Capco AWS Data Engineer Interview Guide – Experienced 3+

Interview Process Breakdown

Round 1: Technical Interview (Hands-On Coding & Conceptual Questions)

This round focused on Python coding, Spark transformations, SQL concepts, and general data engineering fundamentals.

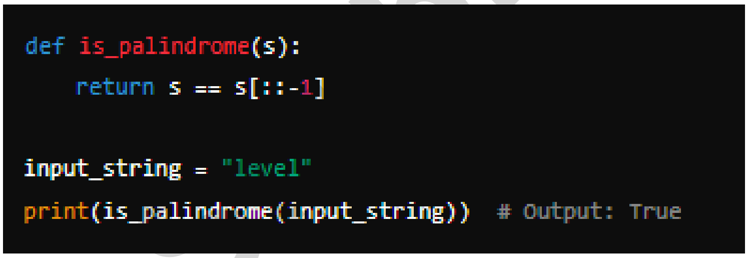
Round 2: Advanced Technical & Scenario-Based Interview

This round evaluated real-world problem-solving skills through scenario-based questions covering AWS, Redshift, Spark, fault tolerance, and data modeling. Experience-based questions explored past projects and the candidate's role in solving specific challenges.

Technical Round 1

1. Python Coding Challenge

- **Problem**: Write a program to check if a given string is a palindrome.
- **Tips for Success**:
  - Use slicing (string[::-1]) or a two-pointer approach for optimal solutions.
  - Be prepared to explain time and space complexity.
- **Example Code**:

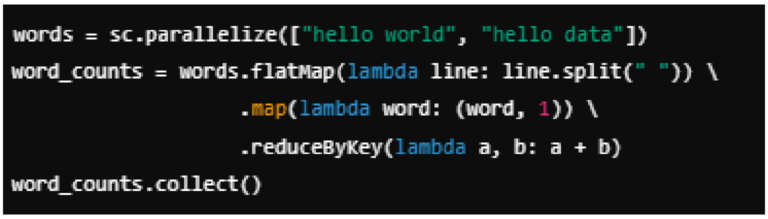


```python
def is_palindrome(s):
    return s == s[::-1]

input_string = "level"
print(is_palindrome(input_string))  # Output: True
```

2. PySpark Word Count Problem

- **Challenge**: Implement a word count using PySpark.
- **Insight**: Use **flatMap()**, **map()**, and **reduceByKey()** for an efficient solution.
- **Common Mistake**: Using groupByKey(), which causes memory inefficiency due to shuffling.
- **Example**:



```
words = sc.parallelize(["hello world", "hello data"])
word_counts = words.flatMap(lambda line: line.split(" ")) \
                   .map(lambda word: (word, 1)) \
                   .reduceByKey(lambda a, b: a + b)
word_counts.collect()
```

3. Key Conceptual Questions

- **reduceByKey vs. groupByKey**:
  reduceByKey combines values locally before shuffling, making it more efficient than groupByKey, which transfers all key-value pairs across nodes.

- **Fault Tolerance in Spark vs. Hadoop**:
  Spark achieves fault tolerance through lineage (DAG) and RDD recomputation, whereas Hadoop relies on replication in HDFS.

- **SQL Query Execution Order**:
  - Example Query: SELECT col FROM table WHERE condition GROUP BY col HAVING condition ORDER BY col;
  - Execution Order: FROM → WHERE → GROUP BY → HAVING → SELECT → ORDER BY.

- **DENSE_RANK vs. RANK**:
  RANK allows gaps in rank values, while DENSE_RANK doesn't skip numbers.

- **Cursor vs. Stored Procedure**:

  Cursor iterates row-by-row in SQL (less efficient), while stored procedures allow reusable query logic with better performance.

- **Python 'pass' Statement**:
  A placeholder when a block of code is syntactically required but no action is needed.

- **Memory: List vs. Tuple**:
  Lists occupy more memory due to dynamic resizing, while tuples are fixed-size and more memory-efficient.

Technical Round 2

1. How would you design a fault-tolerant data ingestion pipeline using AWS services (S3, Kinesis, Lambda)?

- What alternatives to Kinesis would you consider for real-time data ingestion?
- How would you handle retry logic and error handling in the Lambda function?
- How do you ensure message ordering in Kinesis Streams?
- What are the differences between Kinesis Data Firehose and Kinesis Streams?

2. Explain how you would optimize Redshift query performance for a reporting system with large fact tables.

- How would you decide between using DISTKEY and SORTKEY?
- What are the benefits and drawbacks of using compression encodings in Redshift?
- Explain the impact of Vacuum and Analyze operations on performance.
- How would you monitor and reduce disk-based queries (disk spilling)?

3. Describe how to implement cross-region replication for an S3 bucket.

- How would you ensure data consistency between the source and destination regions?
- What are the cost implications of cross-region replication?
- How would you handle replication for objects encrypted with SSE-KMS?
- How does Versioning impact replication behavior?

4. What steps would you take to secure data stored in S3?

- What are the differences between SSE-S3, SSE-KMS, and SSE-C encryption?
- How would you enforce encryption at rest for all objects in a bucket?
- Explain how Bucket Policies differ from IAM Policies.
- What role does Amazon Macie play in securing sensitive data in S3?

5. Explain using AWS Glue for ETL. What challenges might you face with large datasets?

- How would you optimize Glue jobs to reduce processing time for large datasets?
- What strategies would you use to manage dynamic partitions efficiently?
- Explain how Glue’s Spark-based architecture handles data parallelism.
- How would you debug a failed Glue job with limited logging information?

6. How would you monitor a data pipeline in AWS to ensure SLA compliance?

- What metrics would you track in CloudWatch for a Kinesis-based pipeline?
- How would you implement custom alarms for data delays or job failures?
- Describe using Step Functions to handle retries and error notifications.
- How would you set up end-to-end tracing for a complex pipeline?

7. Describe handling schema evolution in AWS Redshift without downtime.

- How would you add columns to a table without impacting queries?
- Explain the differences between table re-creation and ALTER TABLE operations.
- How would you handle data type changes for an existing column?
- What are the best practices for managing external schema evolution with Spectrum?

8. How would you automate Redshift cluster scaling for peak loads?

- Explain the use of Elastic Resize vs. Classic Resize in Redshift.
- What are the trade-offs between Concurrency Scaling and using Reserved Instances?
- How would you configure workload management (WLM) queues for heavy queries?
- What metrics would trigger an auto-scaling event?

9. Explain using IAM roles for secure cross-account access to an S3 bucket.

- How does the trust relationship policy in IAM roles work?
- What are the security risks of using overly permissive role policies?
- Explain how Access Control Lists (ACLs) can affect IAM role permissions.
- How do bucket policies handle the Principal element for cross-account roles?

10. Describe a custom EMR cluster configuration for Spark-based ETL with minimal cost.

- What types of instance types would you choose for cost efficiency?
- How would you configure Spot Instances for a resilient EMR cluster?
- Explain the benefits of auto-scaling policies in EMR.
- What role does the Instance Fleet configuration play in cost optimization?

11. How would you prevent small file problems in S3 when loading data into Redshift?

- What are the benefits of the COPY command's MANIFEST option?
- How would you use Amazon Glue to merge small files?
- Explain how using a staging area in S3 can help.
- How does the MAXERROR parameter affect data loading in Redshift?

12. Explain the use of Amazon Athena for serverless querying.

- What are the pricing models for queries in Athena?
- How does partitioning in S3 affect Athena query performance?
- Explain the role of Glue Catalog in Athena.
- What types of queries would not be efficient in Athena?

13. Describe a real-world use case for using Step Functions with Lambda in a data workflow.

- How would you handle a failure state in a Step Functions workflow?
- What are the advantages of using Wait and Choice states?
- Explain how Step Functions integrate with other AWS services.
- How would you pass data between Lambda functions in Step Functions?

14. How would you design a data archiving strategy in S3 using lifecycle policies?

- How would you manage transitions to Glacier Instant Retrieval and Deep Archive?
- What is the impact of multipart uploads on lifecycle policies?
- How would you handle data expiration for time-sensitive logs?
- What are the cost implications of using Standard-IA for archiving?

15. What are the trade-offs between using Glue Catalog vs. Hive Metastore for metadata management?

- How does Glue Catalog handle schema versioning compared to Hive Metastore?
- What integration challenges might you face with Glue Catalog in non-AWS environments?
- Explain how partition discovery works in Glue compared to Hive.
- How would you migrate metadata from Hive Metastore to Glue?

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