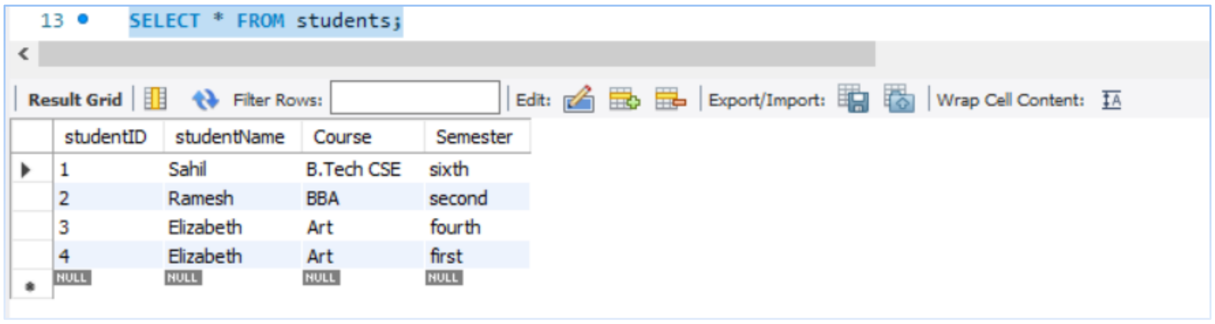
```python
import json
import pymysql


RDS_endpoint = "sahilrds2265.chykuyaeic73.ap-south-1.rds.amazonaws.com"
UserName = "admin"
Password = "sahil2265"
DatabaseName = "StudentDB"

connectionString = pymysql.connect(RDS_endpoint, user= UserName, passwd= Password, db= DatabaseName)

def lambda_handler(event, context):
    header = []
    row_json = []
    table_json = {}
    pointer = connectionString.cursor()
    pointer.execute("INSERT INTO students(studentName, Course, Semester) VALUES ('Elizabeth', 'Art', 'first')")
    connectionString.commit()
    connectionString.close()
    return("Insertion Success")

```

- The output we receive should give insertion success message.



```
Status: Succeeded
Test Event Name: RDSLambda2265

Response:
"Insertion Success"

Function Logs:
START RequestId: 5d597201-3531-4125-974e-10f958bd6de1 Version: $LATEST
END RequestId: 5d597201-3531-4125-974e-10f958bd6de1
REPORT RequestId: 5d597201-3531-4125-974e-10f958bd6de1  Duration: 4.39 ms   Billed Duration: 5 ms   Memory Size: 128 MB Max Memory Used: 42
MB  Init Duration: 261.19 ms

Request ID: 5d597201-3531-4125-974e-10f958bd6de1
```

- Now, go to the MySQL Workbench and run the query that displays the data in the database i.e. ‘select * from students;’ .



```
SELECT * FROM students;
```

studentID	studentName	Course	Semester
1	Sahil	B.Tech CSE	sixth
2	Ramesh	BBA	second
3	Elizabeth	Art	fourth
4	Elizabeth	Art	first
NULL	NULL	NULL	NULL

Here are the results that we can see and the insertion that we did with the code was successful.