Assignment 2

Assignment Overview:

In this practical assignment, you will explore the concepts of virtualization, containerization, and web server deployment using Google Cloud Platform (GCP). You will work on setting up virtual machines (VMs), deploying containers, and using Docker for containerization, with a specific focus on configuring and using the Nginx web server. This assignment aims to deepen your understanding of these fundamental technologies in software and development engineering.

Assignment Tasks:

Total Points: 100

Task 1: Setting Up a Virtual Machine (VM) on GCP (30 points)

- Create a GCP account if you don't have one.
- Set up a Virtual Machine instance using Google Compute Engine.
- Choose an appropriate operating system (Linux distribution) for your VM.
- Configure the VM with custom machine specifications (CPU, RAM, storage).
- Access the VM using SSH from your local machine.
- Install Nginx web server on the VM.
- Display a custom webpage through the web server to demonstrate successful setup.

Task 2: Docker Containerization (40 points)

- Install Docker on your local machine (you can use a VM from Task 1).
- Build a Docker image for a simple application .
- Push the Docker image to Google Container Registry.
- Create a Docker Compose file that defines a multi-container application (e.g., web server with Nginx + backend application).
- Deploy the multi-container application on your VM (from Task 1) using Docker Compose.
- Demonstrate communication between the containers within the application.
- Adjust the Docker Compose configuration to scale the application horizontally.

Task 3: Container Deployment on GCP (30 points)

- Create a Google Kubernetes Engine (GKE) cluster.
- Deploy a sample application container (e.g., a basic web app) into the GKE cluster.
- Ensure the application, including Nginx as a reverse proxy, is accessible over the internet.
- Scale the application by adjusting the number of replicas in the deployment.
- Monitor the application's performance and resource utilization using GCP tools.

Submission Guidelines:

- Prepare a detailed report documenting each task's steps, configurations, and screenshots.
- Include explanations of the concepts utilized in each task.
- Provide insights into the challenges faced and how you overcame them.
- Submit your report along with any necessary code files/scripts (and demo video for executive students).

Grading Rubric:

Task 1: VM Setup (30 points)

1. VM creation and configuration: 10 points
2. Nginx Web server installation: 10 points
3. Custom web page display: 10 points

Task 2: Docker Containerization (40 points)

1. Docker image creation and push: 15 points
2. Docker Compose setup: 15 points
3. Communication and horizontal scaling: 10 points

Task 3: Container Deployment (30 points)

1. GKE cluster setup: 10 points
2. Application deployment, including Nginx configuration and accessibility: 15 points
3. Scaling and monitoring: 10 points

Note:Plagiarism and direct copying of solutions will result in severe penalties. Make sure to understand the concepts and provide original solutions.

This assignment will provide you with practical experience in using Google Cloud Platform for virtualization, containerization, and web server deployment, enhancing your skills in software and development engineering. Good luck!