COS20019 - Cloud Computing Architecture

Week 9: ACA Module 13 Challenge Lab - Implementing a Serverless Architecture for the Cafe

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Due Date: 09/11/2023

Name: Trac Duc Anh Luong - ID: 103488117

Task 1: Downloading the source code

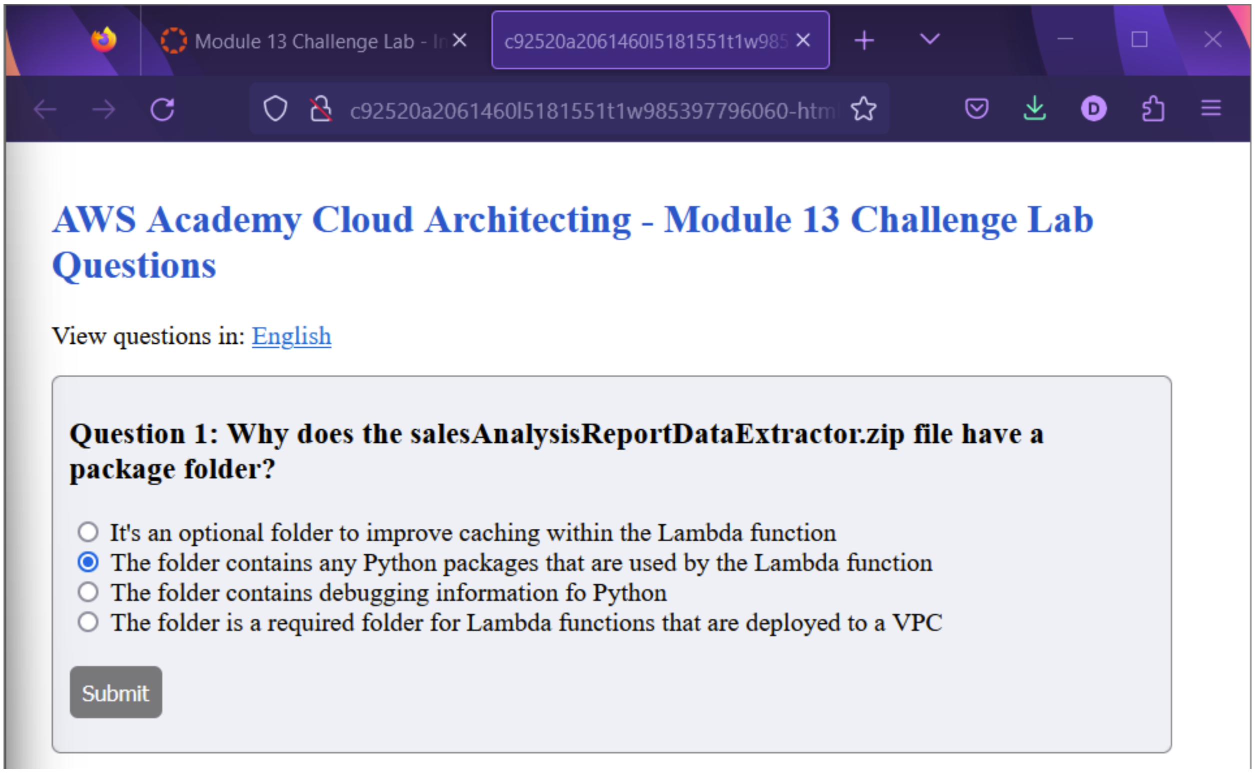
The code for generating the report is already written, packaged, and ready for you to deploy to AWS Lambda.

5. Download the following two files to your local machine:
   - Code for salesAnalysisReportDataExtractor
   - Code for salesAnalysisReport
6. Extract each of the *.zip* files and examine the contents.

Answering questions about the lab

Answers will be recorded when you choose the blue **Submit** button at the end of the lab.

7. Access the questions in this lab.
   - Choose the Details menu, and choose Show.
   - Choose the **Access the multiple choice questions** link that appears at the bottom of the page.
8. In the page you loaded, answer the first question:
   - **Question 1**: Why does the *salesAnalysisReportDataExtractor.zip* file have a package folder?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c92520a2061460l5181551t1w985
c92520a2061460l5181551t1w985397796060-htm

AWS Academy Cloud Architecting - Module 13 Challenge Lab Questions

View questions in: English

Question 1: Why does the salesAnalysisReportDataExtractor.zip file have a package folder?

○ It's an optional folder to improve caching within the Lambda function
● The folder contains any Python packages that are used by the Lambda function
○ The folder contains debugging information fo Python
○ The folder is a required folder for Lambda functions that are deployed to a VPC

Note: Leave the questions webpage open in your browser tab. You will return to it later in this lab.

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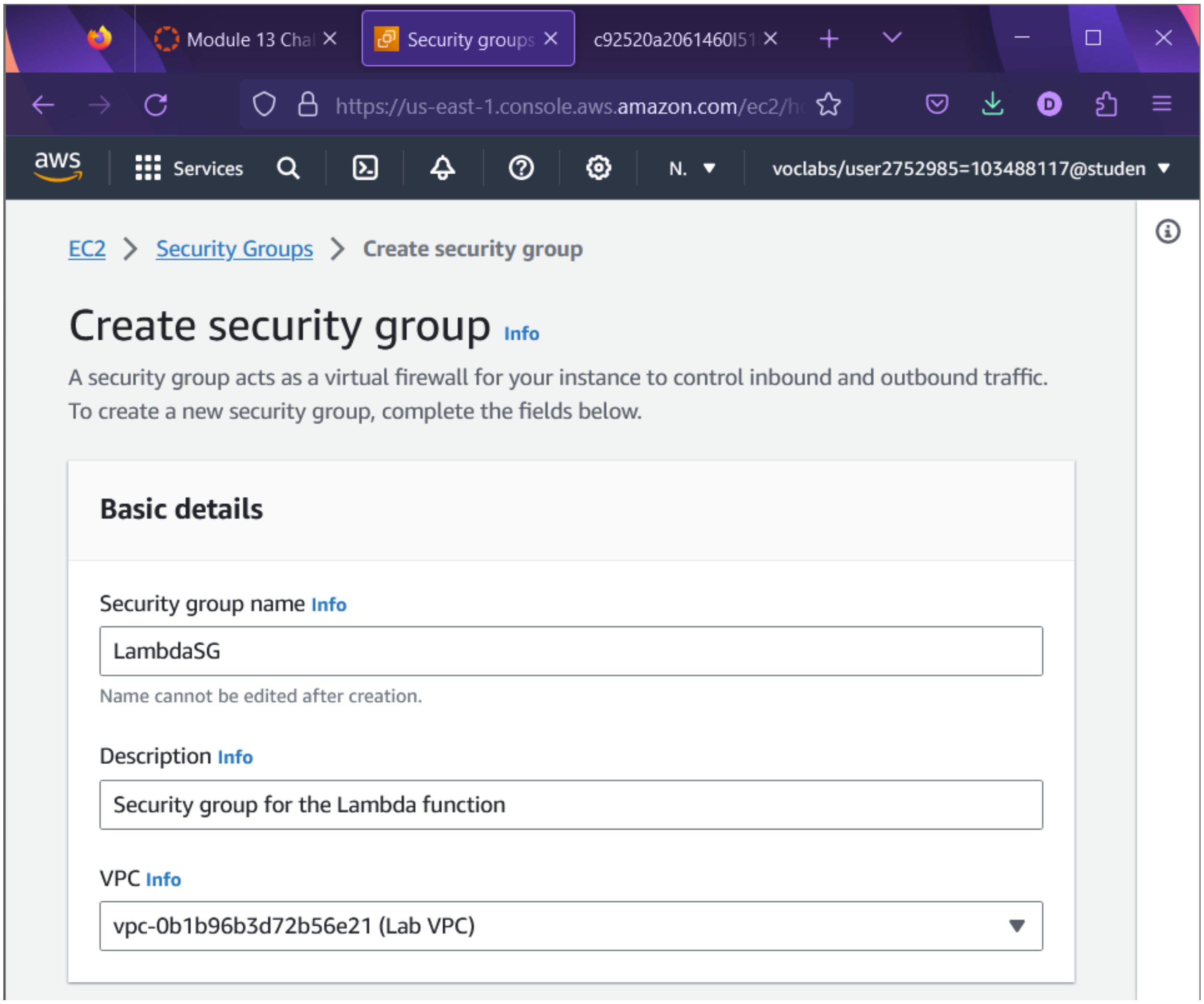
Task 2: Creating the *DataExtractor* Lambda function in the VPC

In this task, you will create the *DataExtractor* Lambda function that extracts the café's sales data from an Amazon RDS database. So the Lambda function can access the RDS database instance, you must update the database security group with a rule to allow connections from the Lambda function. To enable this communication, you will create a security group for the Lambda function and add it as an inbound rule to the security group of the RDS instance.

9. Create a security group for the Lambda function with the following settings:
    - **Security group name**: `LambdaSG`
    - **VPC**: *Lab VPC*
    - **Outbound Rules**: *All traffic* to all addresses



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 Info

LambdaSG

Name cannot be edited after creation.

Description Info

Security group for the Lambda function

VPC Info

vpc-0b1b96b3d72b56e21 (Lab VPC)

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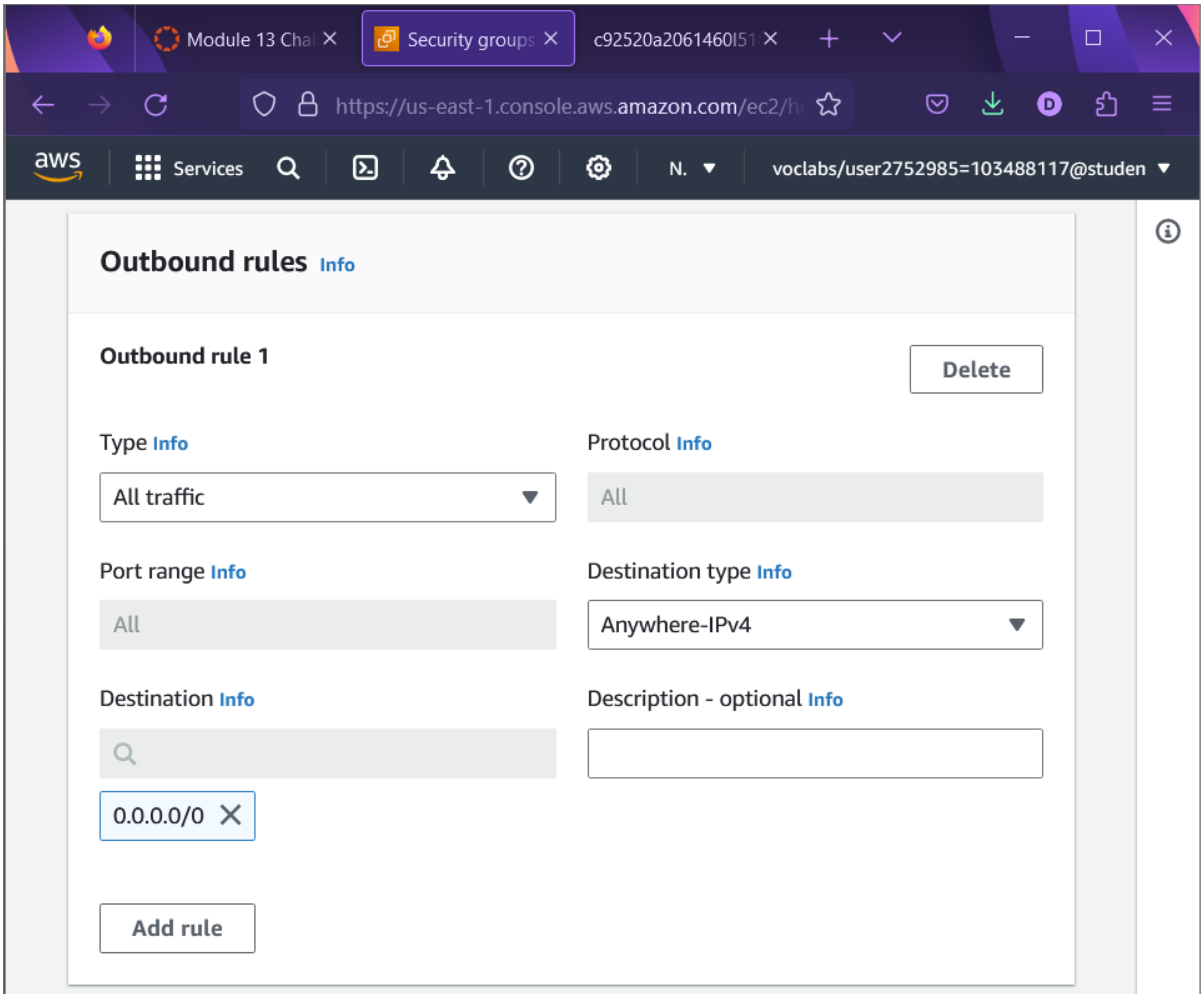
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Outbound rules Info

Outbound rule 1

Delete

Type Info: All traffic

Protocol Info: All

Port range Info: All

Destination type Info: Anywhere-IPv4

Destination Info: 0.0.0.0/0

Description - optional Info:

Add rule

10. Update the **DatabaseSG** security group.
    - Add a second inbound rule. For the new rule, configure the **Type** as **MYSQL/Aurora**. Then, in the search box to the right of **Custom**, type `sg-` and choose your new Lambda function security group as the source. Finally, choose **Save rules**.

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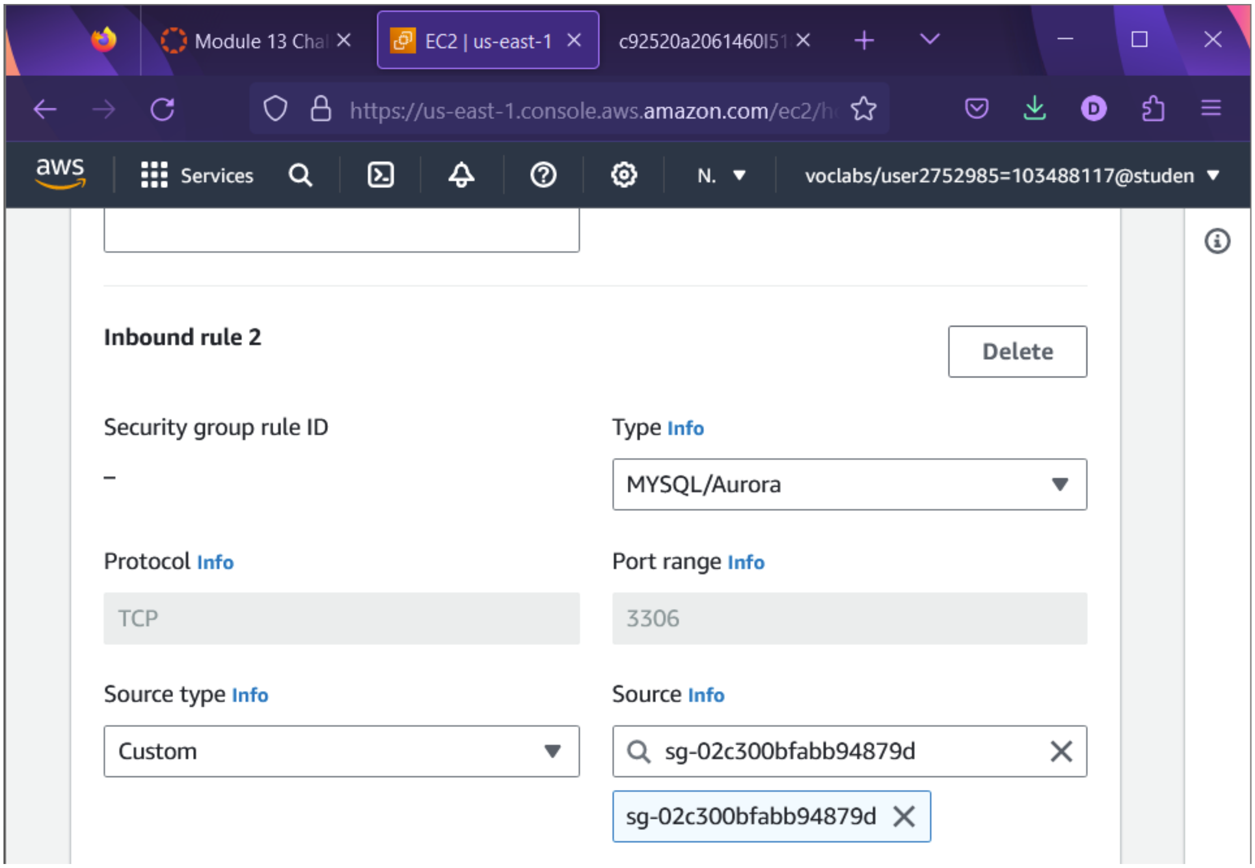
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Delete

Inbound rule 2

Security group rule ID: –

Type Info: MYSQL/Aurora

Protocol Info: TCP

Port range Info: 3306

Source type Info: Custom

Source Info: sg-02c300bfabb94879d

sg-02c300bfabb94879d

11. Create a Lambda function with the following settings:
    - **Function name**: `salesAnalysisReportDataExtractor`
    - **Runtime**: *Python 3.8*
    - **Role**: *salesAnalysisReportDERole*
    - **VPC**:
        - **VPC**: *Lab VPC*
        - **Subnets**: *Private subnet 1* and *Private subnet 2*
        - **Security Group**: The Lambda function security group that you created
    - **Tip**: It will take several minutes for the function to be created.

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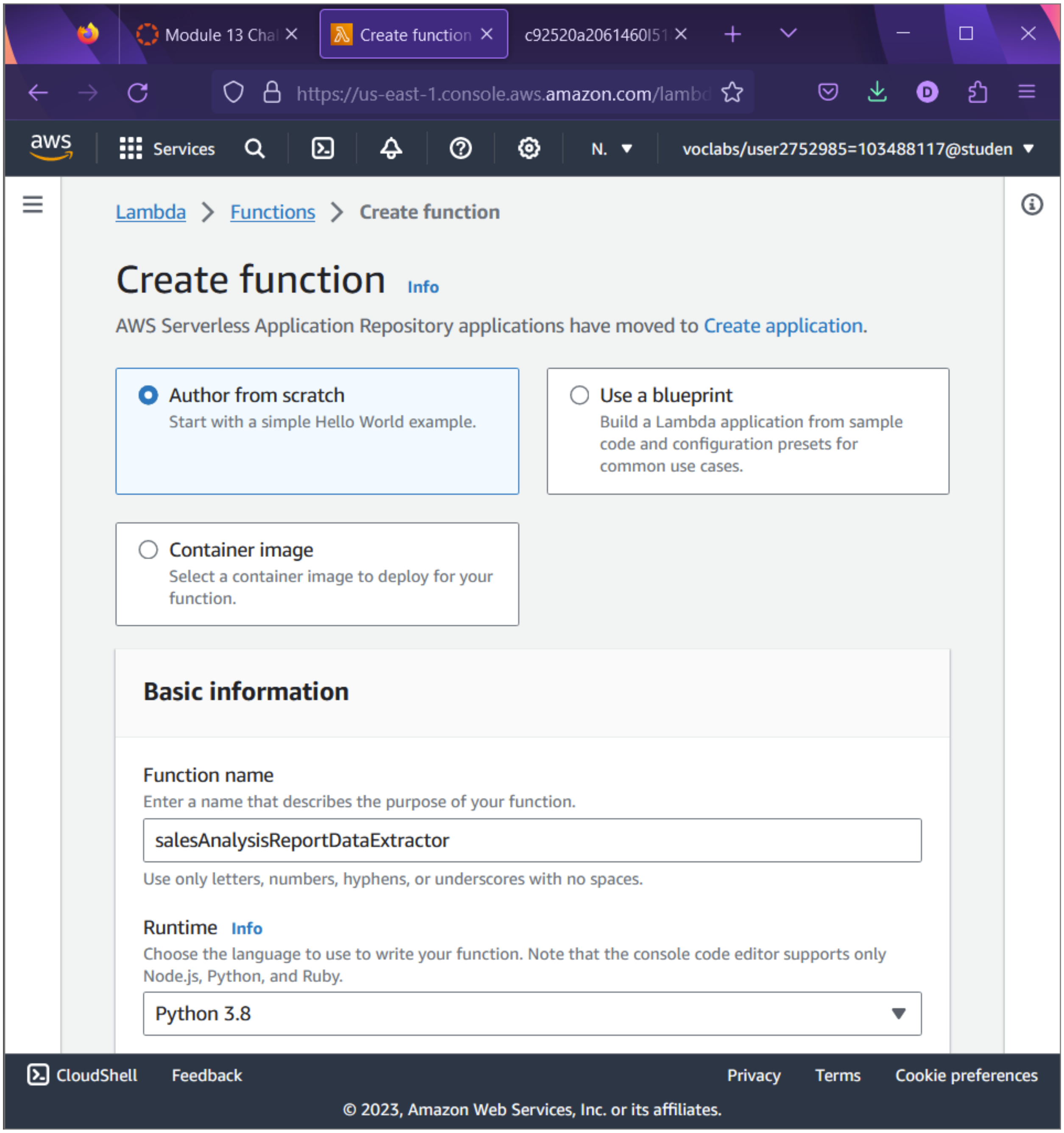

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Lambda > Functions > Create function

Create function Info

AWS Serverless Application Repository applications have moved to Create application.

● 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.
salesAnalysisReportDataExtractor
Use only letters, numbers, hyphens, or underscores with no spaces.

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 3.8

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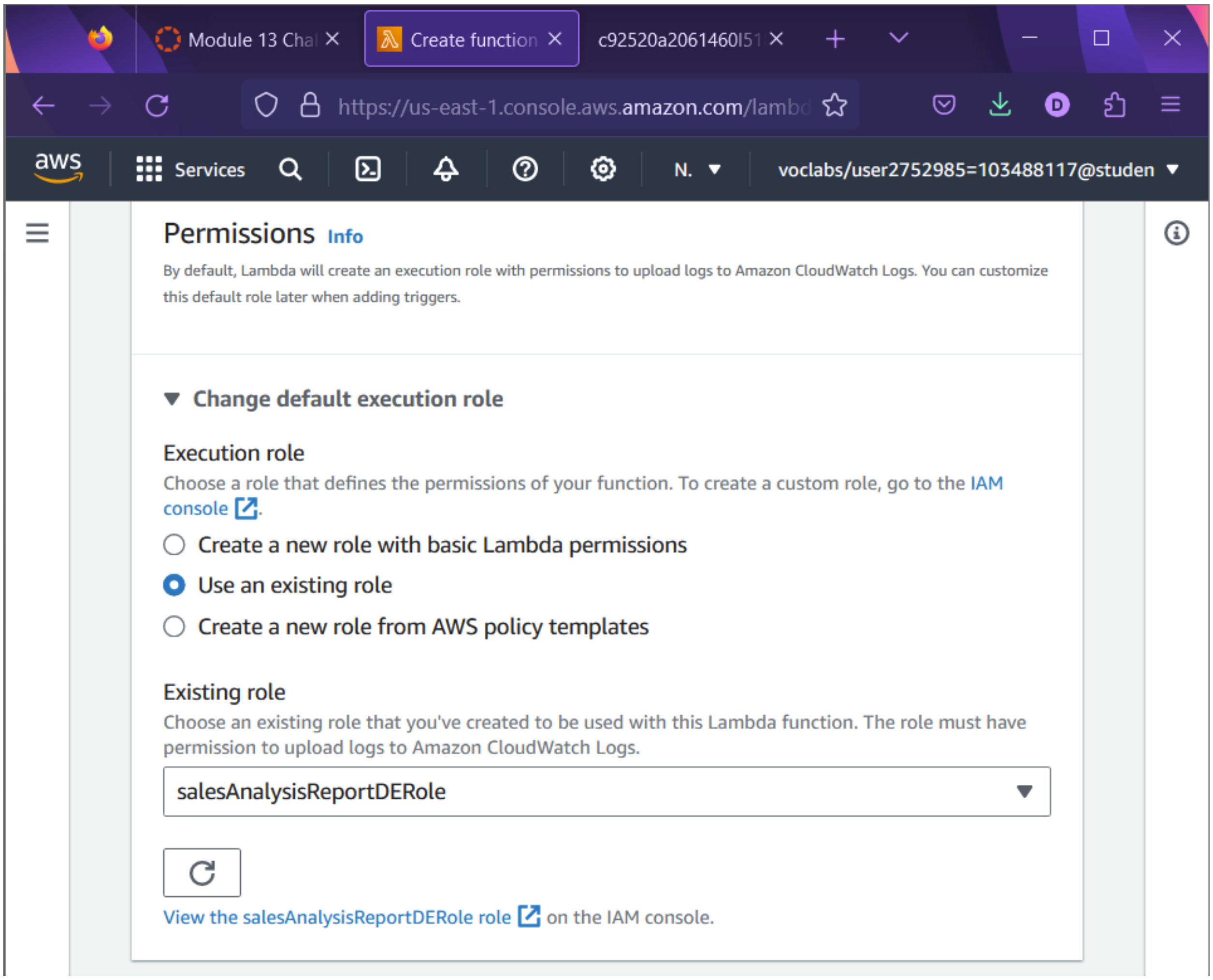
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Permissions Info

By default, Lambda will create an execution role with permissions to upload logs to Amazon CloudWatch Logs. You can customize this default role later when adding triggers.

▼ 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.

salesAnalysisReportDERole ▼

View the salesAnalysisReportDERole role on the IAM console.

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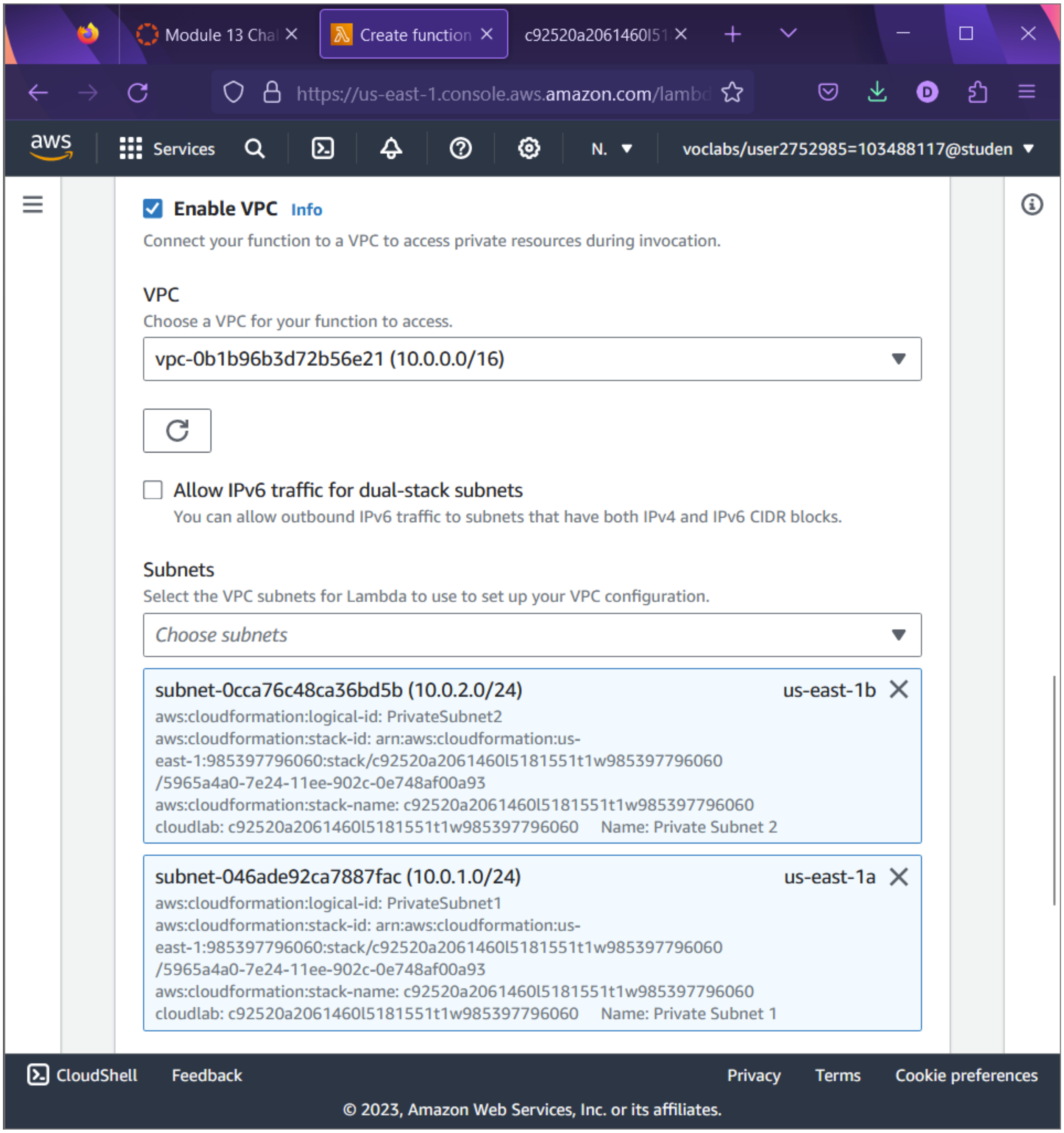
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☑ Enable VPC Info

Connect your function to a VPC to access private resources during invocation.

VPC

Choose a VPC for your function to access.

vpc-0b1b96b3d72b56e21 (10.0.0.0/16)

□ Allow IPv6 traffic for dual-stack subnets

You can allow outbound IPv6 traffic to subnets that have both IPv4 and IPv6 CIDR blocks.

Subnets

Select the VPC subnets for Lambda to use to set up your VPC configuration.

Choose subnets

subnet-0cca76c48ca36bd5b (10.0.2.0/24) us-east-1b
aws:cloudformation:logical-id: PrivateSubnet2
aws:cloudformation:stack-id: arn:aws:cloudformation:us-east-1:985397796060:stack/c92520a2061460l5181551t1w985397796060/5965a4a0-7e24-11ee-902c-0e748af00a93
aws:cloudformation:stack-name: c92520a2061460l5181551t1w985397796060
cloudlab: c92520a2061460l5181551t1w985397796060 Name: Private Subnet 2

subnet-046ade92ca7887fac (10.0.1.0/24) us-east-1a
aws:cloudformation:logical-id: PrivateSubnet1
aws:cloudformation:stack-id: arn:aws:cloudformation:us-east-1:985397796060:stack/c92520a2061460l5181551t1w985397796060/5965a4a0-7e24-11ee-902c-0e748af00a93
aws:cloudformation:stack-name: c92520a2061460l5181551t1w985397796060
cloudlab: c92520a2061460l5181551t1w985397796060 Name: Private Subnet 1

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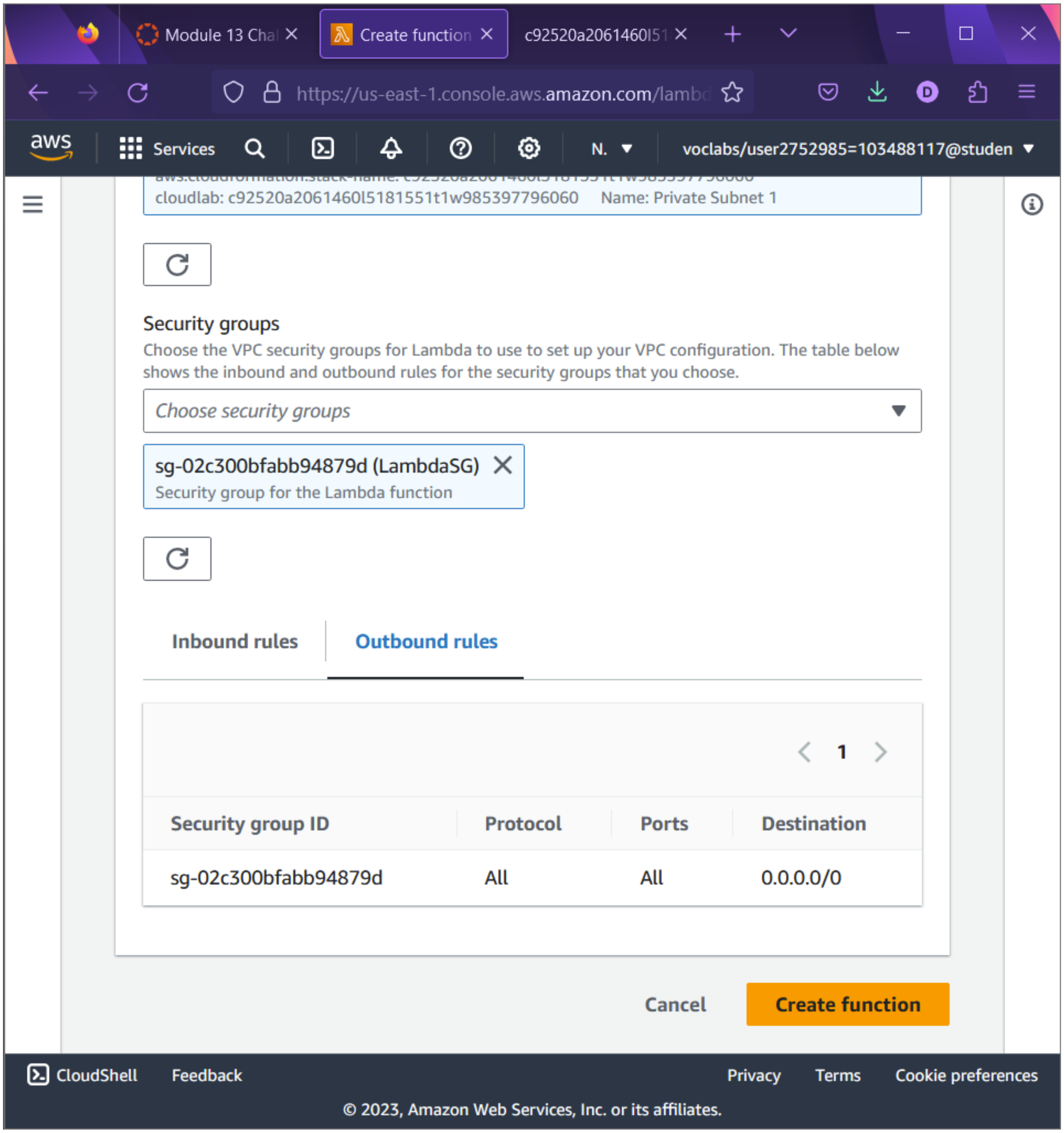
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cloudlab: c92520a2061460l5181551t1w985397796060 Name: Private Subnet 1

Security groups

Choose the VPC security groups for Lambda to use to set up your VPC configuration. The table below shows the inbound and outbound rules for the security groups that you choose.

Choose security groups ▼

sg-02c300bfabb94879d (LambdaSG) ✕
Security group for the Lambda function

Inbound rules | **Outbound rules**

< 1 >

Security group ID	Protocol	Ports	Destination
sg-02c300bfabb94879d	All	All	0.0.0.0/0

12. Configure the *DataExtractor* Lambda function as follows:
    - **Code**: Upload the *salesAnalysisReportDataExtractor.zip* file
    - **Description**: `Lambda function to extract data from database`
    - **Handler**: `salesAnalysisReportDataExtractor.lambda_handler`
    - **Memory Size**: *128 MB*
    - **Timeout** (seconds): `30`

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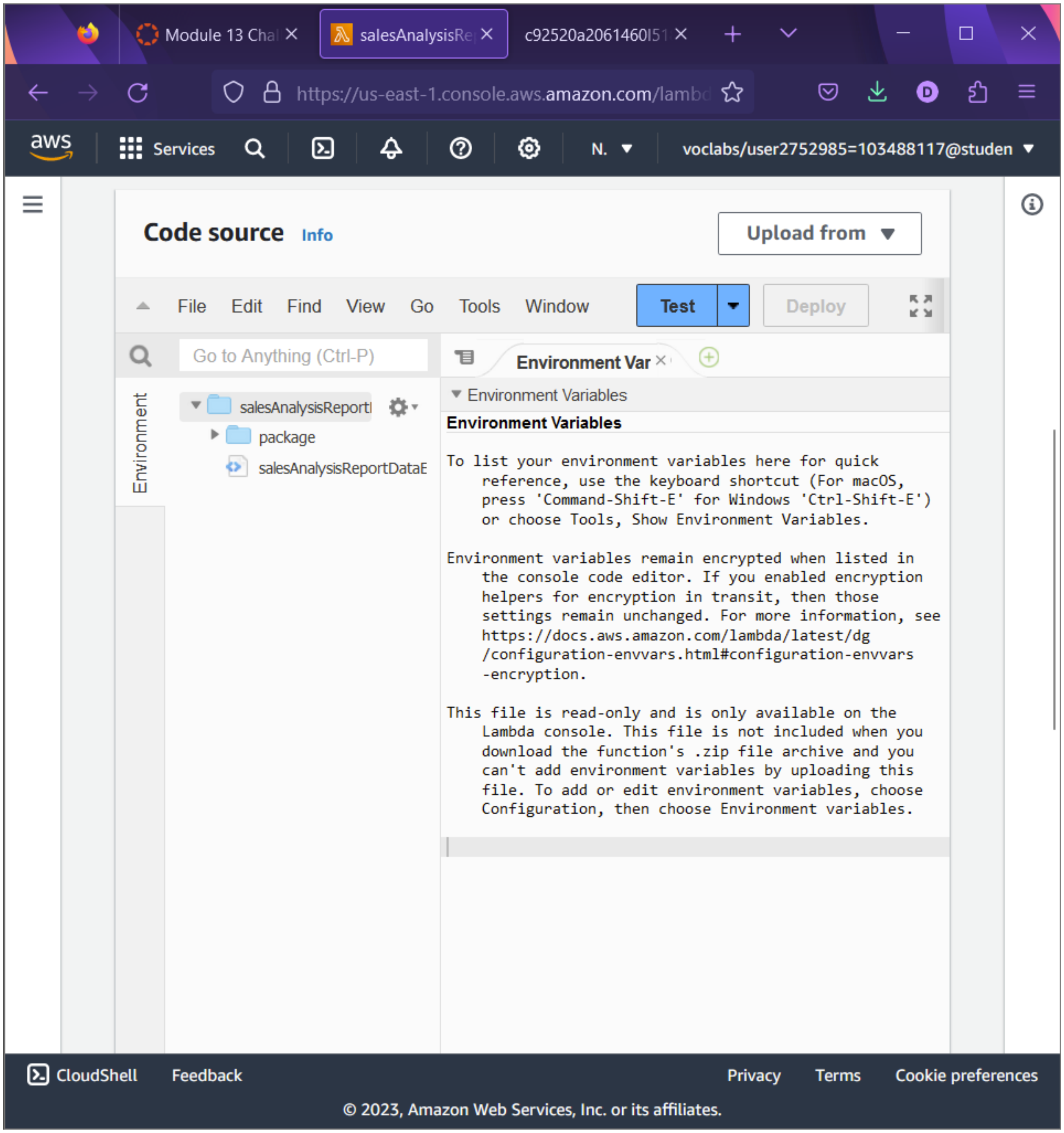

Environment Variables

```
To list your environment variables here for quick
    reference, use the keyboard shortcut (For macOS,
    press 'Command-Shift-E' for Windows 'Ctrl-Shift-E')
    or choose Tools, Show Environment Variables.

Environment variables remain encrypted when listed in
    the console code editor. If you enabled encryption
    helpers for encryption in transit, then those
    settings remain unchanged. For more information, see
    https://docs.aws.amazon.com/lambda/latest/dg
    /configuration-envvars.html#configuration-envvars
    -encryption.

This file is read-only and is only available on the
    Lambda console. This file is not included when you
    download the function's .zip file archive and you
    can't add environment variables by uploading this
    file. To add or edit environment variables, choose
    Configuration, then choose Environment variables.
```

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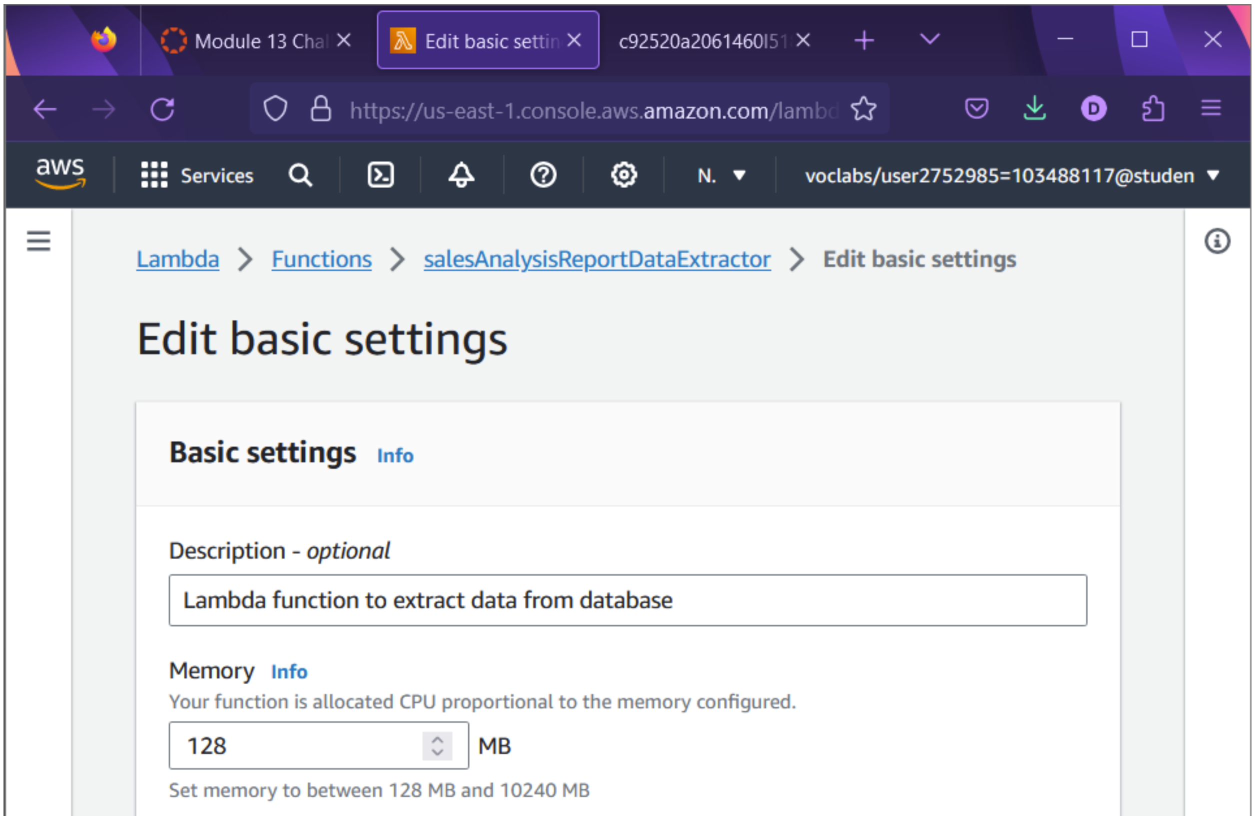
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Lambda > Functions > salesAnalysisReportDataExtractor > Edit basic settings

Edit basic settings

Basic settings Info

Description - *optional*

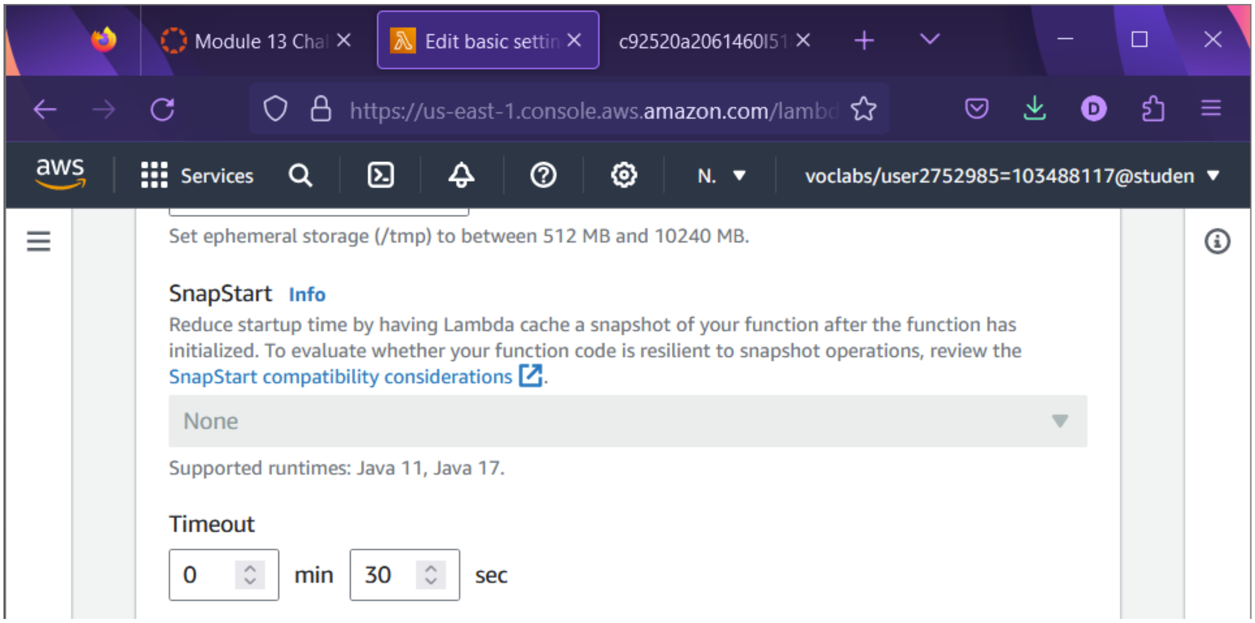
Lambda function to extract data from database

Memory Info

Your function is allocated CPU proportional to the memory configured.

128 MB

Set memory to between 128 MB and 10240 MB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Set ephemeral storage (/tmp) to between 512 MB and 10240 MB.

SnapStart Info

Reduce startup time by having Lambda cache a snapshot of your function after the function has initialized. To evaluate whether your function code is resilient to snapshot operations, review the SnapStart compatibility considerations.

None

Supported runtimes: Java 11, Java 17.

Timeout

0 min 30 sec

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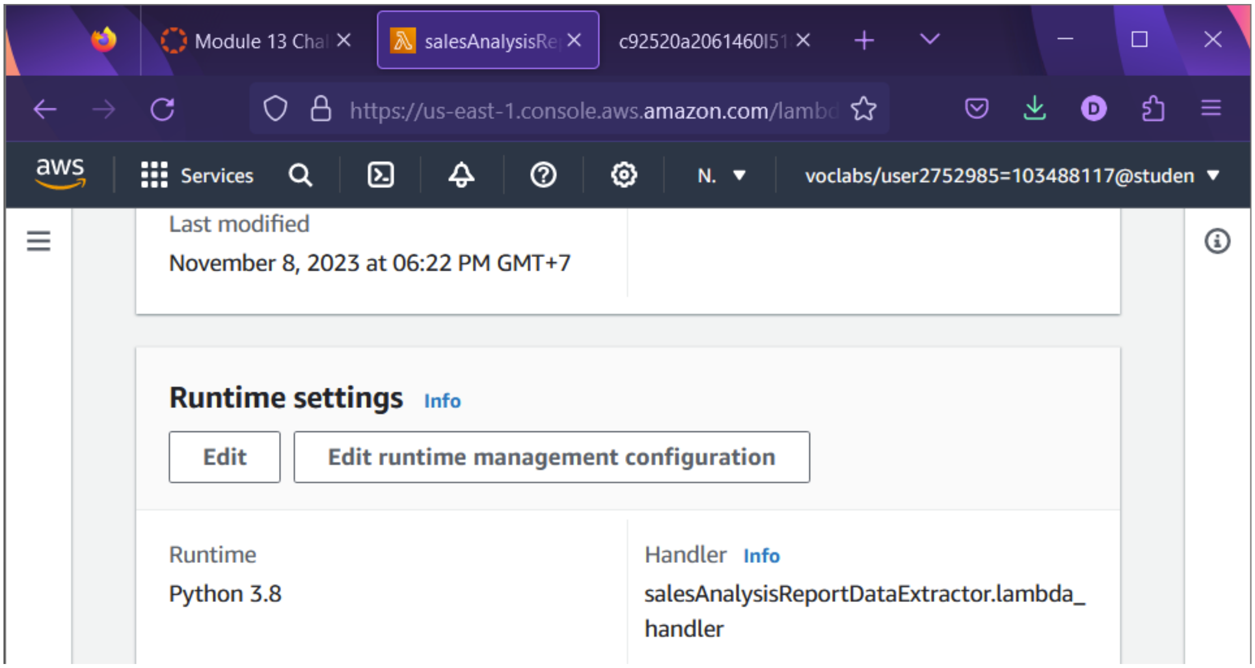
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November 8, 2023 at 06:22 PM GMT+7

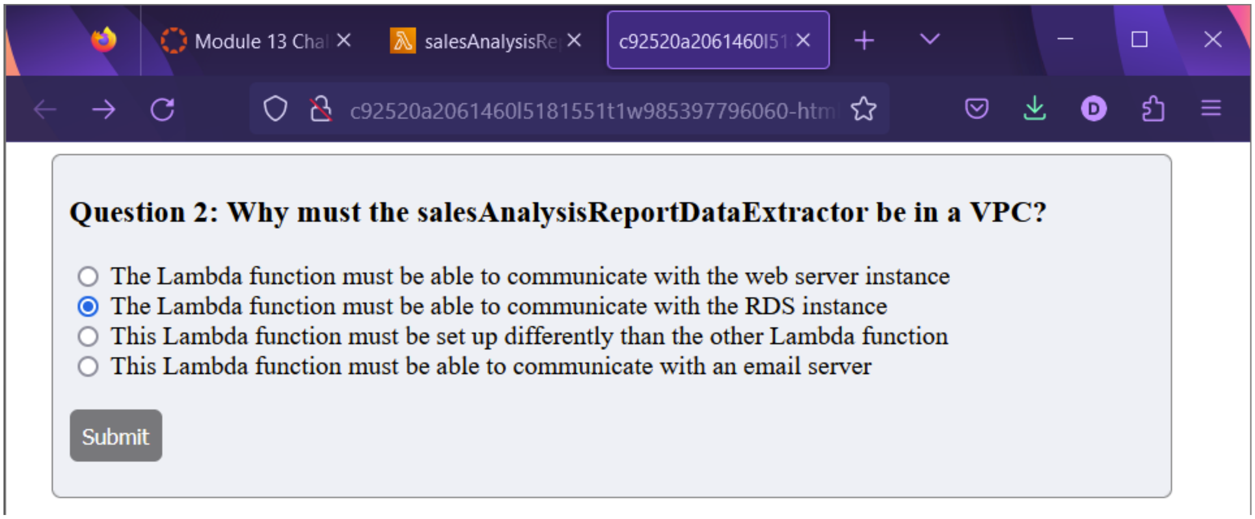
Runtime settings Info

Edit
Edit runtime management configuration

Runtime
Python 3.8

Handler Info
salesAnalysisReportDataExtractor.lambda_handler

13. Return to the browser tab with the multiple-choice questions for this lab, and answer the following question:
    - **Question 2**: Why must the *salesAnalysisReportDataExtractor* be in a VPC?



Question 2: Why must the salesAnalysisReportDataExtractor be in a VPC?

○ The Lambda function must be able to communicate with the web server instance
● The Lambda function must be able to communicate with the RDS instance
○ This Lambda function must be set up differently than the other Lambda function
○ This Lambda function must be able to communicate with an email server

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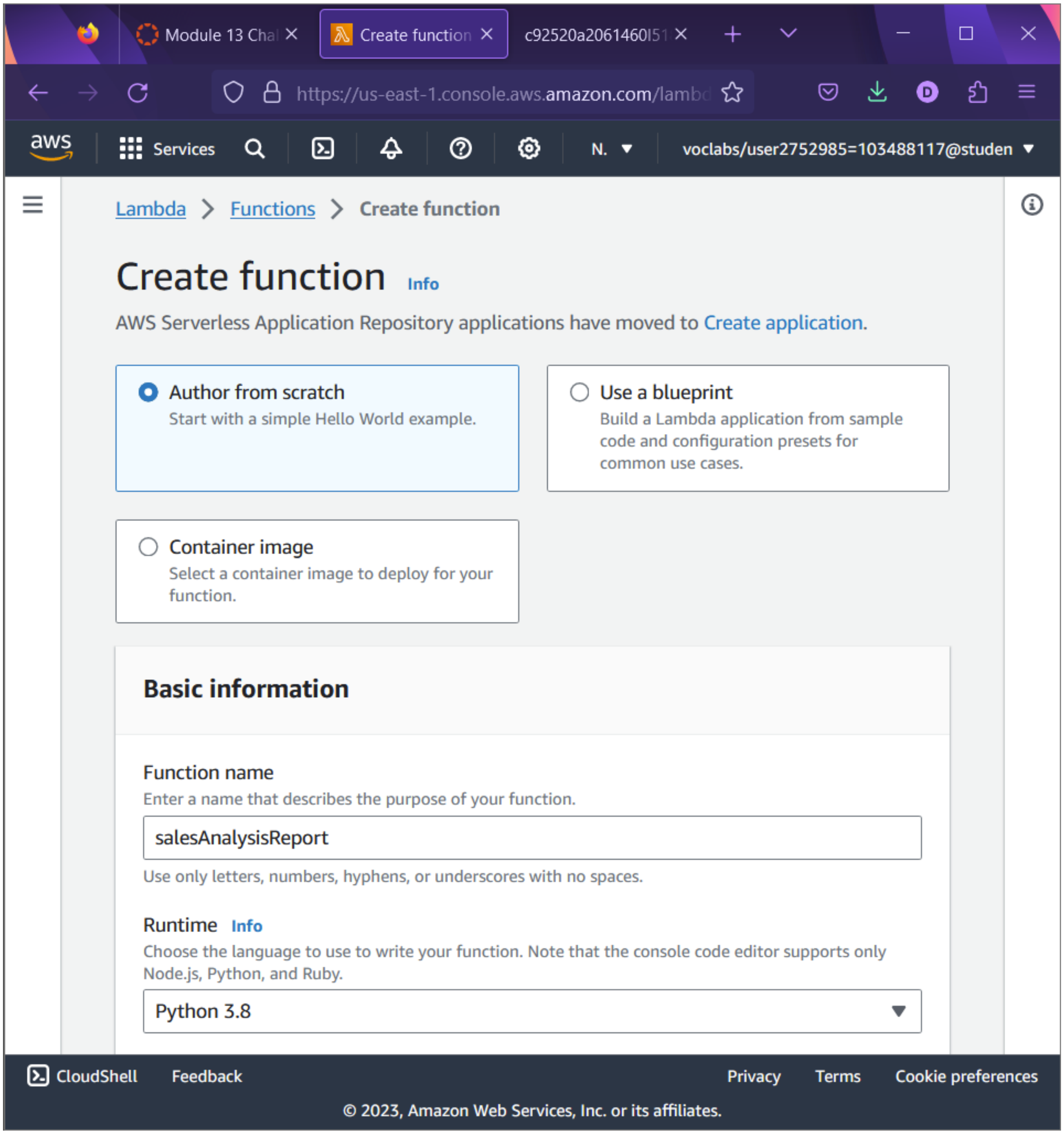
Task 3: Creating the *salesAnalysisReport* Lambda function

In this task, you will create the Lambda function that generates and sends the daily sales analysis report.

14. Create a second Lambda function with the following settings:
    - **Function name**: `salesAnalysisReport`
    - **Runtime**: *Python 3.8*
    - **Role**: *salesAnalysisReportRole*



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Lambda > Functions > Create function

Create function Info

AWS Serverless Application Repository applications have moved to Create application.

● 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.
salesAnalysisReport
Use only letters, numbers, hyphens, or underscores with no spaces.

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 3.8

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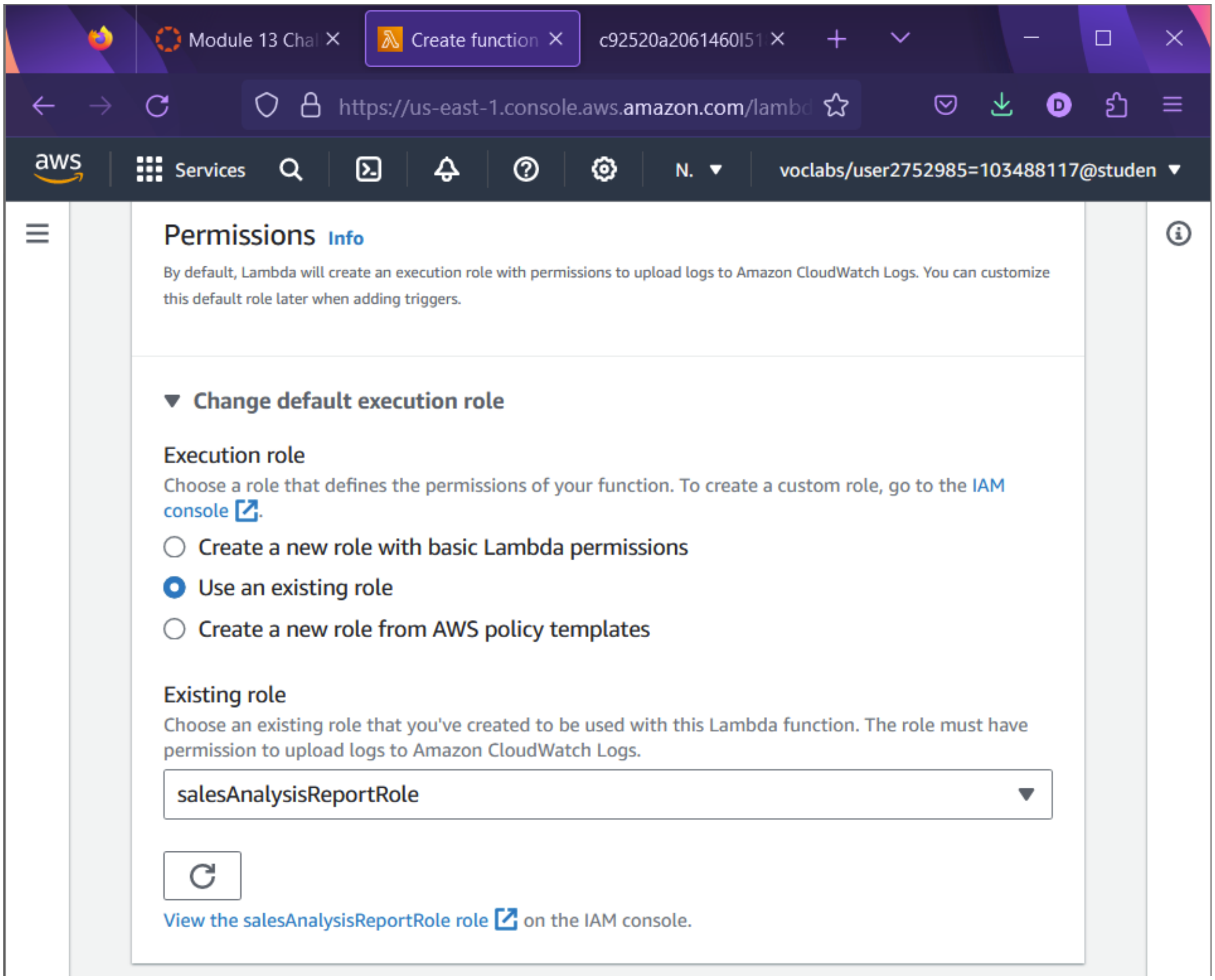
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Permissions Info

By default, Lambda will create an execution role with permissions to upload logs to Amazon CloudWatch Logs. You can customize this default role later when adding triggers.

▼ 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.

salesAnalysisReportRole

View the salesAnalysisReportRole role on the IAM console.

15. Configure the *salesAnalysisReport* Lambda function as follows:
   - **Code**: Upload the *salesAnalysisReport.zip* file
   - **Description**: `Lambda function to generate and send the daily sales report`
   - **Handler**: `salesAnalysisReport.lambda_handler`
   - **Memory Size**: *128 MB*
   - **Timeout** (seconds): `30`

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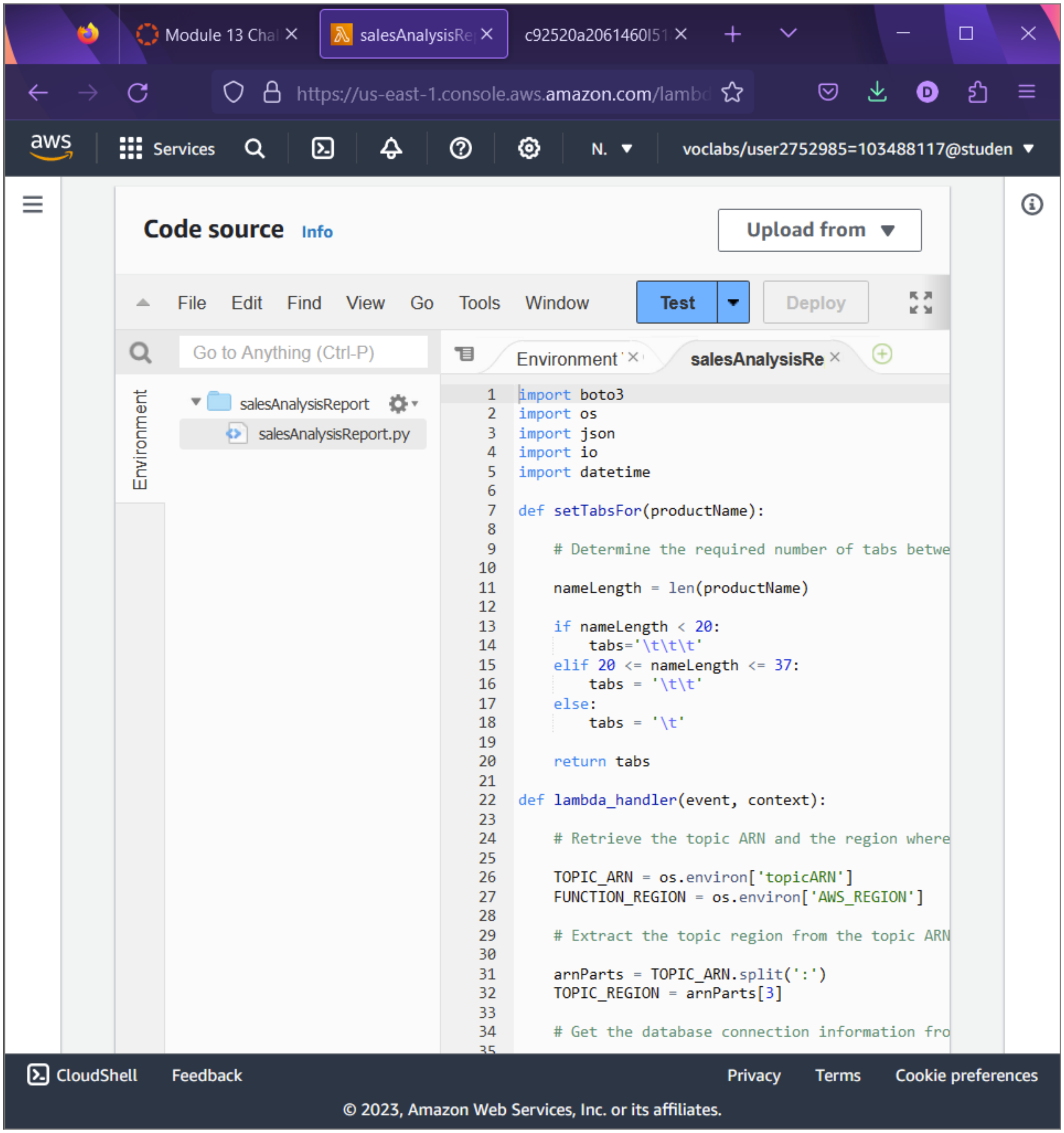

```
import boto3
import os
import json
import io
import datetime

def setTabsFor(productName):

    # Determine the required number of tabs betwe

    nameLength = len(productName)

    if nameLength < 20:
        tabs='\t\t\t'
    elif 20 <= nameLength <= 37:
        tabs = '\t\t'
    else:
        tabs = '\t'

    return tabs

def lambda_handler(event, context):

    # Retrieve the topic ARN and the region where

    TOPIC_ARN = os.environ['topicARN']
    FUNCTION_REGION = os.environ['AWS_REGION']

    # Extract the topic region from the topic ARN

    arnParts = TOPIC_ARN.split(':')
    TOPIC_REGION = arnParts[3]

    # Get the database connection information fro
```

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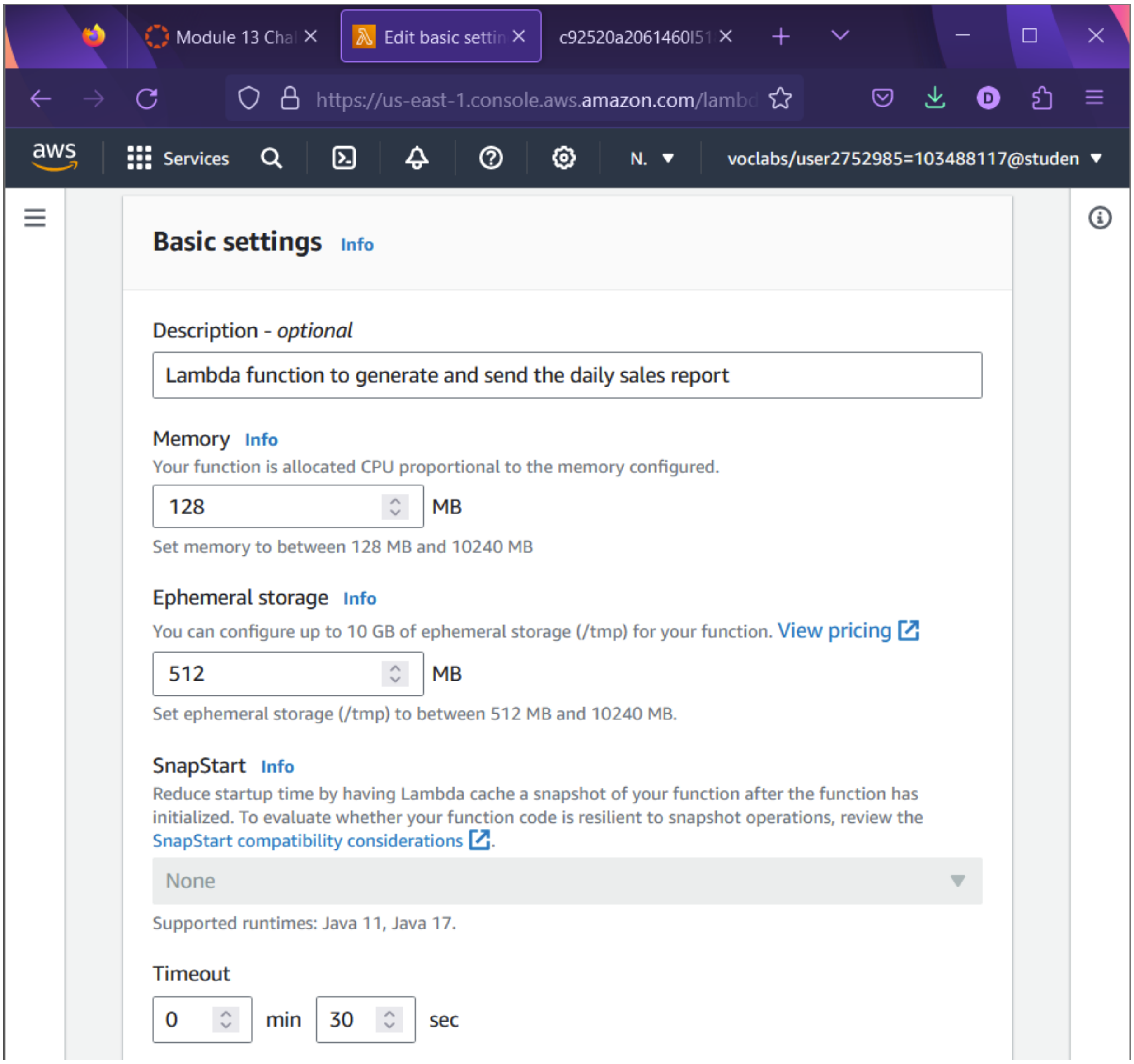

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Basic settings Info

Description - *optional*

Lambda function to generate and send the daily sales report

Memory Info

Your function is allocated CPU proportional to the memory configured.

128 MB

Set memory to between 128 MB and 10240 MB

Ephemeral storage Info

You can configure up to 10 GB of ephemeral storage (/tmp) for your function. View pricing

512 MB

Set ephemeral storage (/tmp) to between 512 MB and 10240 MB.

SnapStart Info

Reduce startup time by having Lambda cache a snapshot of your function after the function has initialized. To evaluate whether your function code is resilient to snapshot operations, review the SnapStart compatibility considerations.

None

Supported runtimes: Java 11, Java 17.

Timeout

0 min 30 sec

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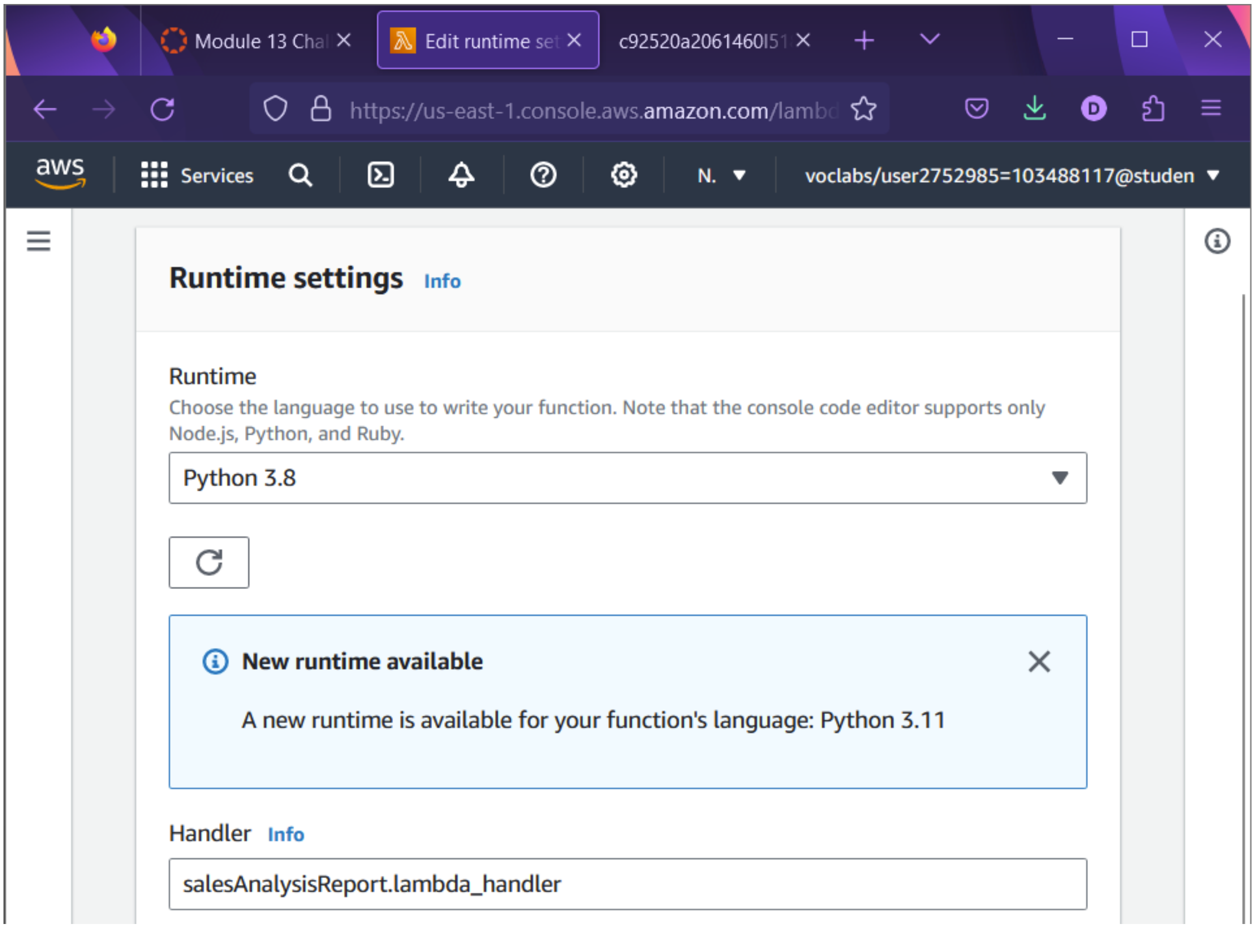

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Runtime settings Info

Runtime

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

Python 3.8 ▼

New runtime available

A new runtime is available for your function's language: Python 3.11

Handler Info

salesAnalysisReport.lambda_handler

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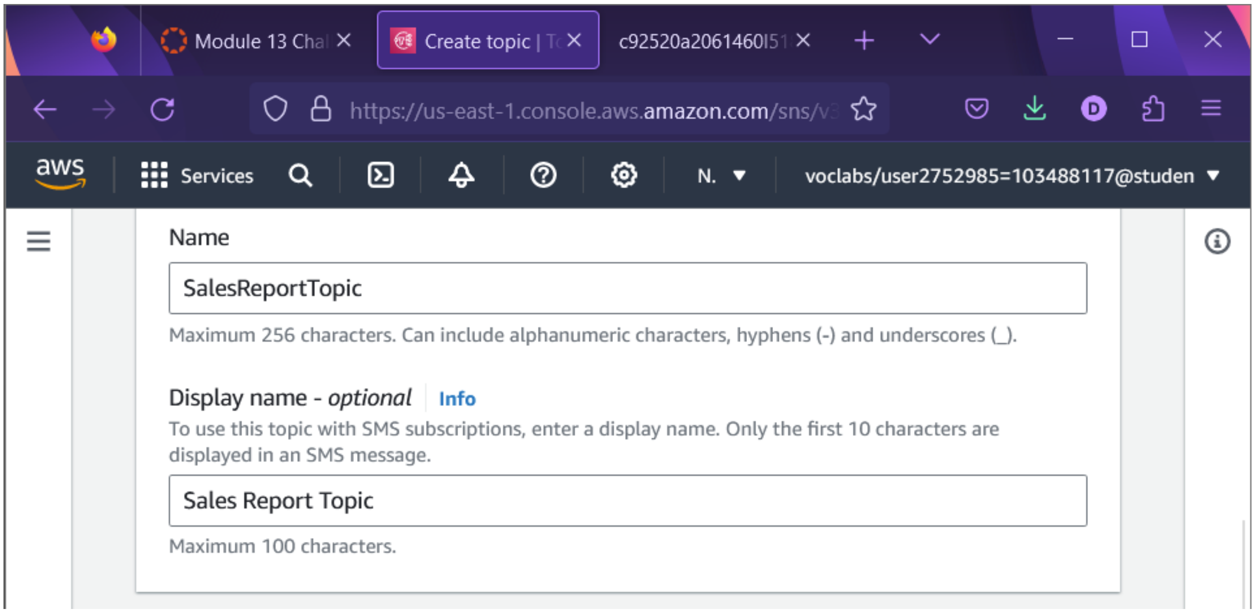
Task 4: Creating an SNS topic

The sales analysis report uses an SNS topic to send the report to email subscribers. In this task, you will create an SNS topic and update the environment variables of the *salesAnalysisReport* Lambda function to store the topic Amazon Resource Name (ARN).

16. Create a standard SNS topic with the following configuration:
    - **Name**: `SalesReportTopic`
    - **Display Name**: `Sales Report Topic`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Name

SalesReportTopic

Maximum 256 characters. Can include alphanumeric characters, hyphens (-) and underscores (_).

Display name - *optional* Info

To use this topic with SMS subscriptions, enter a display name. Only the first 10 characters are displayed in an SMS message.

Sales Report Topic

Maximum 100 characters.

17. Update the *salesAnalysisReport* Lambda function by adding the following environment variable:
    - **Variable Name**: `topicARN`
    - **Variable Value**: The ARN of the topic you just created

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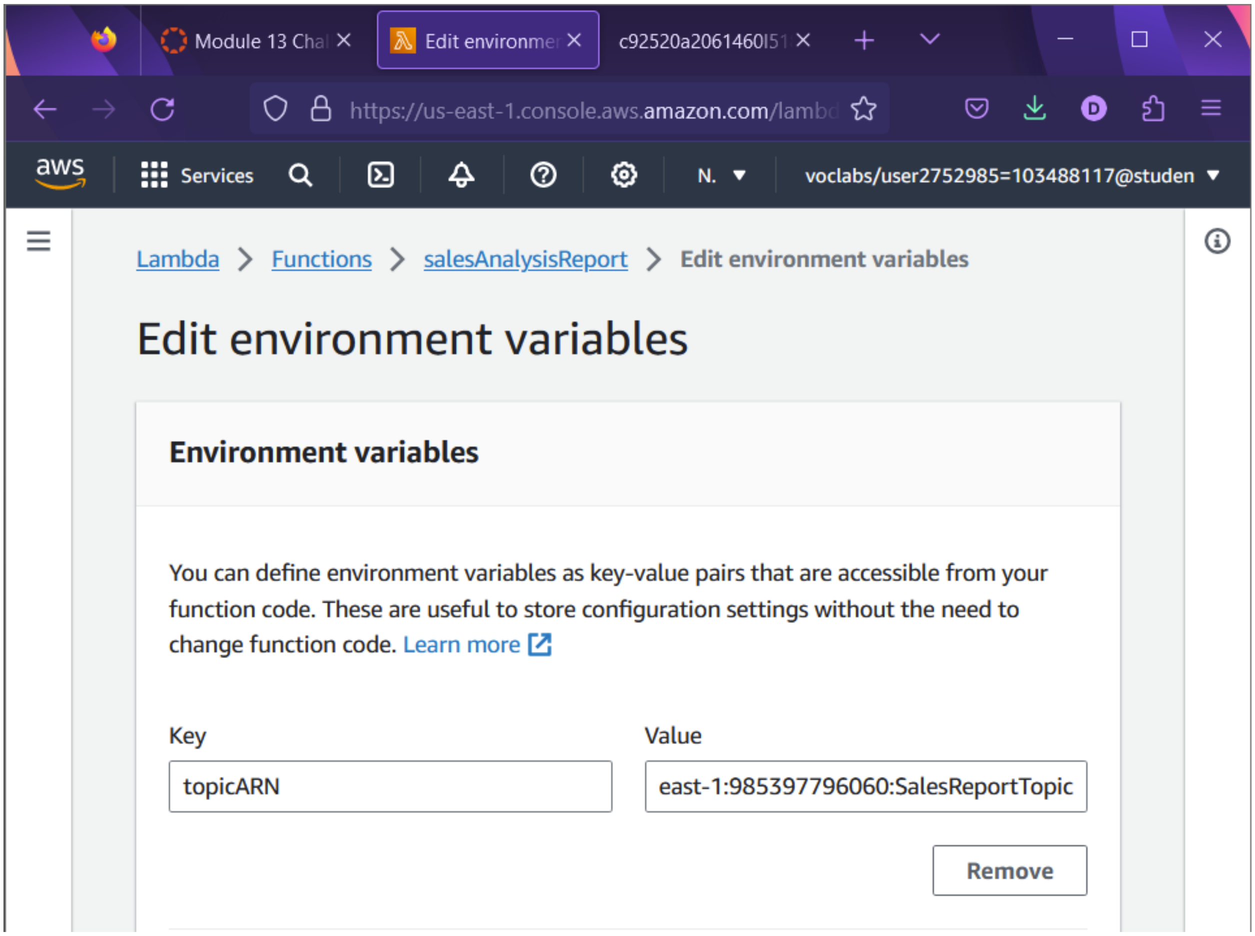
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Lambda > Functions > salesAnalysisReport > Edit environment variables

Edit environment variables

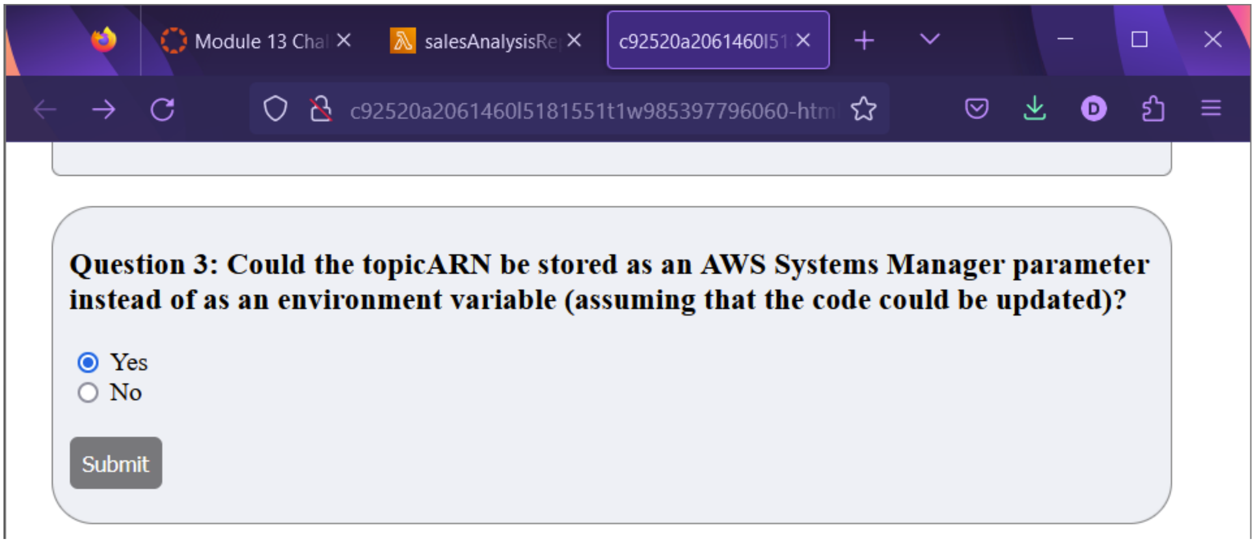
Environment variables

You can define environment variables as key-value pairs that are accessible from your function code. These are useful to store configuration settings without the need to change function code. Learn more

Key: topicARN

Value: east-1:985397796060:SalesReportTopic

18. Return to the browser tab with the multiple-choice questions for this lab, and answer the following question:
    - **Question 3**: Could the *topicARN* be stored as an AWS Systems Manager parameter instead of as an environment variable (assuming that the code could be updated)?



Question 3: Could the topicARN be stored as an AWS Systems Manager parameter instead of as an environment variable (assuming that the code could be updated)?

● Yes
○ No

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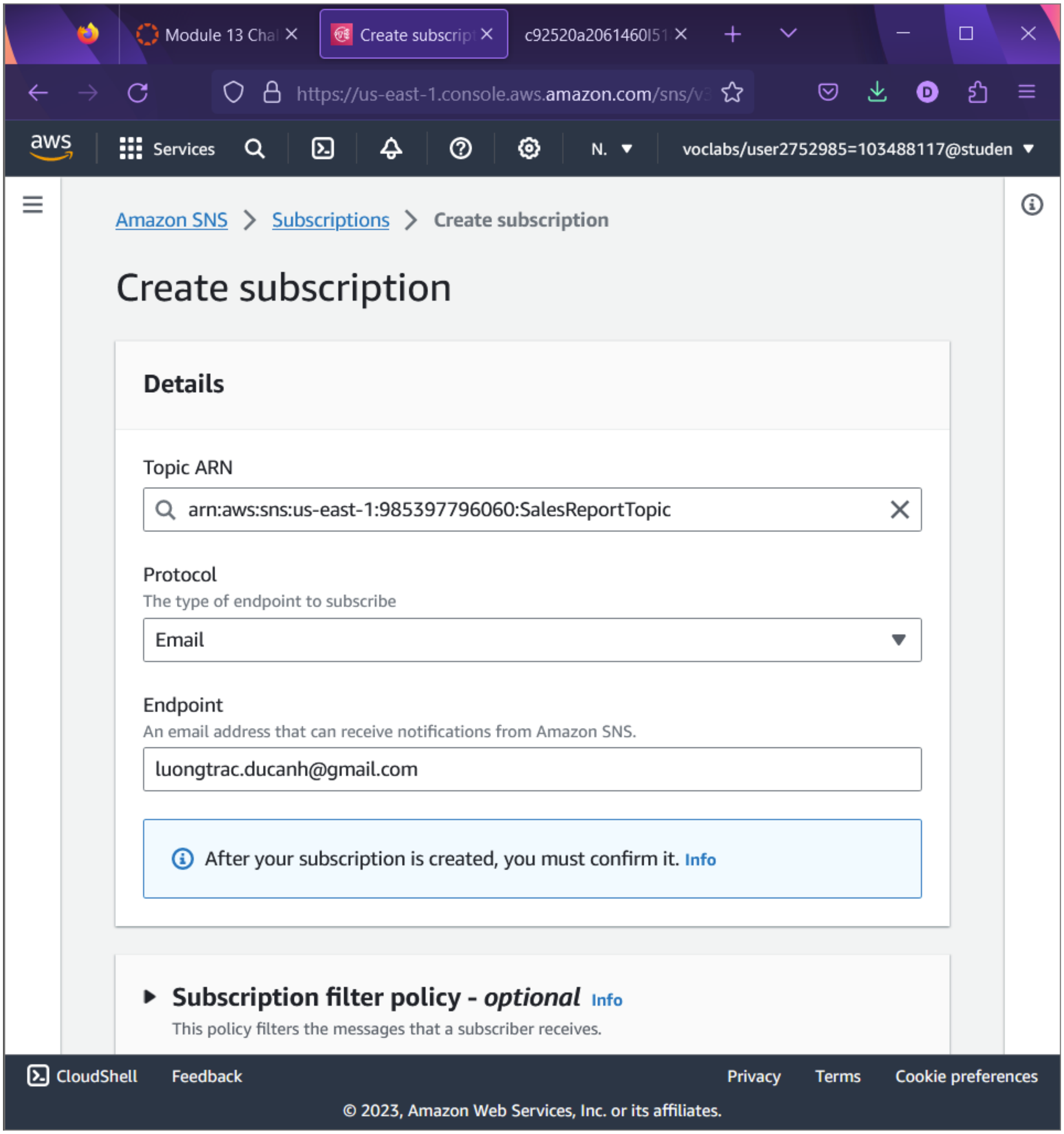
Task 5: Creating an email subscription to the SNS topic

To receive the sales report through email, you must create an email subscription to the topic that you created in the previous task.

19. Create a new email subscription to the topic. Use an email address that you can easily access for this lab.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aws
Services
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voclabs/user2752985=103488117@studen
Amazon SNS > Subscriptions > Create subscription

Create subscription

Details

Topic ARN

arn:aws:sns:us-east-1:985397796060:SalesReportTopic

Protocol

The type of endpoint to subscribe

Email

Endpoint

An email address that can receive notifications from Amazon SNS.

luongtrac.ducanh@gmail.com

After your subscription is created, you must confirm it. Info

Subscription filter policy - *optional* Info

This policy filters the messages that a subscriber receives.

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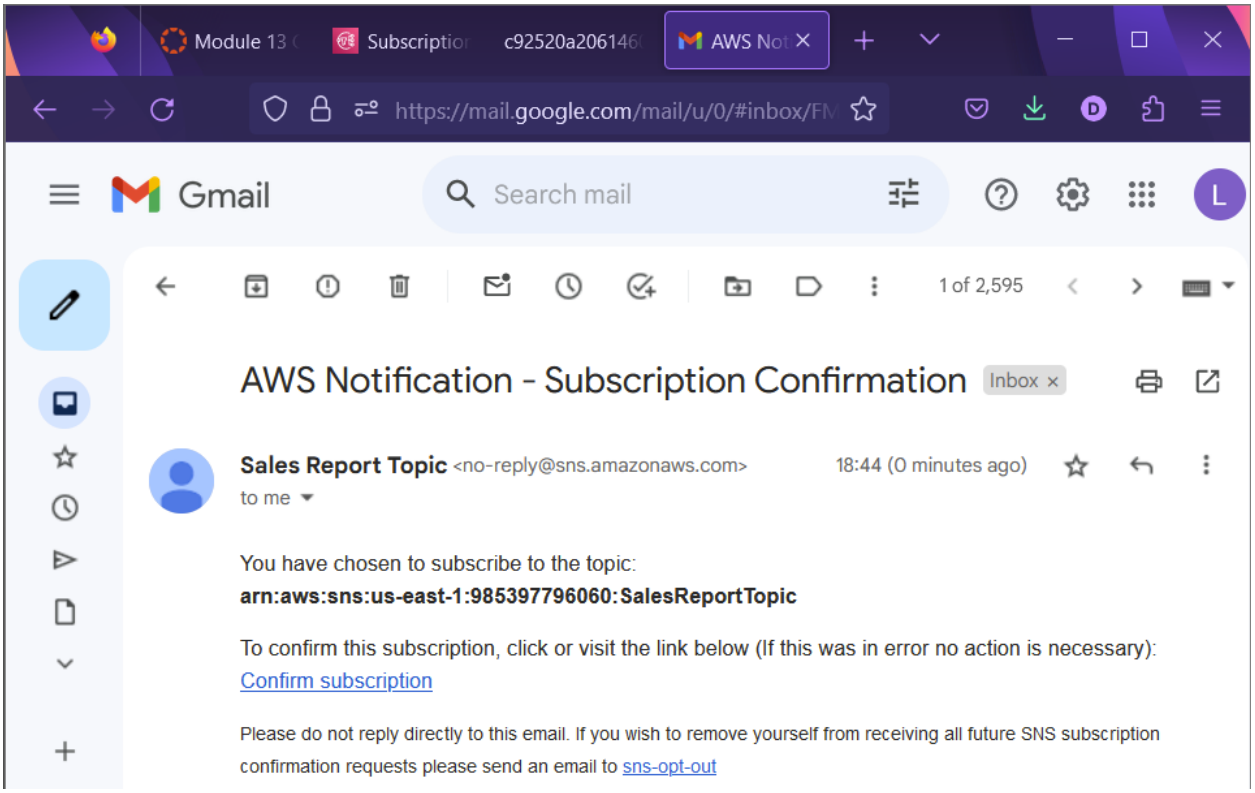
20. Confirm the email subscription from your email client. **Note**: If you don't receive an email confirmation, check your **Junk** or **Spam** folder.



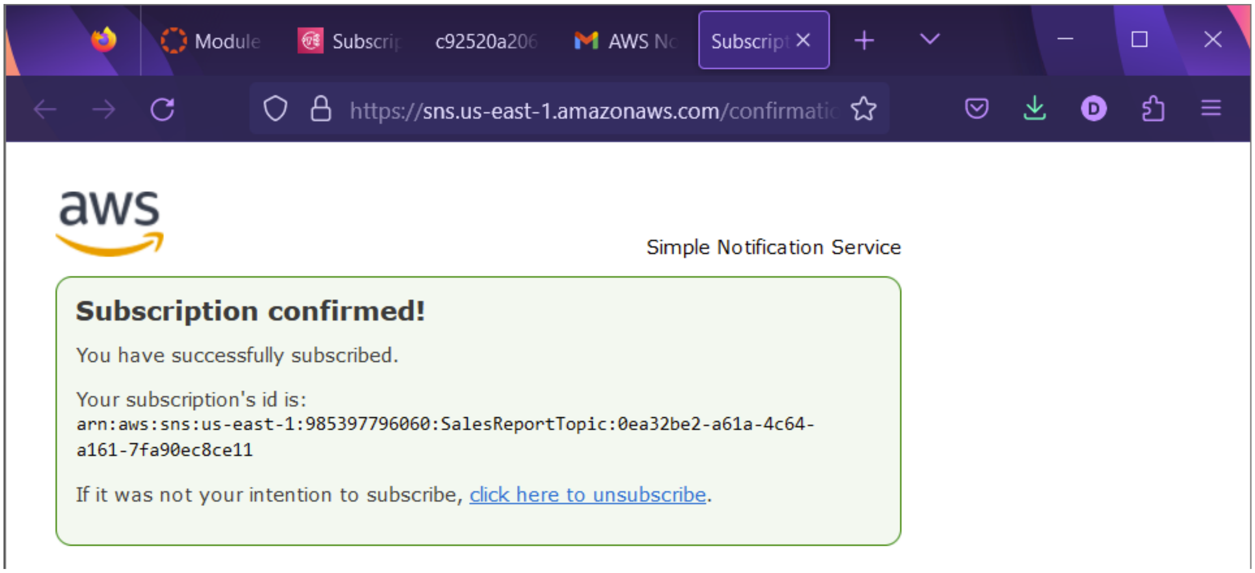
AWS Notification - Subscription Confirmation

Sales Report Topic <no-reply@sns.amazonaws.com> 18:44 (0 minutes ago)
to me

You have chosen to subscribe to the topic:
arn:aws:sns:us-east-1:985397796060:SalesReportTopic

To confirm this subscription, click or visit the link below (If this was in error no action is necessary):
Confirm subscription

Please do not reply directly to this email. If you wish to remove yourself from receiving all future SNS subscription confirmation requests please send an email to sns-opt-out


Module
Subscri
c92520a206
AWS N
Subscript
https://sns.us-east-1.amazonaws.com/confirmati
aws
Simple Notification Service

Subscription confirmed!

You have successfully subscribed.

Your subscription's id is:
arn:aws:sns:us-east-1:985397796060:SalesReportTopic:0ea32be2-a61a-4c64-a161-7fa90ec8ce11

If it was not your intention to subscribe, click here to unsubscribe.

21. Return to the browser tab with the multiple-choice questions for this lab, and answer the following question:
    - **Question 4**: Will you receive an email message if you do not confirm the topic subscription?

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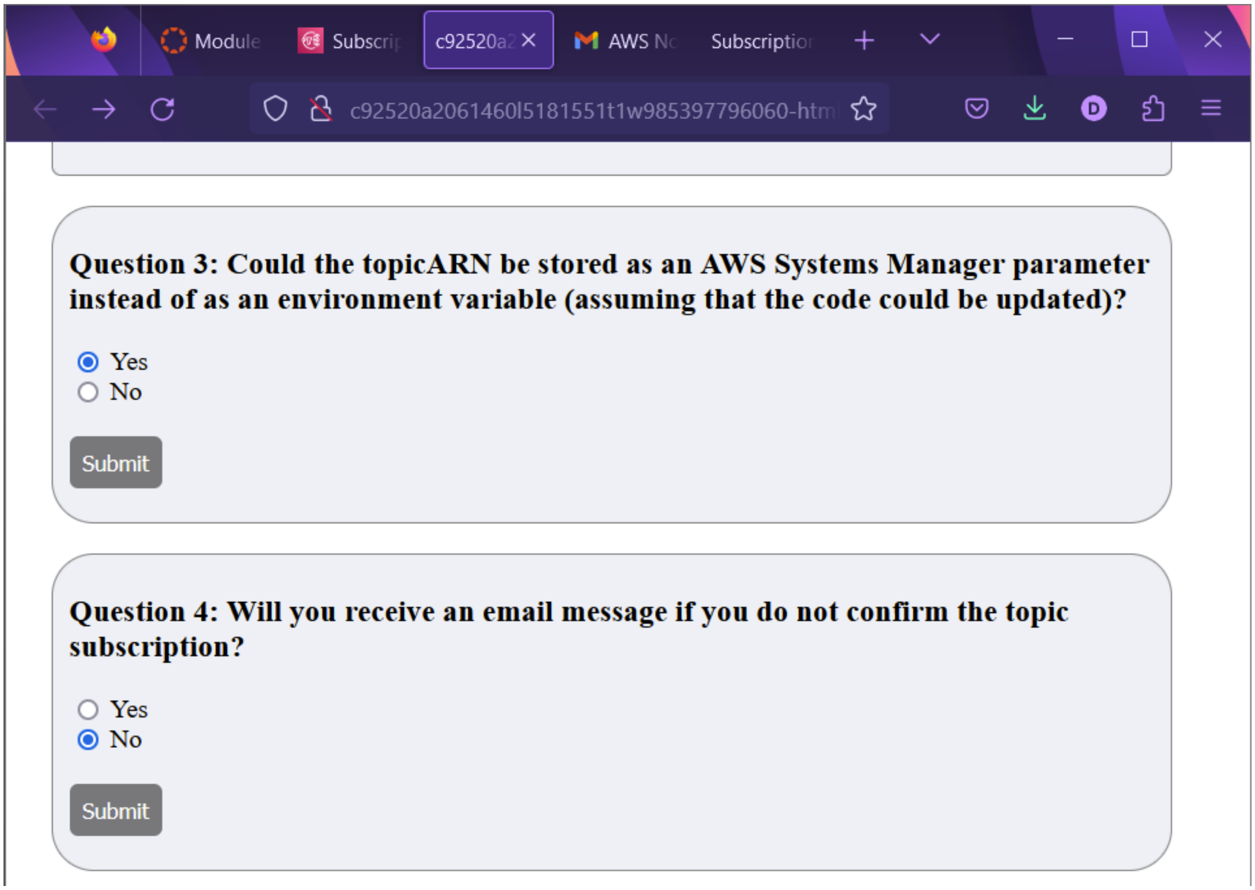

Question 3: Could the topicARN be stored as an AWS Systems Manager parameter instead of as an environment variable (assuming that the code could be updated)?

● Yes
○ No

Submit

Question 4: Will you receive an email message if you do not confirm the topic subscription?

○ Yes
● No

Submit

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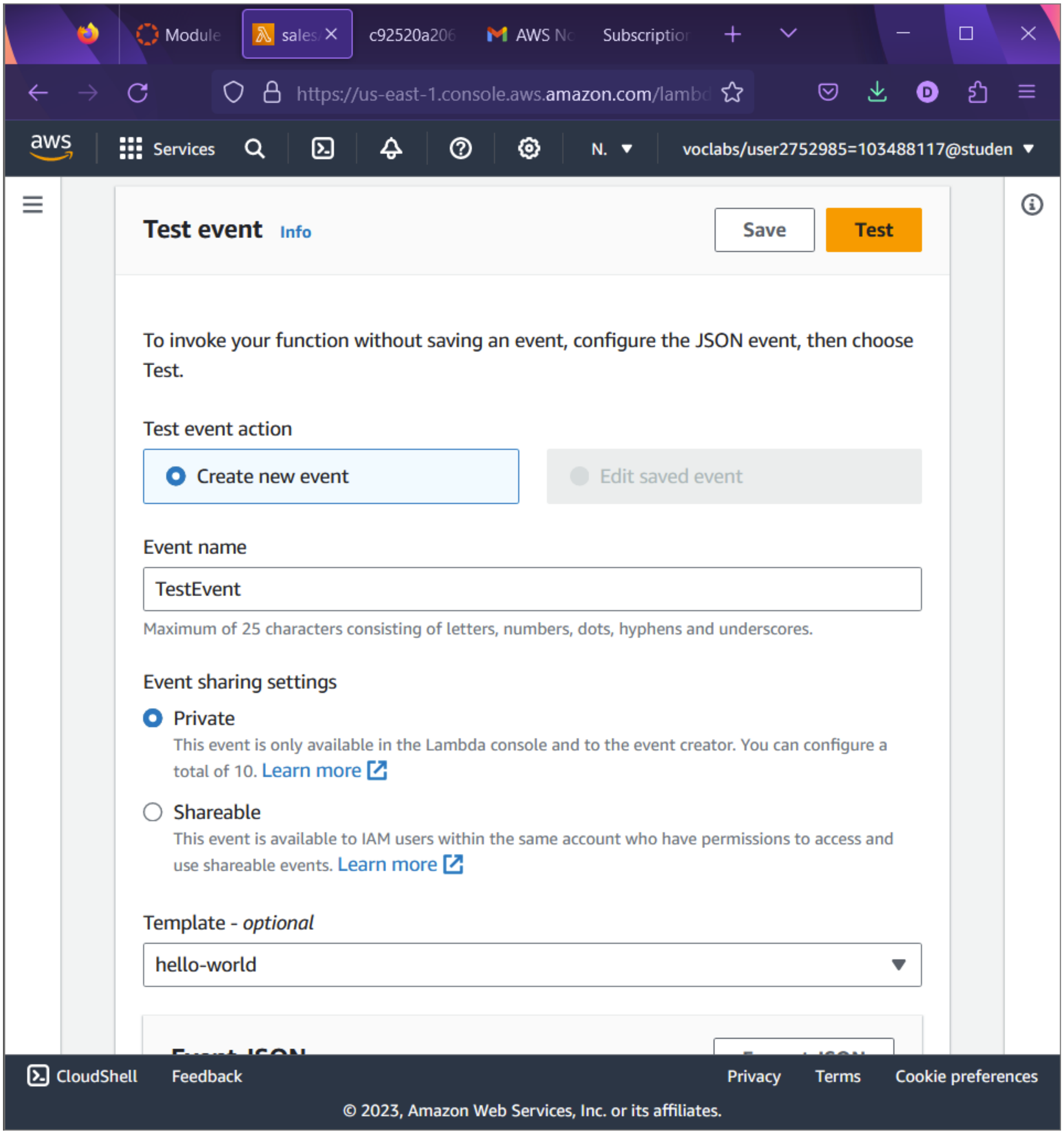
Task 6: Testing the *salesAnalysisReport* Lambda function

Before creating the daily reporting event, you must test that the *salesAnalysisReport* Lambda function works correctly.

22. Create a test for the *salesAnalysisReport* Lambda function.
    Tip: You don't need to worry about parameters, so enter an event name and accept the default `hello-world` test event.


Module
sales
c92520a206
AWS N
Subscriptior
https://us-east-1.console.aws.amazon.com/lambd
aws
Services
N.
voclabs/user2752985=103488117@studen
Save
Test
CloudShell
Feedback
Privacy
Terms
Cookie preferences
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Test event Info

To invoke your function without saving an event, configure the JSON event, then choose Test.

Test event action

● Create new event ○ Edit saved event

Event name

TestEvent

Maximum of 25 characters consisting of letters, numbers, dots, hyphens and underscores.

Event sharing settings

● Private
This event is only available in the Lambda console and to the event creator. You can configure a total of 10. Learn more

○ Shareable
This event is available to IAM users within the same account who have permissions to access and use shareable events. Learn more

Template - *optional*

hello-world

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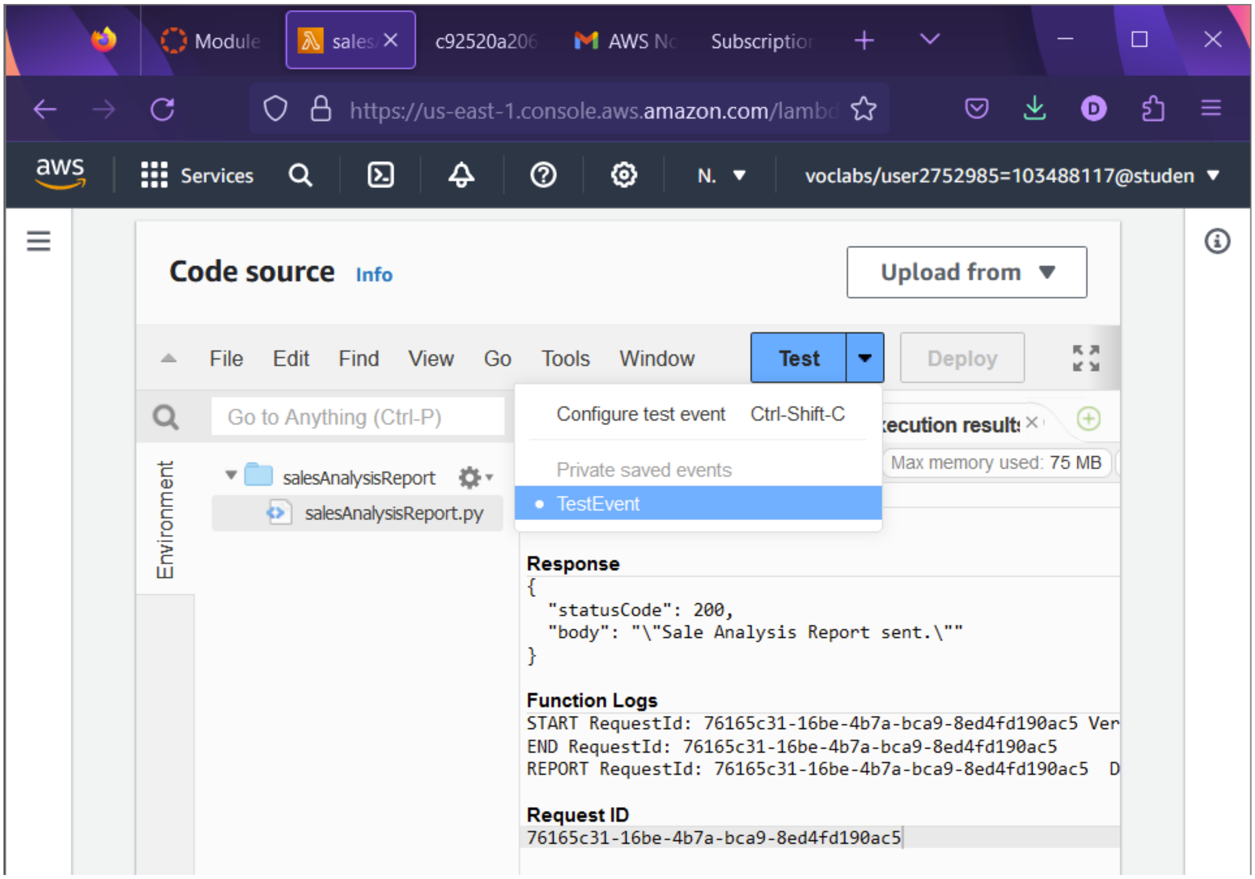
23. Run the *salesAnalysisReport* test. If the test succeeds, you should have an email report in a couple of minutes.



Response
```
{
  "statusCode": 200,
  "body": "\"Sale Analysis Report sent.\""
}
```

Function Logs
```
START RequestId: 76165c31-16be-4b7a-bca9-8ed4fd190ac5 Ver
END RequestId: 76165c31-16be-4b7a-bca9-8ed4fd190ac5
REPORT RequestId: 76165c31-16be-4b7a-bca9-8ed4fd190ac5  D
```

Request ID
```
76165c31-16be-4b7a-bca9-8ed4fd190ac5
```

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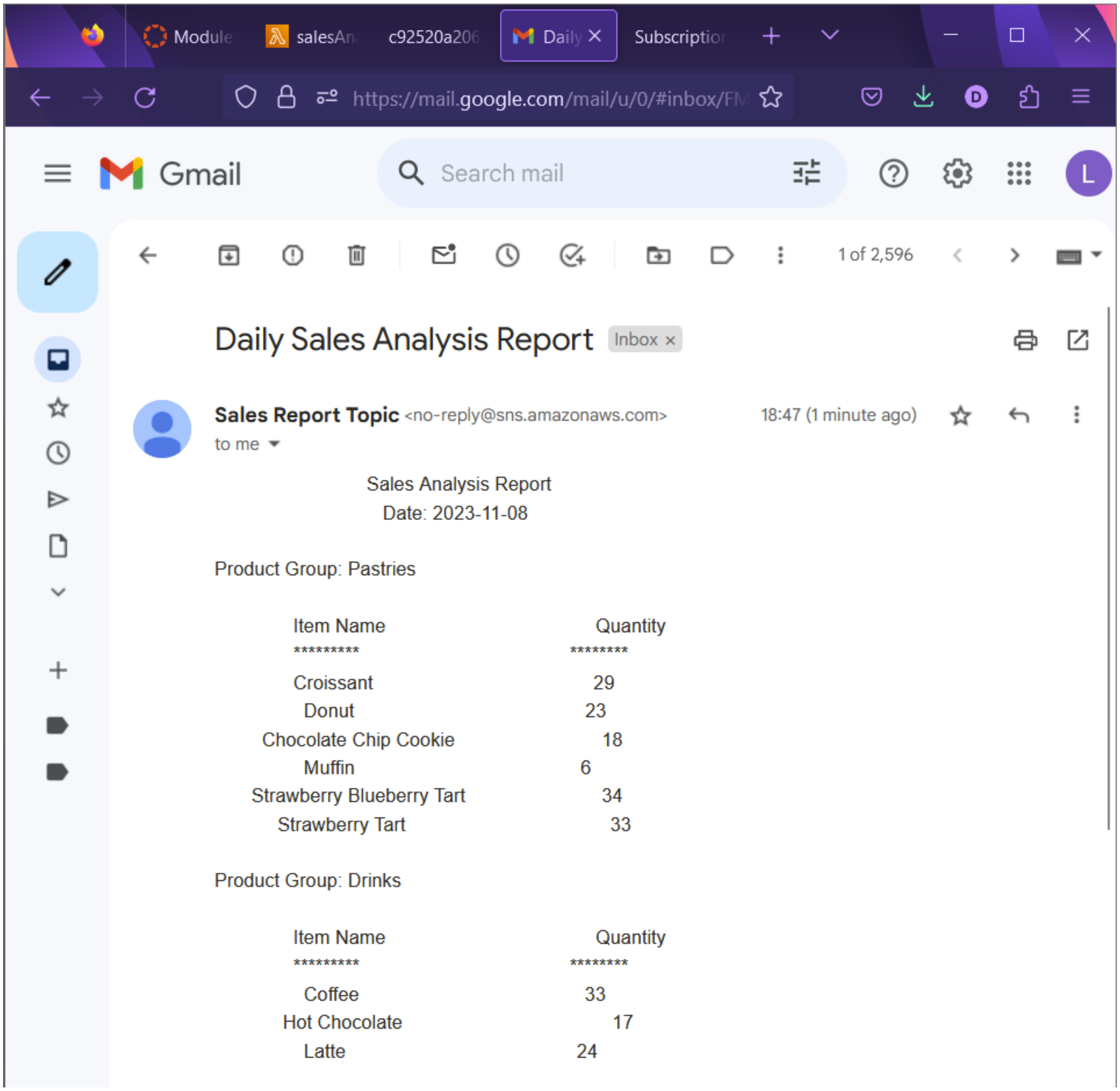

Daily Sales Analysis Report

Sales Report Topic <no-reply@sns.amazonaws.com> 18:47 (1 minute ago)

```
                 Sales Analysis Report
                  Date: 2023-11-08

Product Group: Pastries

        Item Name                       Quantity
        *********                       ********
        Croissant                        29
          Donut                         23
     Chocolate Chip Cookie                18
          Muffin                        6
   Strawberry Blueberry Tart              34
       Strawberry Tart                     33

Product Group: Drinks

        Item Name                       Quantity
        *********                       ********
          Coffee                        33
        Hot Chocolate                      17
          Latte                        24
```

24. If the Lambda function test execution failed, use the logs to review any errors, address them, and run the test again. Here are some *troubleshooting tips* that you can try:
    - Review the logs from Amazon CloudWatch Logs for both Lambda functions:
        - If you see an error about connecting to the café database, check that your security groups are configured correctly.
        - If you see an error about timeout, check that the timeout is set to *30 seconds*.
        - If you see an error about *lambda_function not found*, check that you have configured the correct handler.
    - Review your work to make sure that you completed all the steps.
    - Go to the *Submitting your work* section and follow the steps to submit your work. The submission report will show whether you completed the previous steps correctly.

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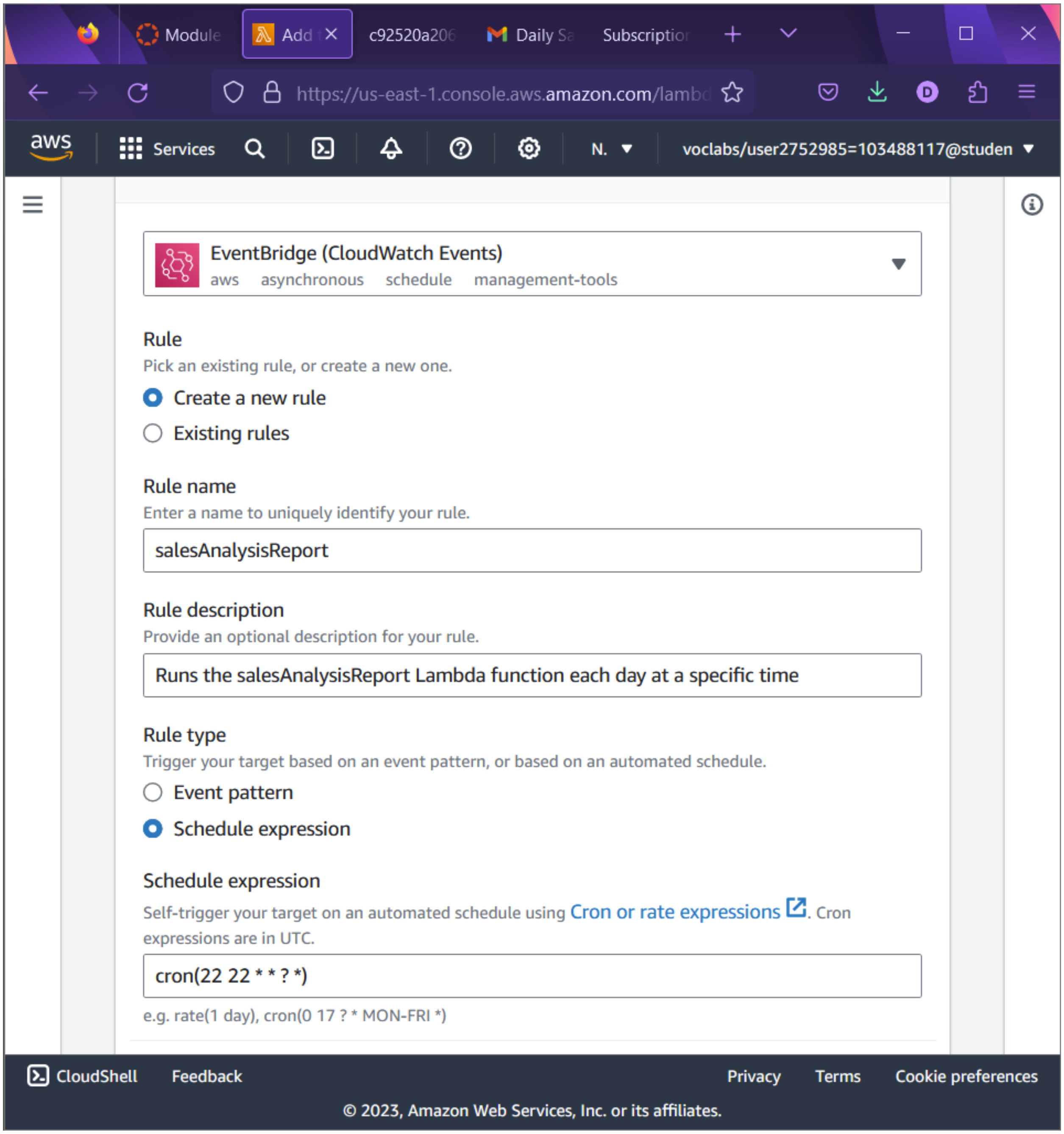
Task 7: Setting up an Amazon EventBridge event to trigger the Lambda function each day

The last step in this challenge is to set up a trigger that will run the report each day.

25. Create a new EventBridge rule that runs the *salesAnalysisReport* Lambda function each day at a specific time. Make sure to choose **Continue to create rule**.



https://us-east-1.console.aws.amazon.com/lambd

voclabs/user2752985=103488117@studen

EventBridge (CloudWatch Events)
aws asynchronous schedule management-tools

Rule
Pick an existing rule, or create a new one.

● Create a new rule
○ Existing rules

Rule name
Enter a name to uniquely identify your rule.

salesAnalysisReport

Rule description
Provide an optional description for your rule.

Runs the salesAnalysisReport Lambda function each day at a specific time

Rule type
Trigger your target based on an event pattern, or based on an automated schedule.

○ Event pattern
● Schedule expression

Schedule expression
Self-trigger your target on an automated schedule using Cron or rate expressions. Cron expressions are in UTC.

cron(22 22 * * ? *)

e.g. rate(1 day), cron(0 17 ? * MON-FRI *)

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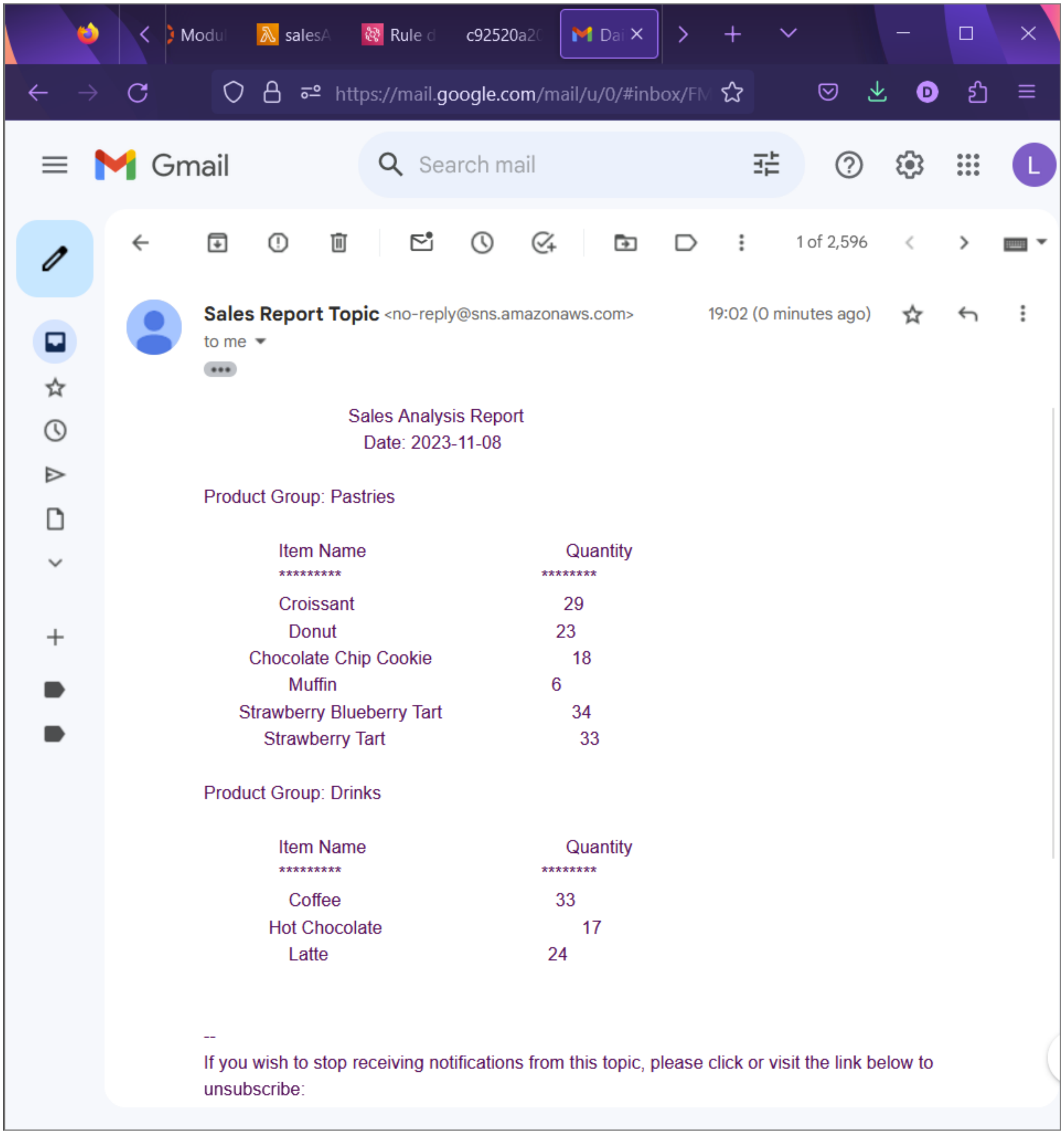
Hint: If you get stuck, see the cron expression examples in the AWS Documentation. **Tip**: Use a time that is close to your current time, but remember that the time must be specified in Coordinated Universal Time (UTC)!

26. Check your email to see if you received the report.

After updating the time to the local time zone (7:02 PM GMT+7)



Sales Report Topic <no-reply@sns.amazonaws.com>   19:02 (0 minutes ago)

```
                Sales Analysis Report
                  Date: 2023-11-08

Product Group: Pastries

        Item Name                    Quantity
        *********                   ********
        Croissant                     29
          Donut                      23
     Chocolate Chip Cookie             18
          Muffin                    6
    Strawberry Blueberry Tart          34
       Strawberry Tart                  33

Product Group: Drinks

        Item Name                    Quantity
        *********                   ********
          Coffee                     33
      Hot Chocolate                     17
          Latte                     24


--
If you wish to stop receiving notifications from this topic, please click or visit the link below to
unsubscribe:
```

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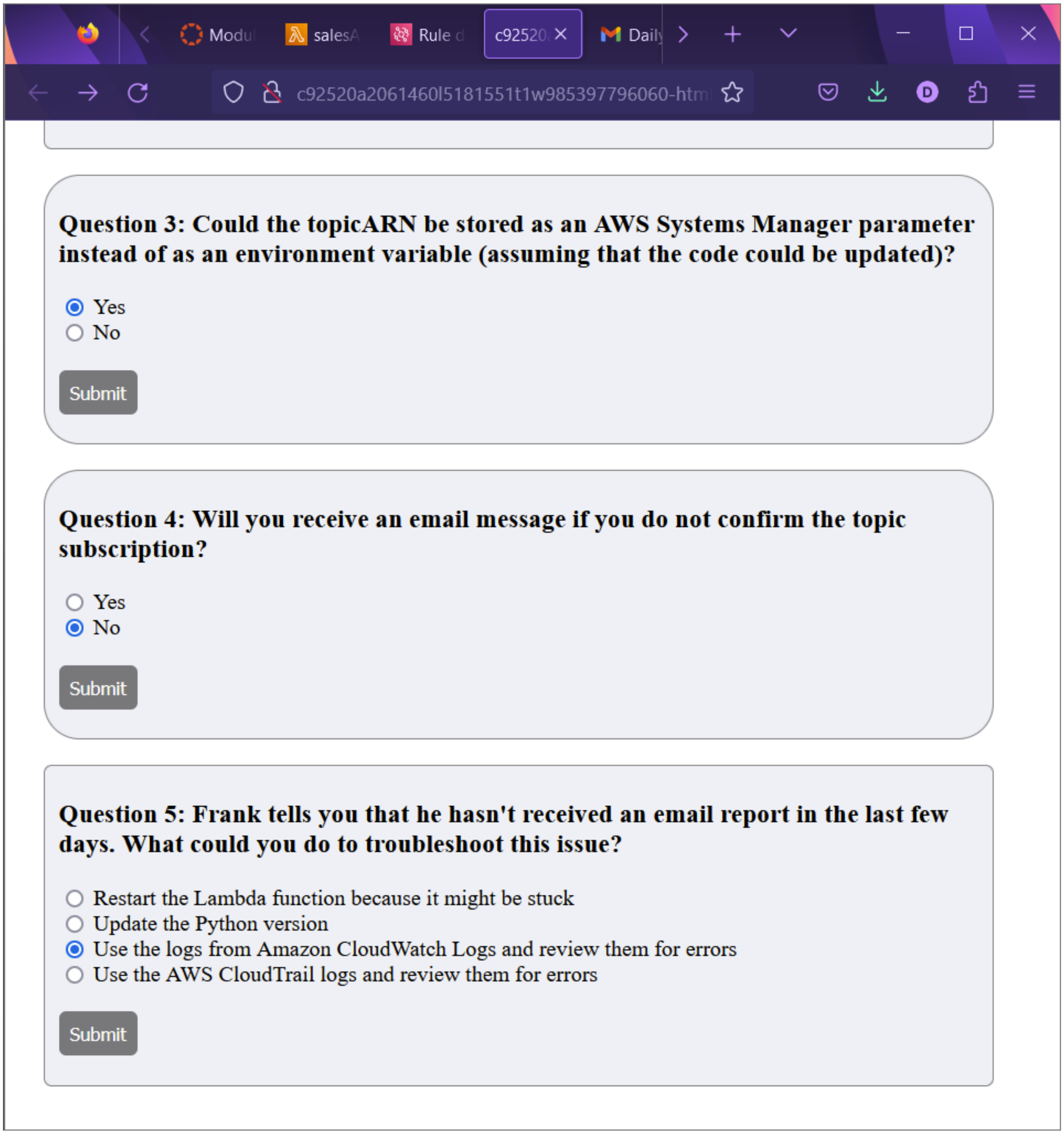
27. Return to the browser tab with the multiple-choice questions for this lab, and answer the following question:
    - **Question 5**: Frank tells you that he hasn't received an email report in the last few days. What could you do to troubleshoot this issue?



Question 3: Could the topicARN be stored as an AWS Systems Manager parameter instead of as an environment variable (assuming that the code could be updated)?

● Yes
○ No

Submit

Question 4: Will you receive an email message if you do not confirm the topic subscription?

○ Yes
● No

Submit

Question 5: Frank tells you that he hasn't received an email report in the last few days. What could you do to troubleshoot this issue?

○ Restart the Lambda function because it might be stuck
○ Update the Python version
● Use the logs from Amazon CloudWatch Logs and review them for errors
○ Use the AWS CloudTrail logs and review them for errors

Submit

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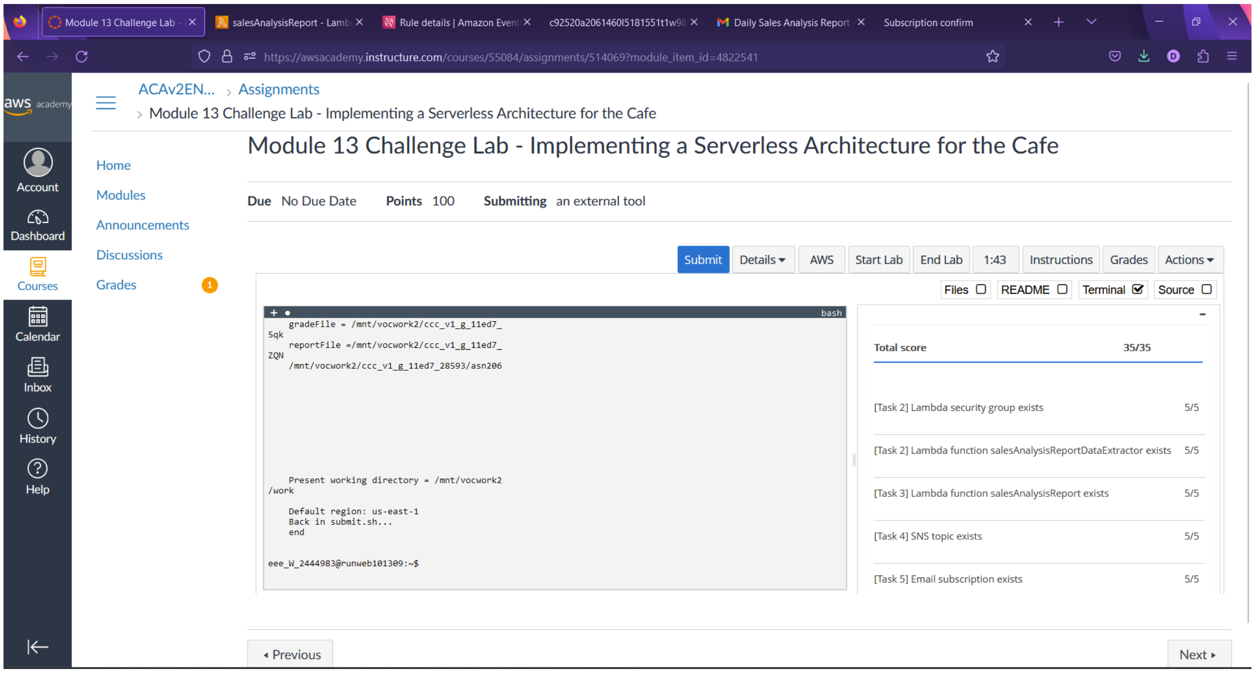
Update from the café

After Sofía finishes testing the reporting, she creates an email subscription for Frank and Martha. Frank and Martha are excited to receive the first daily report from the serverless solution.

Sofía is pleased that she automated sales reporting for the café, which will continue to help Frank and Martha analyze daily sales and plan the café's inventory. She's also happy that she successfully learned how to use AWS Lambda, Amazon SNS, and Amazon EventBridge. In fact, Sofía plans to implement more serverless and automated reporting features into the café's web application to help the café grow and manage their business.

Submitting your work

28. At the top of these instructions, choose Submit to record your progress and when prompted, choose **Yes**.
29. If the results don't display after a couple of minutes, return to the top of these instructions and choose Grades
 Tip: You can submit your work multiple times. After you change your work, choose **Submit** again. Your last submission is what will be recorded for this lab.
30. To find detailed feedback on your work, choose Details followed by **View Submission Report**.



Module 13 Challenge Lab - Implementing a Serverless Architecture for the Cafe

Due No Due Date **Points** 100 **Submitting** an external tool

```
    gradeFile = /mnt/vocwork2/ccc_v1_g_11ed7_
5qk
    reportFile =/mnt/vocwork2/ccc_v1_g_11ed7_
ZQN
    /mnt/vocwork2/ccc_v1_g_11ed7_28593/asn206




    Present working directory = /mnt/vocwork2
/work

    Default region: us-east-1
    Back in submit.sh...
    end


eee_W_2444983@runweb101309:~$
```

Total score	35/35
[Task 2] Lambda security group exists	5/5
[Task 2] Lambda function salesAnalysisReportDataExtractor exists	5/5
[Task 3] Lambda function salesAnalysisReport exists	5/5
[Task 4] SNS topic exists	5/5
[Task 5] Email subscription exists	5/5