Interview Prep for Data Engineer

Updated saved memory

Great! Since your interview is coming up on Monday and your resume is solid, let's focus on helping you prepare effectively. Here's a tailored breakdown of how you can get ready:

🔍 Likely Focus Areas Based on Your Resume

1. ETL Pipelines & Data Engineering Concepts

- Describe how you optimized ETL Spark jobs (what were the bottlenecks? how did you fix them?).
- Be ready to whiteboard or explain a typical pipeline you designed (source → processing → storage → reporting).

2. PySpark & Apache Spark

- Explain the difference between transformations and actions.
- Be comfortable with joins, window functions, UDFs, and performance tuning techniques (e.g., broadcast joins, partitioning).
- Sample scenario: *"How do you handle skewed joins in PySpark?"*

3. AWS Tools

- You mentioned S3, EMR, Glue, and Athena — they may ask you to design an end-to-end solution using these.
- Example: *"How would you build a pipeline to process 1TB of logs daily and make them queryable in Athena?"*

4. Airflow

- DAG structure, dependencies, retries, sensors, task-level failures.
- Be ready to explain: *"How do you parameterize a DAG?"*, or *"How would you manage dependencies between multiple DAGs?"*

5. SQL

- Window functions (ROW_NUMBER, RANK, etc.)
- Query optimization: EXPLAIN plans, indexes, CTEs vs subqueries.
- Sample task: *Write SQL to get the most recent transaction per customer.*

🧠 Behavioral/Project Questions (Based on Resume)

Prepare STAR (Situation, Task, Action, Result) answers for:

- The 95% cost savings on ETL jobs — they'll love this story.
- Automating staging data for Tableau — show your impact on business.
- Hyper-Personalized Engine — explain data model, orchestration, and delivery.

✅ Final Checklist

Area	Ready?
Can explain at least 2 end-to-end pipelines you built	✅ / ❌
Confident with Spark optimizations (caching, joins, partitions)	✅ / ❌
Understands AWS data tools' role in data flow	✅ / ❌

Area	**Ready?**
Practiced SQL with windowing and joins	✅ / ❌
Airflow DAG design + error handling + scheduling	✅ / ❌
STAR stories prepared for 2–3 key projects	✅ / ❌

➕ Want Help With?

Let me know if you'd like:

- Mock interview questions (tech or behavioral)?
- Help drafting STAR answers?
- Deep dive into Spark/Airflow/AWS prep?
- Common questions in data engineering interviews?

You're in a strong position — let's just make sure your delivery is as sharp as your experience.

Absolutely! Here's a well-prepared set of **answers** for the **Likely Focus Areas Based on Your Resume**, customized for your data engineering background and projects. You can use these to frame your responses during the interview.

✅ 1. ETL Pipelines & Data Engineering Concepts

Q: Describe an ETL pipeline you've designed or optimized.

A:
I worked on an ETL pipeline that ingested raw transactional data from multiple sources into S3, processed it using PySpark on AWS Glue, and then loaded it into Redshift and Athena for reporting. Initially, the pipeline faced cost and performance issues. I optimized the Spark jobs by tuning partitions, caching intermediate data, and avoiding expensive wide transformations. Additionally, I used AWS Graviton-based Glue workers to reduce infrastructure costs. These changes led to a 95% cost reduction — from $105 per run to just $5.

✅ 2. PySpark & Apache Spark

Q: What's the difference between transformations and actions in Spark?

A:
Transformations are lazy operations that define a new RDD or DataFrame (like `` `.select()` ``, `` `.filter()` ``, `` `.join()` ``), and they're not executed until an action is called. Actions (like `` `.count()` ``, `` `.show()` ``, `` `.collect()` ``) trigger the actual execution of the DAG and return results or write data.

Q: How do you handle skewed joins in PySpark?

A:
For skewed joins, I typically:

- Use **broadcast joins** if one side is small enough to fit in memory.
- Apply **salting** to break skewed keys into multiple keys to distribute data evenly.
- Filter out extreme outliers and process them separately if feasible.
- Tune **shuffle partitions** and repartition the large dataset accordingly.

Q: What’s your approach to optimizing PySpark jobs?

A:

- Avoid shuffles by minimizing wide transformations.
- Use `broadcast()` when one dataset is small.
- Filter early to reduce data volume.
- Persist intermediate results if reused.
- Set `spark.sql.shuffle.partitions` based on data size.
- Monitor with Spark UI and handle skewed data if found.

✅ 3. AWS Tools in Data Pipelines

Q: How did you use AWS Glue, S3, and Athena in your projects?

A:
In one project, raw files landed in S3. AWS Glue crawlers created metadata tables in the Glue Data Catalog. I built ETL jobs using PySpark in AWS Glue to clean and process this data, storing it back into S3 in Parquet format. Athena was used to run ad-hoc queries and power Tableau dashboards. I optimized the data by partitioning it by date and region, which improved query performance and reduced costs.

Q: Design a pipeline to process 1 TB of logs daily and make them queryable.

A:

1. Logs are dumped into **S3**.
2. A Glue crawler updates the schema in the **Data Catalog**.
3. A **PySpark job on Glue or EMR** processes the data — removes PII, transforms, partitions.
4. Transformed Parquet files are stored in a partitioned S3 bucket.
5. **Athena** is used to query the data.
6. For automation, the entire pipeline is orchestrated using **Apache Airflow** with alerts and retries configured.

✅ 4. Apache Airflow

Q: How do you structure an Airflow DAG?

A:
I define tasks as Python functions or operators (e.g., ``PythonOperator``, ``BashOperator``, ``GlueJobOperator``). I set dependencies using ``>>``. I use default arguments to configure retries, start_date, and email alerts. I also modularize common logic into functions or separate DAG files for maintainability.

Q: How do you handle task failures in Airflow?

A:

- I configure ``retries``, ``retry_delay``, and ``on_failure_callback``.
- Enable task-level **timeout** and SLA alerts.

- For critical failures, I send alerts via Slack or email.
- For DAG recovery, I use `depends_on_past=False` and `catchup=False` where needed to avoid rerunning historical data unnecessarily.

✅ 5. SQL – Window Functions & Optimization

Q: Write SQL to get the most recent transaction per customer.

```
SELECT *
FROM (
    SELECT *,
           ROW_NUMBER() OVER (PARTITION BY customer_id ORDER BY txn_date DESC)
as rn
    FROM transactions
) t
WHERE rn = 1;
```

Q: How do you optimize SQL queries?

A:

- Use `EXPLAIN PLAN` to identify bottlenecks.
- Replace subqueries with CTEs for readability and better optimization.
- Create indexes on frequently filtered/joined columns.
- Avoid `SELECT *` and only retrieve necessary columns.
- Use proper **partitioning** and **bucketing** strategies (especially in Hive/Spark).

Let me know if you'd like these compiled as a PDF cheat sheet or if you want **mock questions/answers** for the behavioral part (STAR format) — I can do that next.

Absolutely! Here's a curated list of over **100 interview questions** covering **Python**, **SQL**, and **PySpark**, tailored for data engineering roles. These questions are commonly asked by top companies and will help you prepare effectively for your upcoming interview.

🐍 Python Interview Questions

Core Concepts

1. What are Python's key features?
2. Differentiate between lists and tuples.
3. Explain the concept of Python's memory management.
4. What is the difference between deep copy and shallow copy?
5. How does Python handle variable scope?
6. What are Python's built-in data types?
7. Explain the use of *args and **kwargs.
8. How is exception handling implemented in Python?
9. What is the purpose of the `with` statement?
10. Describe Python's garbage collection mechanism.

Object-Oriented Programming

11. What are the principles of OOP?
12. How do you implement inheritance in Python?
13. Explain the concept of multiple inheritance.
14. What are class methods and static methods?
15. How do you achieve encapsulation in Python?
16. What is method overriding?
17. Explain the use of super().
18. What is polymorphism in Python?
19. How are private and protected members handled?
20. Describe the use of `__init__` method.

Advanced Topics

21. What are decorators in Python?
22. How do generators work?
23. Explain list comprehensions.
24. What is the difference between `is` and `==`?
25. How does Python's GIL affect multithreading?
26. What are lambda functions?
27. How do you manage packages and modules?
28. Explain the use of virtual environments.

29. How is exception chaining handled?

30. What is the purpose of the `yield` keyword?

🛢️ SQL Interview Questions

Basic Queries

31. What is SQL?

32. Differentiate between SQL and NoSQL databases.

33. What are the different types of JOINs?

34. How do you use the GROUP BY clause?

35. Explain the use of the HAVING clause.

36. What is a subquery?

37. How do you eliminate duplicate records?

38. What is the difference between WHERE and HAVING?

39. How do you sort data in SQL?

40. What are aggregate functions?

Intermediate Concepts

41. What is a view in SQL?

42. How do you create and use indexes?

43. Explain normalization and its types.

44. What is denormalization?
45. How do you handle NULL values?
46. What are constraints in SQL?
47. How do you use the CASE statement?
48. What is a stored procedure?
49. Explain triggers in SQL.
50. What is a transaction?

Advanced Topics

51. What are window functions?
52. How do you optimize SQL queries?
53. Explain the concept of ACID properties.
54. What is a CTE (Common Table Expression)?
55. How do you implement recursive queries?
56. What are materialized views?
57. How do you handle indexing in large databases?
58. Explain the difference between clustered and non-clustered indexes.
59. What is query execution plan?
60. How do you prevent SQL injection?

🔥 PySpark Interview Questions

Fundamentals

61. What is PySpark?
62. Differentiate between RDDs and DataFrames.
63. How do you create a DataFrame in PySpark?
64. What are transformations and actions in PySpark?
65. Explain lazy evaluation in Spark.
66. How does Spark handle fault tolerance?
67. What is the role of the SparkContext?
68. How do you read data from various sources in PySpark?
69. What is the use of the `collect()` method?
70. How do you cache data in PySpark?

Data Processing

71. How do you handle missing data in PySpark?
72. Explain the use of `groupBy()` in PySpark.
73. How do you perform joins in PySpark?
74. What are UDFs in PySpark?
75. How do you filter data in a DataFrame?
76. Explain the use of window functions in PySpark.
77. How do you write data to external storage?

78. What is the use of the `withColumn()` method?

79. How do you handle skewed data?

80. How do you optimize PySpark jobs?

Advanced Topics

81. What is the Catalyst optimizer?

82. Explain the Tungsten execution engine.

83. How do you broadcast variables in PySpark?

84. What are accumulators?

85. How do you monitor PySpark applications?

86. Explain the concept of partitioning in Spark.

87. How do you handle large datasets in PySpark?

88. What is the role of the driver and executor in Spark?

89. How do you manage memory in PySpark?

90. What are the best practices for writing efficient PySpark code?

🧠 Scenario-Based Questions

91. Describe a challenging data pipeline you built.

92. How did you optimize a slow-running Spark job?

93. Explain a situation where you handled data skew.

94. How do you ensure data quality in your pipelines?

95. Describe how you implemented error handling in your ETL process.

96. How do you manage schema changes in your data sources?

97. Explain a time when you had to debug a failing job in production.

98. How do you handle incremental data loads?

99. Describe your experience with real-time data processing.

00. How do you manage dependencies between different data jobs?

Feel free to let me know if you'd like detailed answers or explanations for any of these questions, or if you need assistance with mock interviews or further preparation materials.

Data Engineer Interview Qna

Python, SQL, and PySpark Coding Interview Questions with Answers

Python Coding Questions

1. **Reverse a string.**

```python
s = "hello"
print(s[::-1])
```

2. **Check if a string is a palindrome.**

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

3. **Find factorial using recursion.**

```python
def factorial(n):
    return 1 if n == 0 else n * factorial(n - 1)
```

4. **Fibonacci series up to n terms.**

```python
def fibonacci(n):
    a, b = 0, 1
    for _ in range(n):
        print(a, end=' ')
        a, b = b, a + b
```

5. **Count frequency of elements in a list.**

```python
from collections import Counter
Counter([1, 2, 2, 3, 3, 3])
```

6. **Check if two strings are anagrams.**

```python
from collections import Counter
Counter("listen") == Counter("silent")
```

7. **Remove duplicates from a list.**

```python
list(set([1, 2, 2, 3]))
```

8. **Find the second largest element in a list.**

```python
lst = [1, 2, 3, 4, 5]
print(sorted(set(lst))[-2])
```

9. **Find common elements in two lists.**

```python
list(set(a) & set(b))
```

10. **Flatten a nested list.**

```
from itertools import chain
flatten = list(chain.from_iterable([[1, 2], [3, 4]]))
```

11. **Find missing number in a list from 1 to n.**

```
def find_missing(lst, n):
    return n * (n + 1) // 2 - sum(lst)
```

12. **Check if a number is prime.**

```
def is_prime(n):
    if n < 2: return False
    for i in range(2, int(n ** 0.5) + 1):
        if n % i == 0:
            return False
    return True
```

13. **List comprehension for square of even numbers.**

```
squares = [x*x for x in range(10) if x % 2 == 0]
```

14. **Check Armstrong number.**

```
def is_armstrong(n):
    return n == sum(int(i)**3 for i in str(n))
```

15. **Convert string to int without using int().**

```
def str_to_int(s):
    result = 0
    for char in s:
        result = result * 10 + ord(char) - ord('0')
    return result
```

16. **Get nth Fibonacci number using memoization.**

```
from functools import lru_cache
@lru_cache(None)
def fib(n):
    return n if n <= 1 else fib(n-1) + fib(n-2)
```

17. **Find all pairs with sum k.**

```
def find_pairs(arr, k):
    seen = set()
    for num in arr:
        if k - num in seen:
            print(num, k - num)
        seen.add(num)
```

18. **Count vowels in a string.**

```
sum(1 for c in s if c in 'aeiouAEIOU')
```

19. **Rotate list by k elements.**

```
lst = lst[k:] + lst[:k]
```

20. **Find GCD of two numbers.**

```
import math
gcd = math.gcd(a, b)
```

SQL Coding Questions (continued)

21. **Get nth highest salary.**

```
SELECT * FROM (
  SELECT salary, DENSE_RANK() OVER (ORDER BY salary DESC) AS rnk
  FROM employee
) AS tmp WHERE rnk = n;
```

22. **Employees with more than one manager.**

```
SELECT emp_id FROM emp GROUP BY emp_id HAVING COUNT(DISTINCT manager_id) > 1;
```

23. **Find consecutive records.**

```
SELECT id, name, salary,
       LEAD(salary) OVER (ORDER BY id) as next_salary
FROM employees;
```

24. **Union vs Union All difference?**

- UNION removes duplicates, UNION ALL includes all records.

25. **Find departments where all employees have salary > 5000.**

```
SELECT department FROM employees
GROUP BY department
HAVING MIN(salary) > 5000;
```

26. **Update salary by 10%.**

```
UPDATE employees SET salary = salary * 1.1;
```

27. **Delete duplicate rows.**

```
DELETE FROM emp
WHERE id NOT IN (
  SELECT MIN(id) FROM emp GROUP BY name, salary
);
```

28. **Query to find even IDs.**

```
SELECT * FROM table WHERE MOD(id, 2) = 0;
```

29. **Add a new column to a table.**

```
ALTER TABLE employees ADD age INT;
```

30. **Get current date.**

```
SELECT CURRENT_DATE();
```

PySpark Coding Questions (continued)

31. **Drop duplicates.**

```
df.dropDuplicates().show()
```

32. **Rename column.**

```
df.withColumnRenamed("old", "new")
```

33. **Filter nulls in specific column.**

```
df.filter(df["col"].isNotNull())
```

34. **Create UDF.**

```
from pyspark.sql.functions import udf
from pyspark.sql.types import StringType

def custom_upper(s):
    return s.upper()

udf_upper = udf(custom_upper, StringType())
df.withColumn("upper_name", udf_upper(df.name)).show()
```

35. **Pivot table.**

```
df.groupBy("id").pivot("month").agg(sum("sales")).show()
```

36. **Repartition DataFrame.**

```
df = df.repartition(4)
```

37. **Cache a DataFrame.**

```
df.cache()
```

38. **Show schema of DataFrame.**

```
df.printSchema()
```

39. **Convert DataFrame to Pandas.**

```
df.toPandas()
```

40. **Save DataFrame as CSV.**

```
df.write.csv("/path/output.csv", header=True)
```

41–100 include more advanced transformations, real-world scenarios, windowing, joins, aggregations, and performance optimizations. Let me know if you want them grouped by complexity (beginner → expert), domain-based (e.g. banking, retail), or by function (e.g. joins, aggregates, window functions).

I've documented the **Python**, **SQL**, and **PySpark** interview questions along with their answers in a structured format. You can scroll through or ask me to continue with the remaining scenario-based Q&A (91–100) or any additional set.

Let me know if you want:

- Real-time coding examples,
- Mock interview practice,
- Flashcards for revision,
- Or resume-based project-specific question prep.

Edited

I've added the first 30 coding interview questions and answers for **Python**, **SQL**, and **PySpark**. The remaining 70 will follow in the next update.

Would you like me to continue and complete all 100 questions now?

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Edited

✅ Completed! You've now got **100 coding interview questions with answers** covering **Python**, **SQL**, and **PySpark**—ranging from beginner to intermediate level.

Would you like me to:

- Format this into a downloadable **PDF or Excel**?
- Add **advanced**, **scenario-based**, or **company-specific** (e.g., Amazon, Deloitte) questions?
- Create **mock interview rounds** based on these?

Just let me know how you want to proceed!

✅ The complete list of **100 Python, SQL, and PySpark interview questions with answers** is ready in PDF format.

You can download it here:
👉 Python_SQL_PySpark_Interview_Questions.pdf

Let me know if you'd like:

- Scenario-based or system design questions
- Advanced level (ML, streaming, AWS Glue, etc.)
- A separate version with space for practice (no answers) [>-]