

UGA CSCI4795/6795: Cloud Computing (Spring 2019)

Programming Assignment 1 (PA#1) (out: Tues Jan 22; **due: Fri Feb 01 11:59 p.m.**)

Goals

Gain hands-on experience writing an IaaS cloud application, specifically by using Amazon Web Services (AWS). Secondary goals are to gain a little experience administering a Windows Server machine and to gain/reinforce experience with SQL and Web programming.

Assignment

Create a “Lite” version of healthcare.gov by following the instructions below. This is a “tutorial-style” assignment, consisting of 3 parts: [1] setting up the Web frontend; [2] setting up the cloud database to hold the specific health plans; [3] creating the Web functionality (which is given to you) of showing of showing the health plans on the Web page and making it so that a person can register for a plan.

[STRONGLY SUGGESTED] Before starting this assignment, apply for the “github developer pack” (<https://education.github.com/pack>) – as part of this, you should receive “up to \$110 in bonus AWS credits for a total of \$75-\$150”

Next, if you do not already have an AWS account, create one here: <http://aws.amazon.com/> or <https://portal.aws.amazon.com/billing/signup#/start>

Whether or not you already had an AWS account, you should now apply for “AWS Educate” (“students”), which will give you \$40 credit for this year: <http://aws.amazon.com/education/awseducate/apply/> **NOTE: Do NOT apply for an “AWS Educate Starter Account”! Also note that YOU will be responsible for paying for AWS! With careful management, you should incur minimal cost.**

Do NOT start this assignment unless you have at least 2 hours available.

You MUST do this assignment BY YOURSELF. This assignment is, of course, subject to the UGA’s Academic Honesty – you cannot give or receive code, answers, screenshots, etc., (directly or indirectly) with ANYONE. Please see me if this is unclear.

As you do this assignment, you are asked to cut-and-paste certain screens into the corresponding “What to submit” document.

Part 1: Set an alarm for “billing alerts”

1. From the AWS Web interface (<https://console.aws.amazon.com>), login. Then, **make sure that the middle item upper-right has the “N Virginia” region selected (it might say “Oregon or Ohio” by default)**
2. Upper right, click your name on AWS, then click “My Billing Dashboard”.
3. Click on (upper left) “Budgets” → “Create a Budget” on AWS Budgets menu → Select “Cost Budget” → “Set your budgets”
4. On “Set your budget” page, set name “CSCI4795”, period is “Monthly”, budget amount is “\$40.” Below “effective date”, select “Expiring Budget”, start month is Jan, end month is Apr, then click on “Configure Alerts”
5. You are **REQUIRED** to configure an email notification to be sent if actual costs exceed 25% of the \$40 budget. On “Configure alerts” page, set send alert based on “Actual Cost”, Alert threshold is “10” “Dollar Amount”. Specify user UGA email account (e.g., ik32xxx@uga.edu). Do not check “Notify via Amazon SNS topic,” then click the “confirm budget”
6. Review your inputs and click on “Create” if everything is correct.
7. **Do question #1 of the “What-to-submit” Doc.**

Part 2: Set up your Web frontend VM and Backend RDS

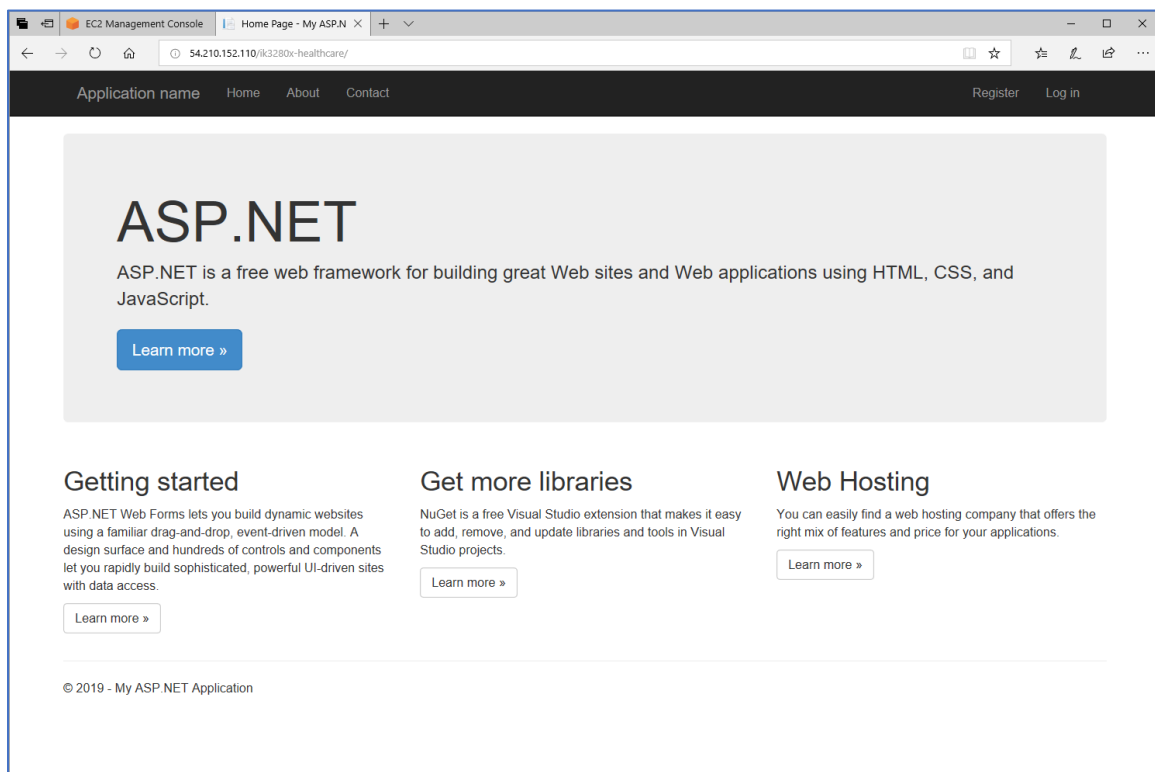
8. From the AWS Web interface (<https://console.aws.amazon.com>), login. Then, make sure that the middle item upper-right has the “N Virginia” region selected.
9. Start a Windows machine via:
 - a. Click on (upper left) Services → Compute → EC2, “Launch Instance” (middle of screen), “Quick Start” tab should already be selected, **scroll down a few screens** on the right side of the screen and select **“Microsoft Windows Server 2016 Base - ami-0f4c7e570f044b46f”**.
 - b. On the next screen (Step 2), change “t2.micro” to “t3.xlarge”. Note: I believe that “t3.xlarge” (which cost \$0.24 per Hour) is the smallest/cheapest VM that is sufficient to do the software development work on this machine, but you can use a larger machine if you wish – but remember that a bigger machine costs more! Hit the “Next: Configure Instance Details” button.
 - c. On Step 3, Enable termination protection and hit the “Next: Add Storage” button, change the default disk size to **50 GiB**, then hit the “Next: Add Tags” button.
 - d. In the middle of the screen hit the “click to add a name tag” and set the Value to be “CSCI4795 PA1” and then hit “Next: Configure Security Group”.
 - e. Click “Add Rule” and change the Type of the new rule to allow HTTP from anywhere (which is the default -- “Custom 0.0.0.0/0”). Also click “Add Rule” again and change the type of new rule to allow **MS SQL and RDP** from anywhere. Read the warning on the screen (but do nothing in response), then click “Review and launch” **Note that please remember the security group name.**
 - f. Read but then do nothing about the two warnings on the next screen. Then click “Launch”. Because this is your first time, you will need to “Create a new key pair” (name it **CSCI4795PrivateKey**) and download it. **DO NOT LOSE THIS PRIVATE KEY!** Then click “Launch Instances”. While it is important to keep the private key safe – remember that you can always delete an old keypair and create a new one via the Web console.
10. Click “Services → Compute → EC2”, then click “running Instances” You can see the “status checks” that indicate the state of the machine.
11. While we’re waiting for this VM to boot, we’ll create our database service (RDS):
 - a. On this EC2 screen, click the row that is your VM, and scroll all the way to the right to see the “Security Groups” column, and **remember the name of this security group.**

- b. Now select Services → Database → RDS, then “Create database”, select “Microsoft SQL Server”, then SQL Server Express and hit Next. Then, change “DB instance class” to “db.t2.micro” (\$0.022/hr). Make “DB Instance Identifier” be “healthcare”, username: “CSCI4795root”, and make password be “CSCI4795rootpw”.
 - c. On the next screen, change “Publicly Accessible” to No, change the “VPC Security Group” to be the same as your EC2 instance, then “Create database”. As this is booting, we’ll go back to our VM...
12. Click Services → Compute → EC2, then “1 running instance”. Right click on your machine’s row in the AWS Web page and select “Get Windows Password” – note that booting can take up to 15 minutes or so and that it can take a few minutes after “status checks” changes to “2/2” to get the admin password. Hit the upper right “refresh Web page” periodically – note that it might go from “2/2” to “1/2” before coming back to “2/2”. Get the Administrator password and save it locally -- Note that if “Key Pair Path” does not work, then cut-and-paste it into the wizard.
13. Remote desktop (RDP) to the machine as Administrator (note: you might be able to cut-and-paste this password from the “decrypt” wizard; also note that case matters). Note that it may not be entirely finished with its booting so give it a moment to generate the expected remote desktop.
14. [On the Windows Server VM] Turn off the Internet Explorer (IE) intrusive-ness and add the Web server (IIS) via:
 - a. Click on the “Windows” Icon in lower left of screen (you might need to full-screen the RDP window to see this), and then select “Server Manager”, then click on “Local Server” (upper left)
 - b. Right column, on “IE Enhanced Security Configuration” (in “Properties” Box), click on the “On” link and turn both OFF, hit OK, (hit “Refresh” upper right to confirm)
 - c. Click on “Dashboard” (upper left), then “Add roles and features”
 - d. Select the default for the first three screens; then, on the “Select Server Roles” screen, scroll down and select “Web Server (IIS)” (then “Add Features” and “Next”)
 - e. Expand “.NET Framework 4.6 Features”, Expand “WCF Services”, and select “HTTP Activation” and then “Add Features”, then “Next”, “Next”, “Next”, and then “Install”
 - f. After this completes (wait for “Installation succeeded..” – **maybe 5 min**), close the wizard
15. [On the Windows Server machine] Install “Visual Studio Web Express 2015” via:
 - a. Make the RDP session full-screen, and hit the “Internet Explorer (IE)key” in the lower-left and then go to <https://visualstudio.microsoft.com/vs/older-downloads/>, do **NOT download/install “Download 2017 version”**. Instead, scroll down and click on “expand all” and the “Download” for 2015 Visual Studio 2015 and other Products. If you see **“Sorry if you couldn’t find any downloads for you”** then join **“Visual Studio Dev Essentials”** Then go to <https://visualstudio.microsoft.com/vs/older-downloads/> again, expand all, and click download. Then on next page, find “Visual Studio Express 2015 for Web” and click on download. Then, select “Save”, then “Open folder”. **Then right click on it and select “Run as Administrator”**. After it seems to take forever to get off the splash page, click “Next” then “Install”. **This typically takes 30 minutes**. (You must wait here for this to install). Then hit “launch”.
16. [On the Windows Server machine] Install “SQL Server Management Studio” via
 - a. Go to <https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-2017>. Scroll down and click **“Download SQL Server Management Studio 17.9.1”** Then, select “Save”, then “Open folder”. **Then right click on “SSMS-Setup-ENU” and select “Run as Administrator”**. Click on install button in SQL Server Management Studio (SSMS) installation menu. **This typically takes 20 minutes**. (You must wait here for this to install). After the installation, click “Restart”

Part 3: Create a default site for web frontend

[On the Windows Server machine] When Visual Studio (VS) boots (start → express for web), select the “Not now, maybe later” option. Then File → New Web Site → select “ASP.NET Web Forms Site”, and change “Web location” from “File System” to “HTTP” and then specify <http://localhost/your-student-id-healthcare> (e.g., <http://localhost/ik3280x-healthcare>), then “OK”

17. [On the Windows Server machine] Once it finishes grinding away, it will complain that SQL Server Express needs to be installed. Do NOT install it (just hit “OK”). Hit F5 (“debug mode”) to deploy/test your Web site. IE will then show you the content. You can kill IE here (it will not kill the Web site).
18. On your local machine, hit your Web site with your browser of choice. It should be something like <http://ec2-107-20-82-207.compute-1.amazonaws.com/ik3280x-healthcare/> or <http://52.210.152.110/ik3280x-healthcare/>. You can get the “Public DNS” name or “Public IP” via the AWS console. In your browser, adjust the column width to see the whole page. This should work and produce something like this (below) – and if it does, congratulations! [if not, go back through the instructions and make sure that you performed every step as written.]



Part 4: Setting up the cloud database to hold the specific health plans

19. Back in the AWS Web console, select Services → Database → RDS, then “**Databases**” on the left. Hopefully the RDS instance has come on-line. Click on your “healthcare” instance. Then copy the endpoint. (left-click on its row and then right below it will be “endpoint”)

20. Back on the EC2 instance, Start → Microsoft SQL Server Management Studio. Server Name: use the RDS endpoint, change to “SQL Server Authentication”, use the username/password from Step 11b, and Hit “Connect”
21. Right click Databases → new Database. Database name: HealthCare (hit OK)
22. Let’s design the schema for the health plans: Expand “Databases”, expand HealthCare, right click Tables, “Table...”, and specify the following columns:
 - a. ID, int, NO allow null (Right click on this row and “Set Primary Key”)
 - b. PlanTitle, nvarchar(100), no
 - c. Company, nvarchar(50), no
 - d. Category, nvarchar(50), no
 - e. MonthlyPremium, money, no
 - f. Deductible, money, no
 - g. OutOfPocketMax, money, no
23. Right click on top (“... Table_1*”), “save_Table_1” (THEN change name to **InsurancePlans**)
24. Now to fill in the insurance plans...
 - a. Back on left, expand “Tables”, right click on dbo.InsurancePlans and Edit top 200 rows (you might have to right click on your server name and do a “Refresh” to see this table)
 - b. **Add the entries from Table 1.** Note that you can cut-and-paste, use TAB to skip through. Hit ctrl-S to save.

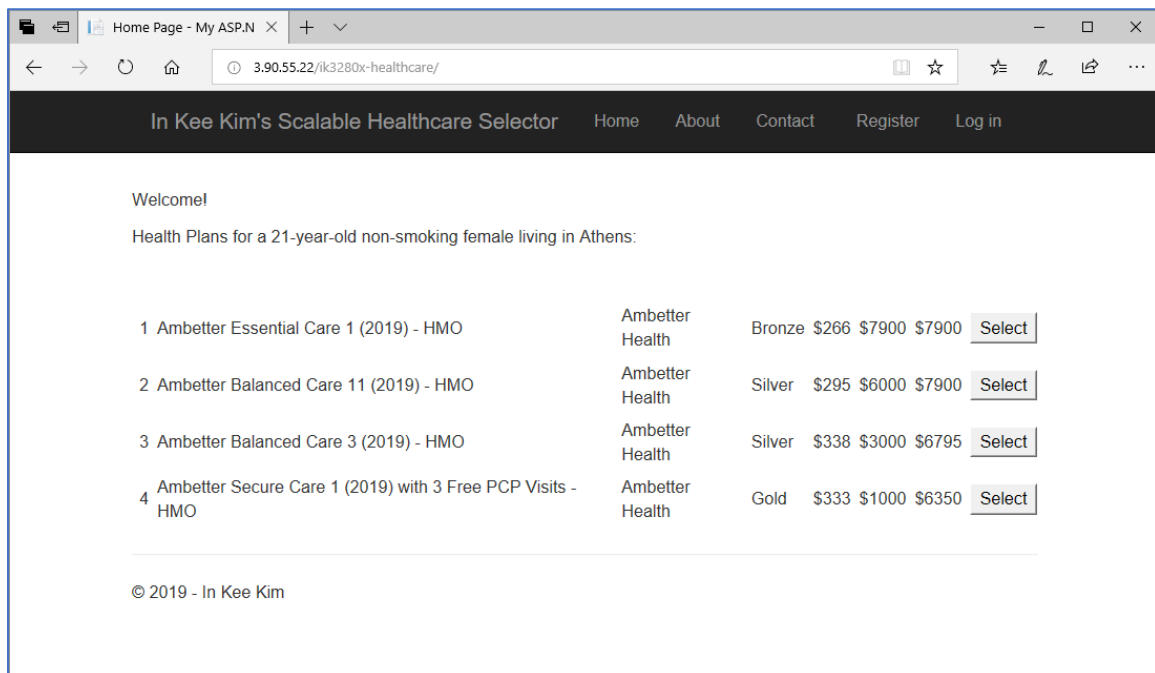
Table 1: Subset of Health Insurance Plan Rates [Source: www.healthsherpa.com , retrieved Monday 1/18/19, Zip Code: 30602, Age 21, Female, non-smoker, income: \$50,000, Athens City, Expected Use: Low]

	<i>Plan Title</i>	<i>Company</i>	<i>Category</i>	<i>Monthly Premium (\$)</i>	<i>Deductible (\$, person, per-year)</i>	<i>Out of Pocket Maximum (\$, person, per-year)</i>
1	Ambetter Essential Care 1 (2019) - HMO	Ambetter Health	Bronze	\$266	\$7,900	\$7,900
2	Ambetter Balanced Care 11 (2019) - HMO	Ambetter Health	Silver	\$295	\$6,000	\$7,900
3	Ambetter Balanced Care 3 (2019) - HMO	Ambetter Health	Silver	\$338	\$3,000	\$6,795
4	Ambetter Secure Care 1 (2019) with 3 Free PCP Visits - HMO	Ambetter Health	Gold	\$333	\$1,000	\$6,350

25. Create the non-privileged SQL Server login account (via SQL Studio Management Studio):
 - a. Find “Security” on the same level as “Databases” (not inside “Databases”), right-click, New, Login
 - b. Change it to “SQL Server authentication”
 - c. Login name: **Cloud**, password is **Cloud\$19!** [note: case matters!]
 - d. Clear the “Enforce password policy” and then hit “OK”
26. Give this “**Cloud**” login access to this DB:
 - a. Right click on Security inside “HealthCare” → New → User (User name: Cloud, Login name: Cloud) hit OK
 - b. Expand Security on the left inside HealthCare, then expand “Users”, right click “Cloud” then select “properties”. In “Membership”, select “db_datareader” and “db_datawriter” and then hit “OK”, and kill SQL Server Management Studio

Part 5: Creating the Web functionality

27. If not still running, open Express for Web (VS) [via Start → recently added → “Express for Web”]. Then File → Recent Projects and Solutions → your healthcare solution. Ignore the “SQL Server Express” warning and check the “Do not ask me...”
28. Then, in “Solution Explorer” (upper right), right click on “Site.Master” (scroll down) and select “View Designer” and then modify “Application name” to “your name’s Scalable HealthCare Selector” (e.g., “In Kee Kim’s Scalable Healthcare Selector”, see the figure in Step 30 – change the copyright too). Ctrl-S to save the site.master
29. Because this is not a Web design class, you will be given the basic code that retrieves the healthcare plans from RDS and displays them on the Web page: (do this using IE within the VM)
 - a. IE to <http://cobweb.cs.uga.edu/~kim/classes/S19-CSCI4795-6795/PA1/Default-aspix.txt>, cut-and-paste this into your “Default.aspx” (then ctrl-s to save)
 - b. IE to <http://cobweb.cs.uga.edu/~kim/classes/S19-CSCI4795-6795/PA1/Default-aspix-cs.txt>, cut-and-paste this into your Default.aspx.cs (in the Solution explorer, expand “Default.aspx” and you’ll find this “.cs file”) **Fix the DB connect string (“connect”) with your servername.** Although not necessary for this assignment, you are strongly encouraged to study the code for a moment to see how the code reads from the database and populates the User Interface (UI). Ctrl-S to save
30. Hit the Web page from your laptop and you should see something like this, below. If it’s not working, make sure all files are saved in VS. Fix any issues and then Do question #2 of the “What-to-submit” Doc.



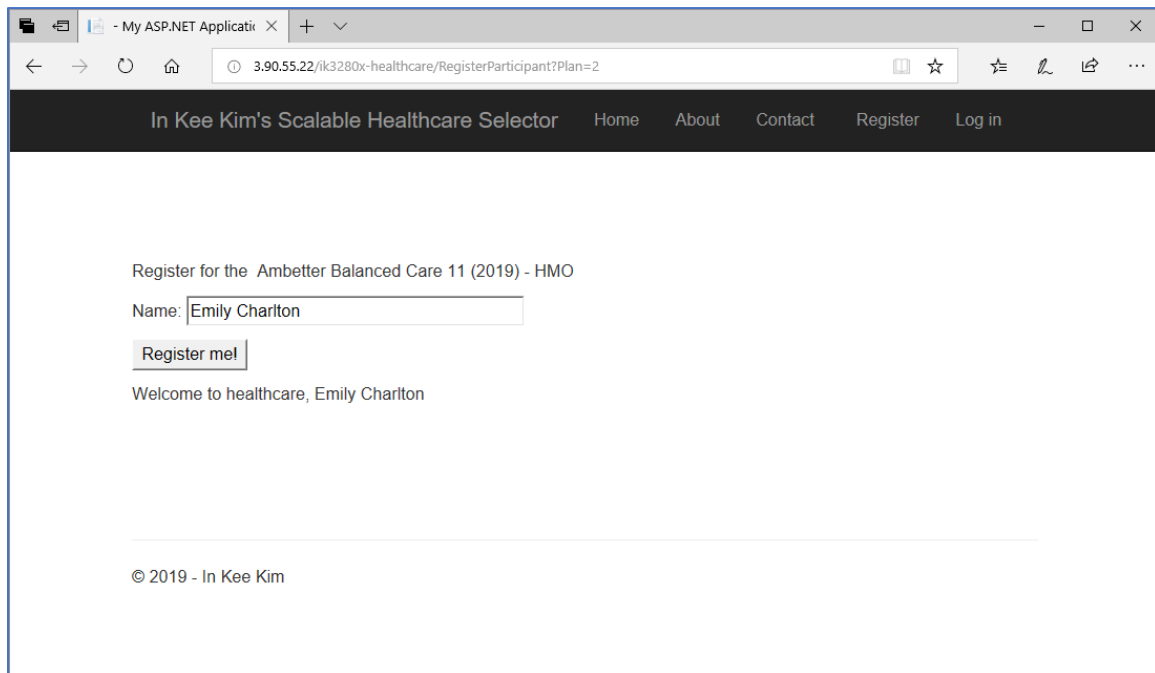
31. Similarly (because this is not a Web design class), here’s how to add/change the code to support a person making a selection:
 - a. Begin by creating a new table in our existing HealthCare DB that will hold the following info for each person:
 - i. ID, int, NO allow null (Right click on this row and “Set Primary Key”)
 - ii. Full Name, nvarchar(100), no
 - iii. Insurance Plan, int, no

- iv. Registration Date/Time, datetime, no
- v. You'll want an auto-generated "ID" (int) in the Table (When you specify this column in the Table, toward the bottom, change the "Identity Specification" to "Yes"). Save this new table as "Registrations".
- b. In VS, make sure you're not still debugging (Debug → Stop Debugging), and click the **project** (one line below "solution...") in Solution Explorer and "Add→Add New Item" and then "Web Form" with name "RegisterParticipant.aspx". Be sure to select "Select Master page" (and then "Site.master").
- c. In VS, Debug → ..properties (very bottom). Start options → Specific page then select Default.aspx
- d. Replace the contents of this RegisterParticipant.aspx with <http://cobweb.cs.uga.edu/~kim/classes/S19-CSCI4795-6795/PA1/RegisterParticipant.aspx.txt>. Similarly, replace the RegisterParticipant.aspx.cs with <http://cobweb.cs.uga.edu/~kim/classes/S19-CSCI4795-6795/PA1/RegisterParticipant.aspx-cs.txt>. Change the URL of the RDS in the code.
- e. In Default.aspx.cs, right above "if (count == 3) break;" add the following line that will connect the buttons to the new Registration page:

```
plan_selectors[count].PostBackUrl = "../RegisterParticipant.aspx?Plan=" + plan_nums[count].Text;
```

- f. Ctrl-s to save

32. Refresh the top-level page from your browser and select one of the plans. If all goes well, you should have something that looks like this (after "Emily Charlton" registers –note the "Welcome to healthcare, Emily Charlton" on the Web page). Congratulations – you have a working Cloud application! Do question #3 of the "What-to-submit" Doc. (which is NOT this screenshot)



33. That's it! After collecting all screenshots, take everything offline via:

- 1) RDS: Take snapshot and delete your DB instance (healthcare)
 - a. On Services → RDS, select "healthcare" DB instance. Click on "Action" button (upper right). Select "Take Snapshot", name it "pa1-done".

- b. When the snapshot has been created, click on “healthcare” DB instance. (You will go to summary page). Then click on “Modify” (Upper right) and disable “Enable deletion protection” (Bottom). Hit “continue” and click on “Modify DB Instance” and hit delete your RDS instance.
- c. Click on “Actions” (upper right on summary page) and select “Delete”
- d. Disable both “Create final snapshot” and “Retain automated backups.” And check “*I acknowledge that upon instance deletion, automated backups, including system snapshots and point-in-time recovery, will no longer be available.*”
- e. Type “delete me” into the textbox and hit “delete”

2) Stop EC2 (Windows) Instance

- a. On Services → EC2, right click on your Windows VM and select “instance state → stop” (NOT “terminate!”)

34. Do question #4 and #5 of the “What-to-submit” Doc.