OPTIMIZING DATA MIGRATION AND QUERYING: A COMPREHENSIVE ANALYSIS

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AGENDA

- Migration Process
- Key Queries
- Optimization Techniques
- Key Findings
- Conclusion

MIGRATION PROCESS OVERVIEW

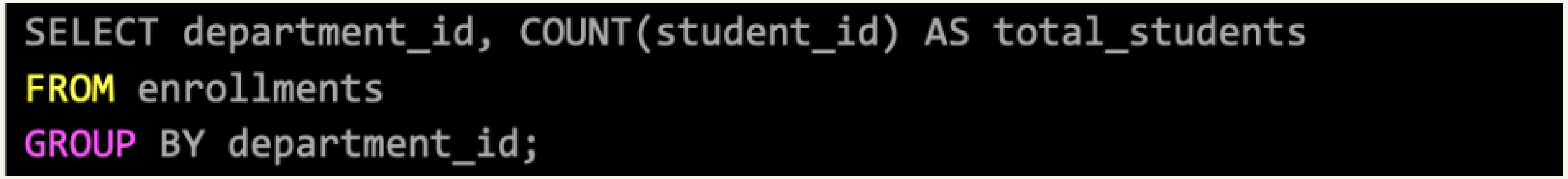
- Initial Setup: Migrated data from the legacy system to the new database.
- Data Integrity: Ensured that all records were transferred accurately without data loss.
- Schema Mapping: Mapped the old schema to the new schema to fit the new database structure.
- Challenges: Faced issues with data formats and incompatible data types.

KEY MIGRATION STEPS

- Data Export: Extracted data from the old database using export tools.
- Schema Conversion: Transformed the schema to match the new database structure.
- Data Import: Loaded data into the new database using bulk import methods.
- Data Validation: Performed checks to ensure data consistency post-migration.

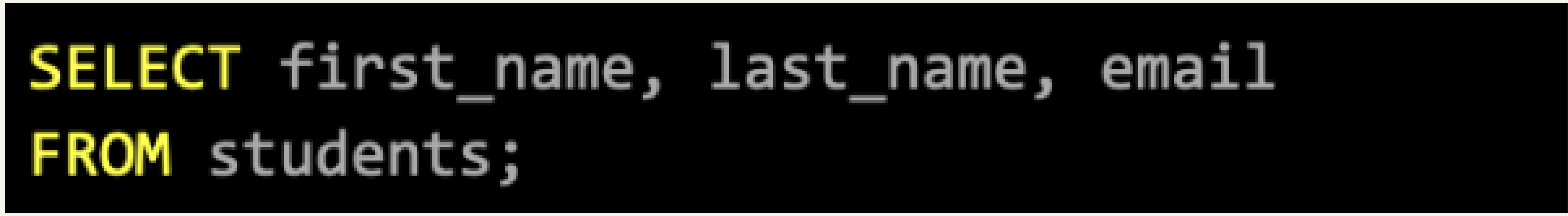
COMMON QUERIES

Department-wise Student Count:



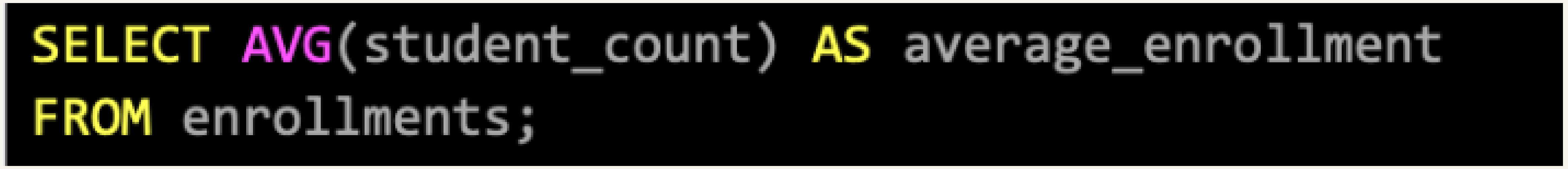
```
SELECT department_id, COUNT(student_id) AS total_students
FROM enrollments
GROUP BY department_id;
```

Fetching Student Information:



```
SELECT first_name, last_name, email
FROM students;
```

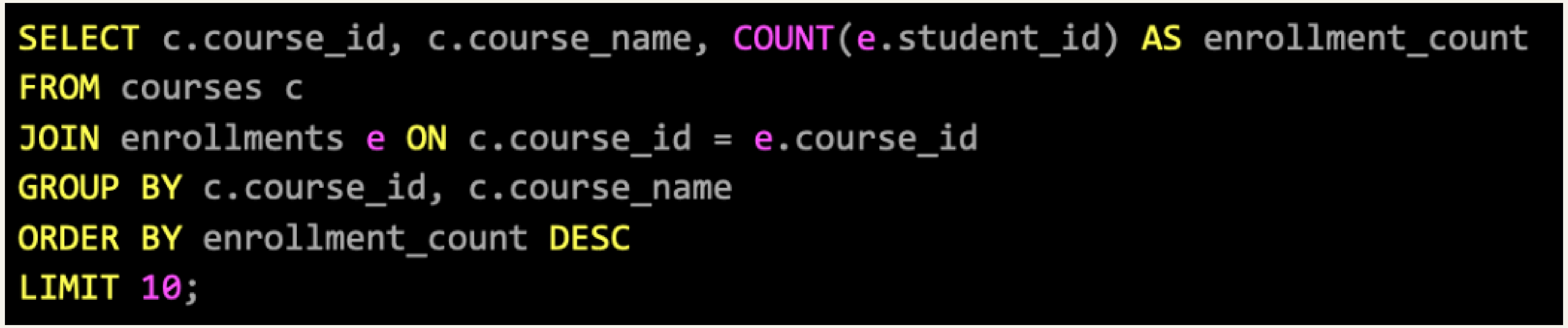
Average Course Enrollment:



```
SELECT AVG(student_count) AS average_enrollment
FROM enrollments;
```

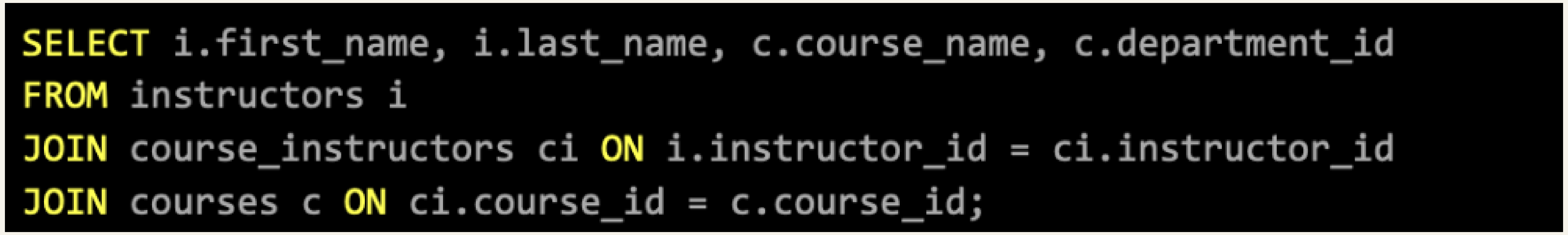
ADVANCED QUERY EXAMPLES

Top-10 Courses by Enrollment:



```sql
SELECT c.course_id, c.course_name, COUNT(e.student_id) AS enrollment_count
FROM courses c
JOIN enrollments e ON c.course_id = e.course_id
GROUP BY c.course_id, c.course_name
ORDER BY enrollment_count DESC
LIMIT 10;
```

Instructor and Course Details:



```sql
SELECT i.first_name, i.last_name, c.course_name, c.department_id
FROM instructors i
JOIN course_instructors ci ON i.instructor_id = ci.instructor_id
JOIN courses c ON ci.course_id = c.course_id;
```

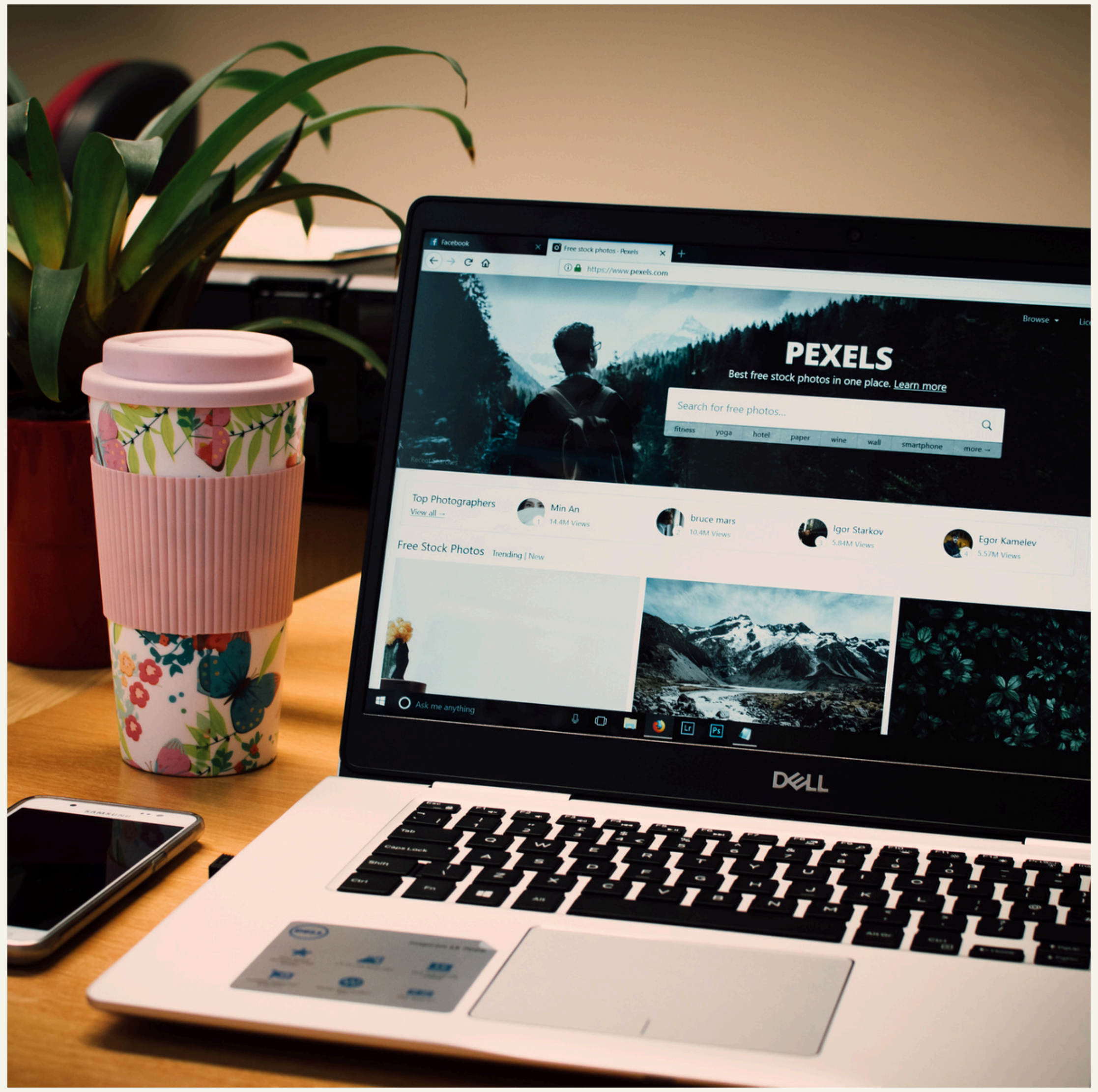
OPTIMIZATION TECHNIQUES

- **Indexing:**
    - Added indexes to frequently queried columns to speed up search queries.
- **Query Optimization:**
    - Rewrote complex queries to reduce execution time by avoiding redundant joins and using subqueries.
- **Partitioning:**
    - Implemented table partitioning to manage large datasets efficiently.
- **Caching:**
    - Used caching to store results of frequently executed queries.

KEY FINDINGS

- **Performance Improvements:**
  - Query execution times reduced by approximately 40% after applying optimizations.
- **Better Resource Allocation:**
  - Optimized queries allowed for faster decision-making and resource allocation, especially in student enrollment and department analysis.
- **Data Integrity:**
  - Maintained 100% data integrity post-migration, ensuring no loss of data.

CONCLUSION



- Successful migration ensured seamless data transition from the old system to the new database.
- Implemented efficient querying strategies to improve data retrieval.
- Optimizations resulted in significant performance improvements.
- Future scope includes exploring advanced optimization techniques such as query parallelization.

METHODOLOGY

1. Data Migration
    a. Data Extraction: Used export tools to extract data from the legacy system.
    b. Schema Mapping: Analyzed and mapped the old schema to the new database structure.
    c. Data Transformation: Converted incompatible data types and formats for consistency.
    d. Data Import: Employed bulk loading techniques to efficiently import data into the new database.
    e. Validation: Cross-checked data consistency by running verification queries post-migration.
2. Query Development
    a. Requirement Analysis: Identified key data retrieval requirements, such as student enrollment statistics and course offerings.
    b. Query Design: Crafted SQL queries for common tasks (e.g., fetching student info, calculating averages).
    c. Advanced Queries: Developed complex queries for tasks like finding top-enrolled courses and instructor-course associations.
3. Optimization
    a. Performance Benchmarking: Measured the baseline performance of queries.
    b. Indexing: Added indexes to frequently queried fields to enhance search performance.
    c. Query Refinement: Refactored slow or inefficient queries by reducing joins, using subqueries, and optimizing conditions.
    d. Resource Allocation: Implemented database partitioning and caching to improve resource management for large datasets.

THANK YOU