

10/24/2025 Quiz 1

6:00pm-8:30pm

- This is an open book exam. Only PDFs can be used as a reference. Internet access is strictly prohibited. Handwritten / Physical Reference notes are allowed
- Set your laptop to maximum brightness and have no tab/applications open other than PDFs.
- Marks are not awarded based on the length of the answer, the more precise/concise/bullet-pointed it is, the better.
- Any AI Tools, messaging applications, collaborative editing apps are strictly prohibited, please make sure they're not present on the dock/taskbar

Section A: [Based on Learnings from Assignment 1] 3x10 points

1. When your LF2 in Assignment1 fails while sending an email using SES, and the message is moved to the DLQ, what configuration ensures this happens automatically?
 - a. EventBridge Retry Policy
 - b. MaxReceiveCount in Redrive Policy
 - c. Lambda Destination Policy
 - d. Dead-letter Lambda Handler
2. Your Lex Dining Bot keeps re-prompting for "Cuisine" even after you provide it. What's the most likely reason?
 - a. The slot type for Cuisine isn't defined as CustomSlotType.
 - b. The slot validation Lambda (code hook) throws an exception.
 - c. Lex is using the fallback intent for every utterance.
 - d. The slot is marked as optional.
3. You integrated your Lex bot such that flow is API Gateway -> Lambda -> Lex (LF0). After 30 minutes of no traffic, your first request takes 3 seconds longer. What's the most likely reason?
 - a. The Lex bot is untrained.
 - b. The Lambda (LF0) is experiencing a cold start.
 - c. The API Gateway throttled due to quota.
 - d. The SQS queue is empty.
4. Your LF2 worker Lambda times out while querying DynamoDB for restaurant details. What's the first configuration to check and how do you fix it?
 - a. Increase the Lambda function memory.
 - b. Increase the Lambda timeout duration.
 - c. Add a VPC endpoint for DynamoDB.
 - d. Enable DynamoDB Auto Scaling.
5. You add a new cuisine, "Mediterranean," but your Lex bot doesn't recognize it. What's the fix?
 - a. Rebuild and retrain the Lex bot with updated slot values.
 - b. Add a new DynamoDB table.
 - c. Restart the Lambda function.
 - d. Update API Gateway CORS policy.

6. You want to restrict OpenSearch queries so LF2 can only GET and not PUT or DELETE. Which feature should you use?
- a. Domain-level resource policy ✓
 - b. Fine-grained access control with index-level permissions
 - c. Security Groups
 - d. IAM Trust Policy ✓
7. Which statement about OpenSearch indices is true?
- a. Each index can only contain one type of document.
 - b. Index names must start with a capital letter.
 - c. Deleting an index automatically deletes its mappings and data.
 - d. An index must always contain at least one shard.
8. While testing your chatbot, you notice that Lex always returns the fallback intent, even when the user input clearly matches an intent. What is the most probable reason?
- a. The Lex bot is not properly trained with enough utterances
 - b. The Lex bot has not been published and deployed to a specific version
 - c. The Lambda code hook is failing and Lex is defaulting to fallback
 - d. Any of the above can be a cause
9. Your replication controller in Kubernetes is set to maintain 5 replicas of a pod, but you notice that only 3 are running. What could be the reason?
- a. The remaining nodes in the cluster do not have enough resources
 - b. Kubernetes does not support replication for multi-container pods
 - c. The pod deployment is using an unsupported Docker image
 - d. The replication controller is waiting for approval to create new pods
10. If your liveness probe is failing continuously, what action will Kubernetes take?
- a. Kubernetes will scale down the pod
 - b. Kubernetes will restart the failing pod
 - c. Kubernetes will log the failure but take no action
 - d. Kubernetes will redirect traffic to a different service

Section B: System Design[30]

Real-time Restaurant Recommendation System

Background:

Extend assignment 1 to contain the features for:

- Allow users to add reviews and upload pictures for the restaurants they visited. Users should be able to see their reviews and the photos they uploaded in the user's area. The user's provided reviews should also be shown to a user when they are searching for the restaurants.
- The apps should show the trending restaurants in the user's area when the user logs in

Assume trending restaurants in the area can be obtained through an external api call that has already been provided to you.

As user traffic increases, performance bottlenecks emerge. You must design a scalable, low-latency system that efficiently delivers recommendations while handling high traffic loads.

For both the above, implement the following:

- State all APIs created and assumptions made.
- Devise a way to figure out the user's location
- Design an architecture diagram for your backend system with all services. You need not draw the architecture provided in the assignment, just mention the connecting services properly.
- Design the schema for any Databases used for this. Make sure to choose appropriate database choices for reviews and photos accordingly.
- How would you scale this system to handle millions of users while maintaining a low-latency experience?

Section C: [Lecture Notes] 4x5

1. Explain the key difference between Full Virtualization, and Para Virtualization and state the pros-cons of each
2. Your company is deciding between serverless (AWS Lambda) and containerized (ECS/EKS) architectures for a high-traffic web application.Explain:
 - a. The key differences in scalability, cold start latency between serverless functions and containers.
 - b. A scenario where serverless would be the better choice, and another where containers would be preferable.

- ✓ 3. Imagine you are developing a containerized application where user-uploaded files need to be persistently stored across container restarts. How would you use Docker volumes to achieve this, and provide a small Docker Compose template illustrating this.

- ✓ 4. You built a docker image where the dockerfile looks like follows:

Docker image 1 -----

- 1) COPY ./Assignment ./src
- 2) RUN cd ./src
- 3) RUN "some build operation" ----> point 1

Docker image 2 -----

- 1) COPY ./Assignment ./src
- 2) RUN cd ./src
- 3) RUN "some build operation"
- 4) RUN "rm -rf ./src"
- 5) RUN "ls" -----> point 2

What do you think about the image size of docker image 1 and docker image 2, which one will be greater ? Explain your answer clearly

Section D: [Papers] 4x5

- ✓ 1. Describe the concept of eventual consistency in DynamoDB and how it supports high availability.
- ✓ 2. How do the design architectures of the Google File System (GFS) and Bigtable differ in terms of data storage, scalability, and fault tolerance, and what are the implications of these differences for their performance and suitability for various applications?
- ✓ 3. In the Borg system, what role does the priority system play in ensuring resource allocation for high-priority tasks, especially during resource contention?
- ✓ 4. What is the key problem that Dremel handles? How is it different or compared to BigQuery?