ISCG7420
Web Application Development

Assignment 2

Semester 1, 2020

School of Computing, Electrical and Applied Technology

Due Date: June 30th 2020 11:59 PM

Total Marks: 150
Course Weighting: 40%

Learning outcomes covered in this assignment

1. Discuss the philosophy of client-server computing and its impact to the computing industry.
2. Discuss the tools used in providing web-based applications.
3. Design and implement a dynamic web application using a range of languages/technologies/tools.
4. Discuss and evaluate the available data access technologies.
5. Design and develop a database client-server solution that meets specified organisational requirements using database and modern data access technologies.

Assignment instructions:

- You will work individually on this assignment.
- Continuing on your idea from Assignment 1, you will now separate the code into an Application Programming Interface (API) for the backend, and a Single-Page Application (SPA) for the frontend.
- You will then use Docker to deploy your backend implementation to Amazon ECS, and deploy your ReactJS frontend to Amazon S3.

Assignment Submission:

- Create a branch in the existing Assignment 1 repository so that you can work alongside your existing code. Periodically throughout the course your lecturer will clone your repository and check your progress. On the assignment due date (and for up to 72 hours afterwards) your lecturer will download the most recent version of your assignment. You are required to ensure that GitHub always has the latest version of your code.
- If you forget to push your most recent changes by the due date, then the lecturer will use the version available on GitHub when the deadline is reached for marking.

Task 1: Create an API Backend [25 Marks]

Create a Git branch in your existing repository. Make sure that you push your branch to GitHub so that it also appears there.

You will now create a REST (Representational state transfer) API.
Use Django REST Framework and Serializers to convert some of your HTML-based views from Assignment 1 into JSON views. At least one serializer used must be a ModelSerializer.

For views you must use DRF's class-based viewsets to create at least 5 views, with at least one view using a ModelViewSet.

For URLs you must use DRF's DefaultRouter.

Task 2: Create a Single Page Application Frontend [25 Marks]

Using ReactJS and Material-UI, create a single-page application which uses at least 5 components from the Material-UI framework.

Create 3 of your own components using each of the following methods:

- One stateless function-based component
- One stateful function-based component which uses Hooks
- One stateful class-based component

Use fetch() with either async/await or promises to perform Create, Read, Update, Delete (CRUD) operations for a model used by your backend. It can be simple data.

Use sessionStorage and localStorage to save data returned from the backend.

Task 3: Setup Docker [25 Marks]

Create a Dockerfile which uses the following keywords: FROM, COPY, ENV, RUN, WORKDIR, EXPOSE, CMD.

Create a docker-entrypoint.sh file and run it with the CMD command in your Dockerfile. The entrypoint file should run **gunicorn** *YourProjectName***.wsgi** instead of **python manage.py runserver**.

Build a Docker image from your Dockerfile and make sure it works correctly.

Task 4: Deployment [25 Marks]

Run the **npm build** command to create a production bundle for your React application. Add this production bundle to version control.

Create an Amazon S3 bucket for this, and deploy it to S3.

Deploy your Docker image to ECS. Make sure that you configure your VPC security groups to allow connections to the port used by your container.

You will need to set *ENV PYTHONUNBUFFERED=1* in your Dockerfile in order to see ECS logs.
Add a link to your deployed React & ECS container in your branches README.md file.

Task 5: Discussion [50 Marks]

Using your journal from Assignment 1 and any additional notes you may have taken, discuss and evaluate the architectural differences between Assignment 1 and Assignment 2. Most of these answers can be one sentence long. Each question is worth 1 mark.

Your answers to this must be in a *Discussion.md* file.

Architecture:

- When would you prefer to develop an Assignment 1 style web application (Server-side rendering, serving HTML)?
- When would you prefer an Assignment 2 one (REST API & Single Page Application)?

Version Control:

- What is git and what is it used for?
- List 3 git commands you've learned in this course.
- What is GitHub and what is it used for?
- What is Kanban and what is it used for?
- What is Markdown and what is it used for?

Platform vs Infrastructure:

- What are some of the pros and cons of using Platform-as-a-Service (PaaS) providers such as Heroku?
- What are some of the pros and cons of using Infrastructure-as-a-Service providers such as Amazon?

Web Frameworks:

- What is Django? What are some of its useful features?
- What is a model?
- What is a view?
- Name two other popular non-Python web frameworks.
- What is WSGI? What is ASGI?
- What is celery and what are task queues used for?

Databases:

- What is PostgreSQL? Using StackShare, list 3 well-known companies that use PostgreSQL.
- List two other well-known databases.
- What are some of the pros and cons of using an Object Relational Mapper (ORM)?
- What is the purpose of database migrations?
- What is redis and what are two things it can be used for?
- Why do we use caches?

HTTP & REST:

- Which four HTTP methods does REST use for performing CRUD operations?
- What is Django REST Framework used for?
- What is serialization and why do we use it?
- Which type of object serialization notation is most commonly used on the web?
- What is Postman and what is it used for?
- What are websockets and what are they used for?

Javascript:

- What is NodeJS and how is it different from in-browser Javascript?
- What is npm and what is it used for?
- What is ES6? List the names of 3 features that ES6 provides.
- What is ReactJS and what is it used for?
- List two popular alternative Javascript libraries to ReactJS.
- What is the DOM? What is a virtual DOM?
- What is the difference between sessionStorage and localStorage?
- What is a library like Material-UI used for?

Docker:

- Why do we run apt-get update && apt-get install -y in one command when using Docker?
- What are Docker containers and what are the pros and cons of using them?

- What is the difference between ADD and COPY with Docker?
- What is a .dockerignore file used for?
- What is Kubernetes and why didn't we use it?

Deployment:

- What is Amazon S3 used for?
- What is Amazon ECS?
- What is the difference between ECS Fargate and EC2?
- Name 3 other cloud providers.
- What is Sentry and what is it used for?
- What is Cloudflare and what is it used for?
- What is SendGrid and what is it used for?
- What is the difference between a DNS A record and a CNAME record?

Meta:

- What are some of the mistakes or difficulties you encountered in developing these 2 assignments?
- What have you learned from this course that you think might be useful in your career?

Marking Schedule

Task	Marking Criteria	Marks	Given	Comments
1	Uses Django REST Framework	3		
	Has 5 serializers (including at least 1 ModelSerializer)	10		
	Has 5 working ViewSets	10		
	Uses DefaultRouter	2		
2	Uses 5 Material UI components.	5		
	Has stateless function-based component	2		
	Has working stateful function-based component which uses Hooks	3		

	Has working stateful class-based component	5		
	Uses fetch() for CRUD	6		
	Uses sessionStorage	2		
	Uses localStorage	2		
3	Uses FROM	2		
	Uses COPY	2		
	Uses ENV	1		
	Uses RUN	2		
	Uses WORKDIR	1		
	Uses EXPOSE	1		
	Uses CMD	2		
	Has docker-entrypoint.sh	2		
	Uses gunicorn	2		
	Dockerfile builds and runs a working image	10		
4	Created React Bundle	6		
	Deployed Bundle to S3	6		
	Deployed Docker image to ECS	6		
	ECS accessible via Internet.	6		
	Have links in branch README.md	1		

5	Discussion.md	50		
Total Marks		**150**		

Late Submission of Assignments:

Assignments submitted after the due date and time without having received an extension through Affected Performance Consideration (APC) will be penalised according to the following:

- 10% of marks deducted if submitted within 24hrs of the deadline,
- 20% of marks deducted if submitted after 24hrs and up to 48hrs of the deadline,
- 30% of marks deducted if submitted after 48hrs and up to 72hrs of the deadline,
- No grade will be given for an assignment that is submitted more than 72hrs after the deadline.

Assistance to other Students:

Students themselves can be an excellent resource to assist the learning of fellow students, but there are issues that arise in assessments that relate to the type and amount of assistance given by students to other students. It is important to recognise what types of assistance are beneficial to another's learning and also what types of assistance are unacceptable in an assessment.

Beneficial Assistance:

- Study Groups
- Discussion
- Sharing Reading Material
- Reading the available online and library resources

Unacceptable Assistance:

- Working together on one copy of the assessment and submitting it as own work
- Giving another student your work
- Copying someone else's work, this includes work done by someone not on the course
- Changing or correcting another student's work
- Copying from books, the Internet etc. and submitting it as own work; anything taken directly from another source must be acknowledged correctly; show the source alongside the quotation
- Don't copy code from a website or video tutorial and pretend you made it or slightly change it. This will be an instant fail (0%).