**Homework 10: Databases - Solution Template (Total Points: 100)**

Due: Sunday November 18 11:59PM ET

**Problem 1. Relational Database (50 points)**

1. Create new MariaDB database instance (Make sure to check “Only enable options eligible for RDS Free Usage Tier” option):  
   1. Use “<your\_initials>mariadb”, e.g. “skmariadb”, as DB Instance Identifier (that’s the name of your database space to hold all your MariaDB databases), “admin” as Master username, and “admin123” as Master password. You can use your own DB name, master username and password, just don’t forget it.
   2. Configure Network & Security to use default VPC, default subnet, make it **not** publicly accessible, create new VPC security group.
   3. Set database name to “e90\_grade\_tracker” , leave other options with default values, uncheck “Deletion protection”.  
        
      Paste the screenshot of the Summary of your DB instance:

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1. Launch EC2 Instance to be used as MySql DB client to work with your MariaDB database.
   1. Create t2.micro EC2 instance with sqlClient installed on it, using the following script (use security group with open ssh and http ports open):

#!/bin/bash  
yum install httpd php php-mysql mysql -y  
yum update -y  
chkconfig httpd on  
service httpd start  
echo "<?php phpinfo();?>" > /var/www/html/index.php

* 1. Paste the screenshot of the Description tab of your instance:

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Paste the screenshot of the mysql section from the PHP web page displayed by your EC2 instance if you access it through browser (scroll down to find mysql section or search for it in the page)

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1. On the RDS Instances page of the AWS Console setup Inbound Security group to use the same SG that your EC2 instance is using as Source.  
     
   Paste the screenshot of the Connect section of your DB instance:

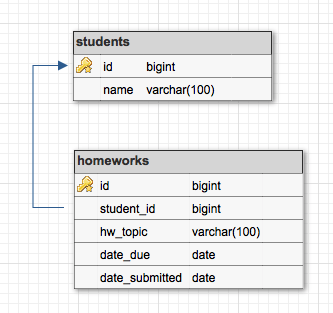
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1. Connect to your DB from EC2 instance:  
   mysql -h e90mariadb.c4sfkoyotzjy.us-east-2.rds.amazonaws.com -P 3306 -u admin -p

Paste the screenshot of the result of show databases query:

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Now run a sequence of SQL statements to create the tables according to the following schema diagram:



* 1. Run the following SQL to create your DB and tables:

CREATE DATABASE e90\_grade\_tracker;  
  
USE e90\_grade\_tracker;  
  
CREATE TABLE `students` (  
 `id` bigint NOT NULL AUTO\_INCREMENT,  
 `name` varchar(100) NOT NULL,  
 PRIMARY KEY (`id`));  
  
CREATE TABLE `homeworks` (  
 `id` bigint NOT NULL AUTO\_INCREMENT,  
 `student\_id` bigint NOT NULL,  
 `hw\_topic` varchar(100) NOT NULL,  
 `date\_due` DATE NOT NULL,  
 `date\_submitted` DATE,  
 PRIMARY KEY (`id`));

* 1. Add students and homeworks to the tables:

INSERT INTO students (name) VALUES ('Johnny Depp');

INSERT INTO students (name) VALUES ('Jennifer Aniston');

INSERT INTO students (name) VALUES ('Natalie Portman');

INSERT INTO homeworks (student\_id, hw\_topic, date\_due, date\_submitted)   
VALUES (1, 'HW1', '2018-11-10', '2018-11-09');

INSERT INTO homeworks (student\_id, hw\_topic, date\_due, date\_submitted)   
VALUES (1, 'HW2', '2018-11-10', '2018-11-09');

INSERT INTO homeworks (student\_id, hw\_topic, date\_due, date\_submitted)   
VALUES (2, 'HW1', '2018-11-10', '2018-11-10');

INSERT INTO homeworks (student\_id, hw\_topic, date\_due, date\_submitted)   
VALUES (2, 'HW2', '2018-11-10', '2018-11-14');

INSERT INTO homeworks (student\_id, hw\_topic, date\_due, date\_submitted)   
VALUES (3, 'HW1', '2018-11-10', '2018-11-12');

INSERT INTO homeworks (student\_id, hw\_topic, date\_due, date\_submitted)   
VALUES (3, 'HW2', '2018-11-10', '2018-11-11');

* 1. Write a SQL query to list all students with late homeworks showing student’s name, homework topic, date\_submitted, and number of days the HW is late. Order by number of days the HW is late:  
     hw\_topic,

Paste your SQL query below:

SELECT students.name, homeworks.hw\_topic, homeworks.date\_submitted, DATEDIFF(homeworks.date\_submit ted, homeworks.date\_due) AS late FROM students INNER JOIN homeworks ON homeworks.student\_id=students.id W HERE homeworks.date\_submitted > homeworks.date\_due ORDER BY late;

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Paste the screenshot of the result of the above query:

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**Problem 2: Set up a NoSQL DynamoDB Database to store device info for an IOT project (50 points).**

1. Create a table with the name “devices” with a partition key of type number named “deviceID” and with a sort key of type String named “deviceType”.
2. Use default settings for all other options.
3. Initially we want to list 5 devices with just their ID and Type, so we need to add 5 items, for example:
   * id=1, type=sensor
   * id=2, type=lightbulb
   * id=3, type=sensor
   * id=4, type=mobile
   * id=5, type=sensor  
       
     Paste the screenshot of your full table Scan:

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1. Try adding an item with the same id but different type:
   * id=5, type=mobile

Describe what happened and explain why:

Both adds were allowed, this is because the primary key is a composite of the id + deviceType. AS long as the combination is unique, the addition will be allowed. The partion key by itself defines which physical partition the date will live in, and is not a unique key. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Try adding an item with the same id and type:
   * id=1, type=sensor

Describe what happened and explain why:

This addition fails, since it would have a duplicate entry for both the id and type, which together combine to form the primary key, which cannot have duplicates.

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1. Add additional attribute “temperature” of type number to all devices of type “sensor” with some values.
2. Add additional attribute “motion” of type boolean to all devices of type “mobile”, set values to true or false  
     
   Paste the screenshot of your full table Scan:

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1. Run a query to retrieve all attribute values of sensor with id=1  
     
   Paste the screenshot of the results of your query:

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1. Add an index on attribute temperature to optimize your table’s searches by temperature values.
2. Paste the screenshot showing your new index:

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