Sri Lanka Institute of Information Technology

IT3021 - Data warehousing and Business Intelligence

Assignment 02

IT22118936

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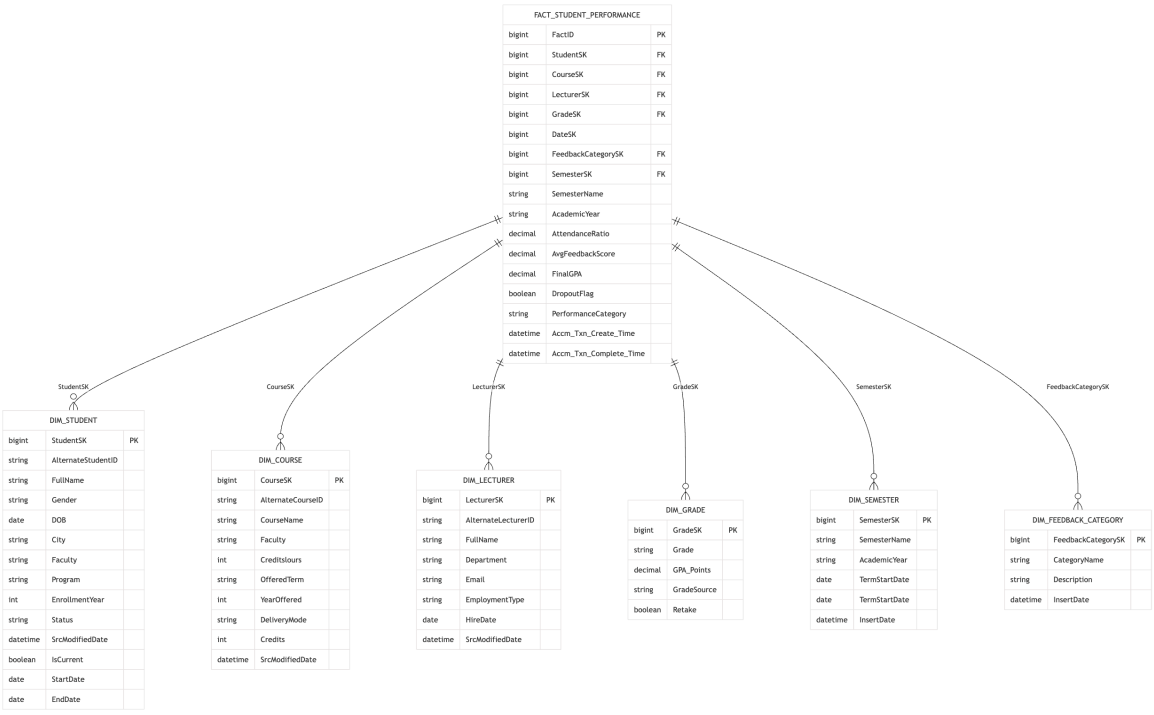
Step 1: Data source for the assignment 2

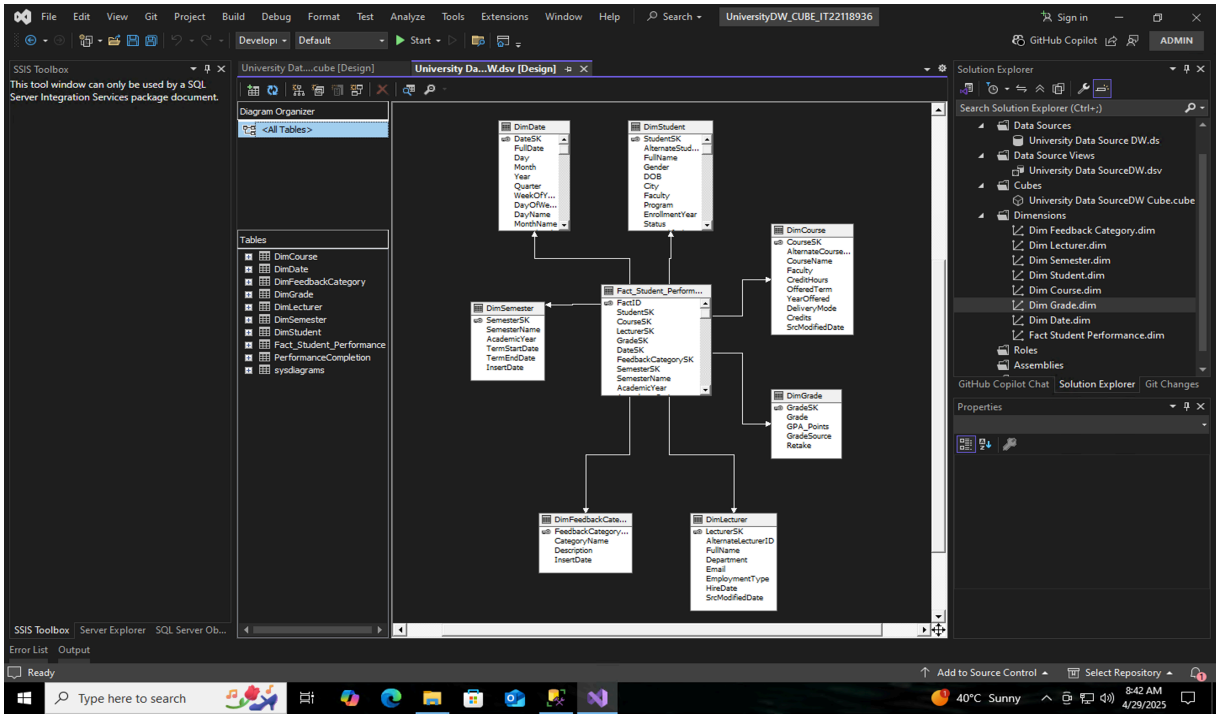
Data Warehouse Design



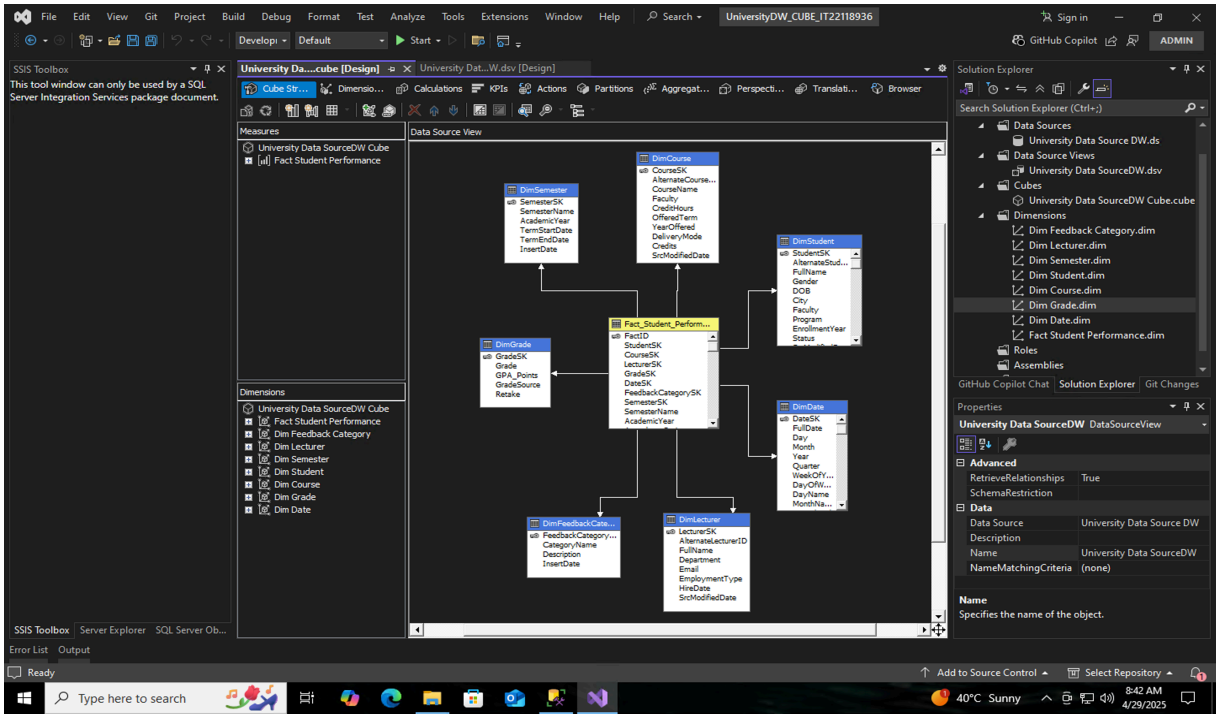
This University Data Warehouse (DW) is designed using a star schema to support performance analysis, academic monitoring, and decision-making processes. The central fact table, Fact_Student_Performance, captures key metrics such as attendance ratio, GPA, and feedback scores, and is linked to multiple dimension tables that provide contextual information. Among these, DimStudent is implemented as a Slowly Changing Dimension Type 2 (SCD2) to track historical changes in student attributes like city, status, and program over time. The other dimension tables include DimCourse, DimLecturer, DimGrade, DimDate, DimSemester, and DimFeedbackCategory, each offering granular insight into the respective entities.

Step 2: SSAS Cube implementation

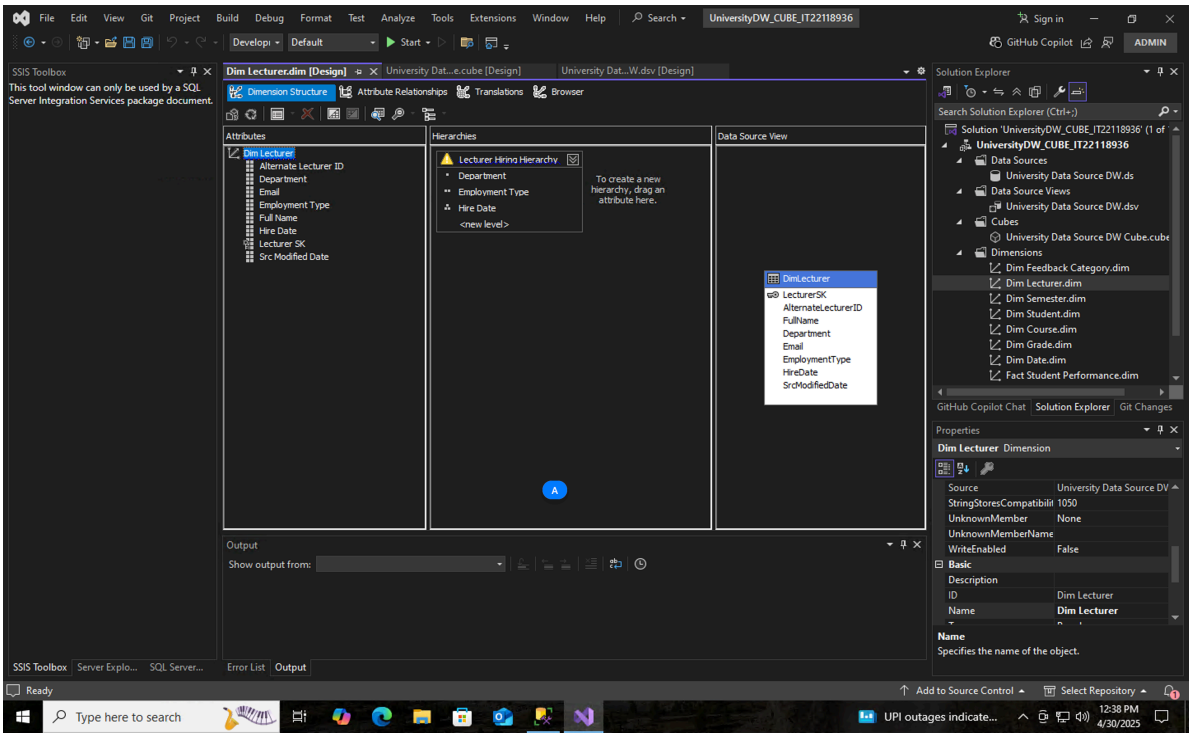
1. Created SSAS Project - Launched SQL Server Data Tools (SSDT) and created a new "Analysis Services Multidimensional and Data Mining Project".
2. Established Data Source - Configured a connection to the existing data warehouse database using Windows authentication.
3. Built Data Source View - Imported all fact and dimension tables from the DW and manually established relationships between them.



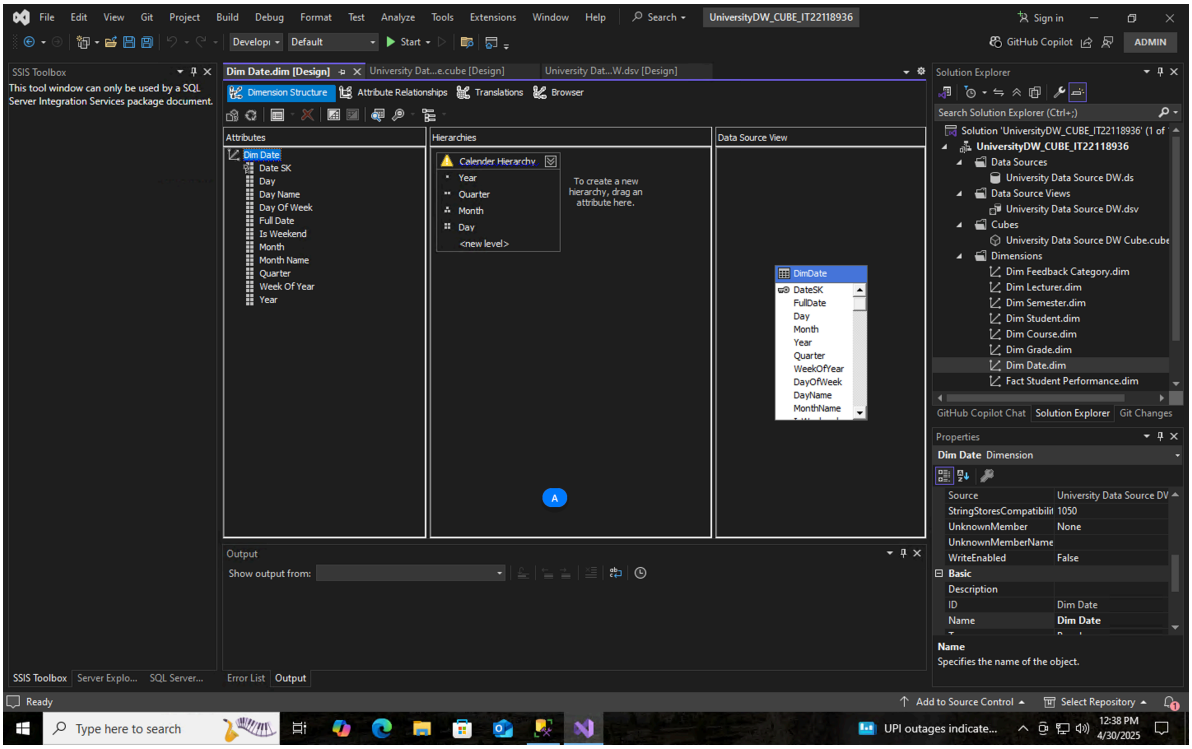
4. Initiated Cube Creation - Used the Cube Wizard with "Use existing tables" option and selected the fact table as the measure group.
5. Incorporated Dimensions - Added all dimension tables to create the star schema structure.
6. Enhanced Dimensions - Edited each dimension to include all attributes and set appropriate key attributes.



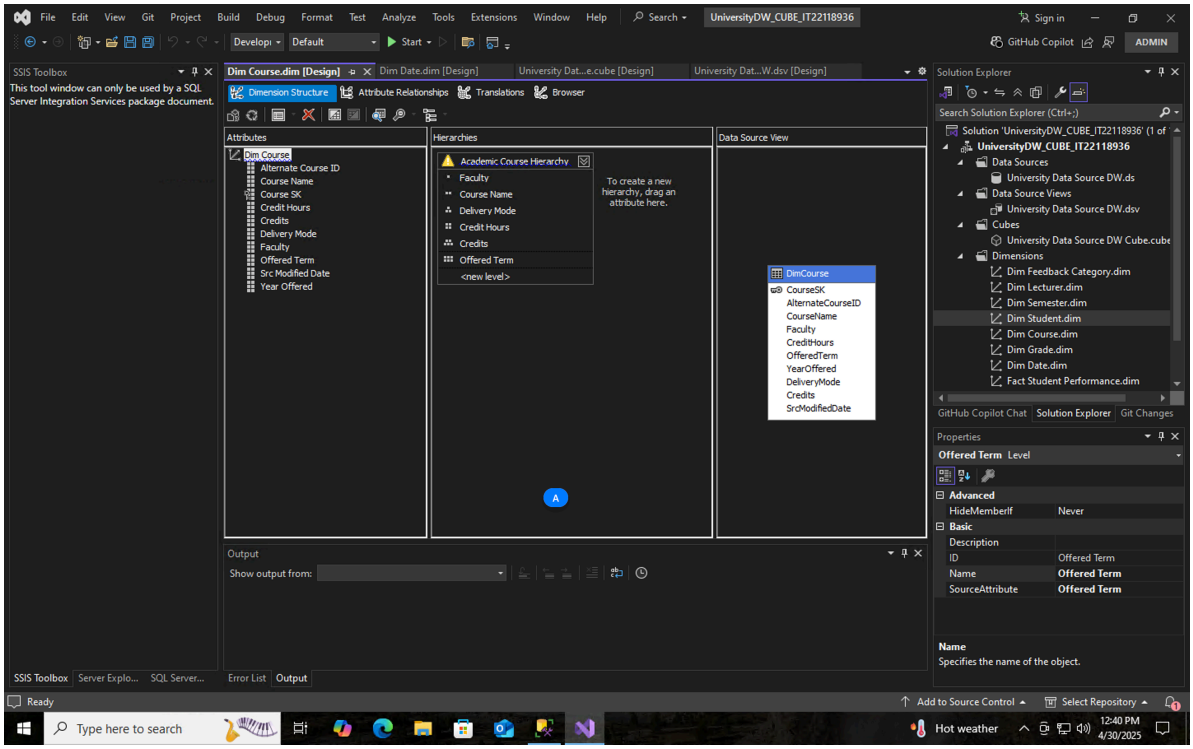
7. Created Hierarchies - Built user hierarchies:
   Lecturer Hiring Hierarchy → Department – Employment Type – Hire Date



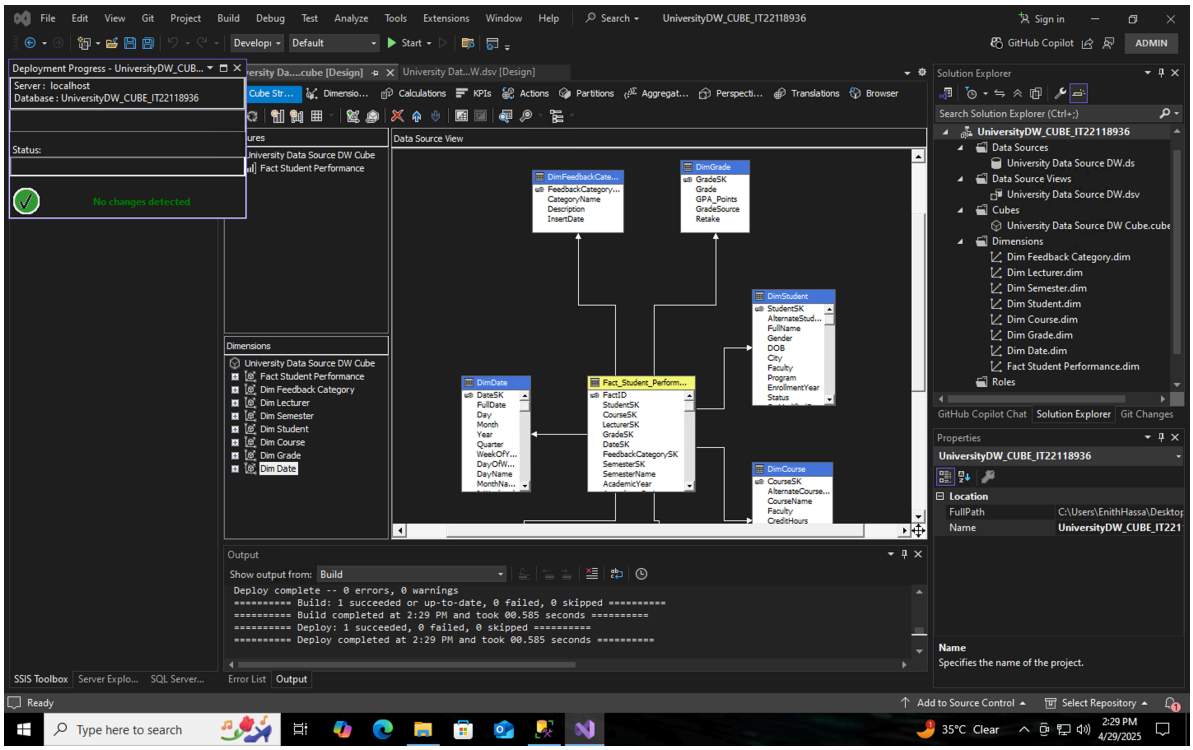
Calendar Hierarchy → Year – Quarter – Month – Day



Academic Course Hierarchy → Faculty – Course Name – Delivery Mode – Credit Hours – Credits – Offered Term

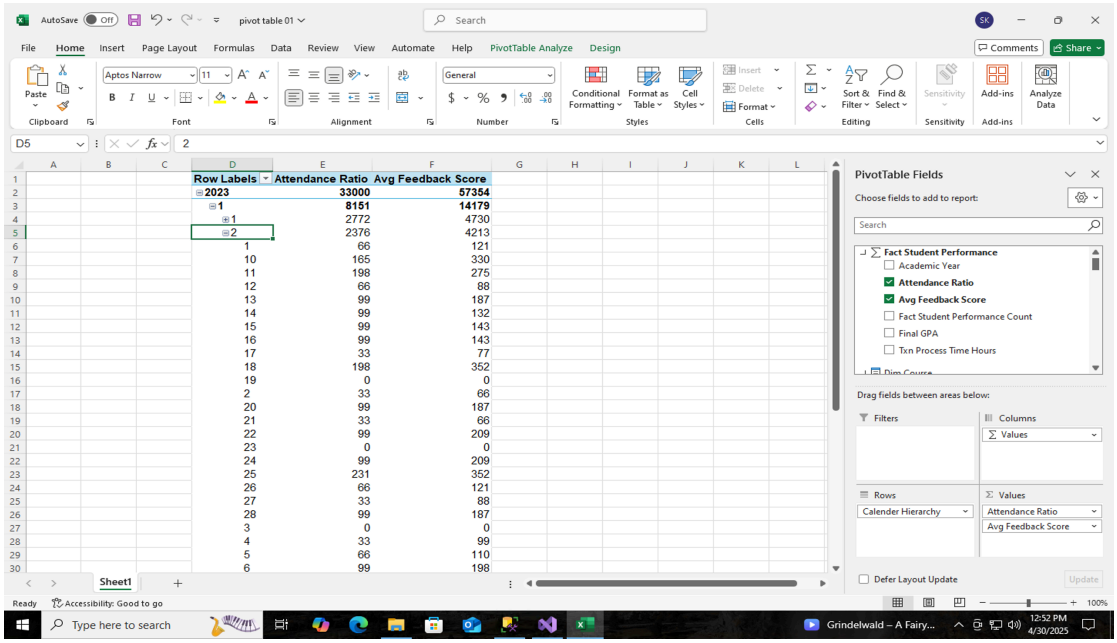


8. Verified Relationships - Checked and corrected dimension usage mappings between fact and dimension tables.
9. Deployed the Cube - Configured deployment settings and successfully processed the cube to the SSAS server.
10. Validated Deployment - Confirmed cube accessibility through both SSDT browser and SQL Server Management Studio.

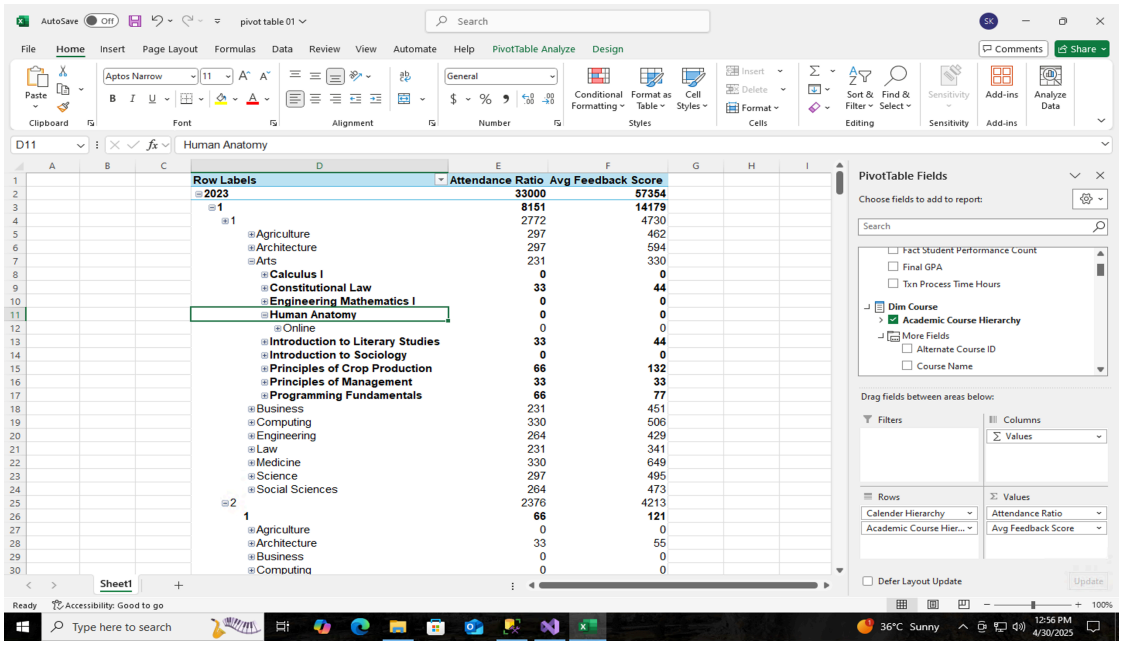


Step 3: Demonstration of OLAP operations

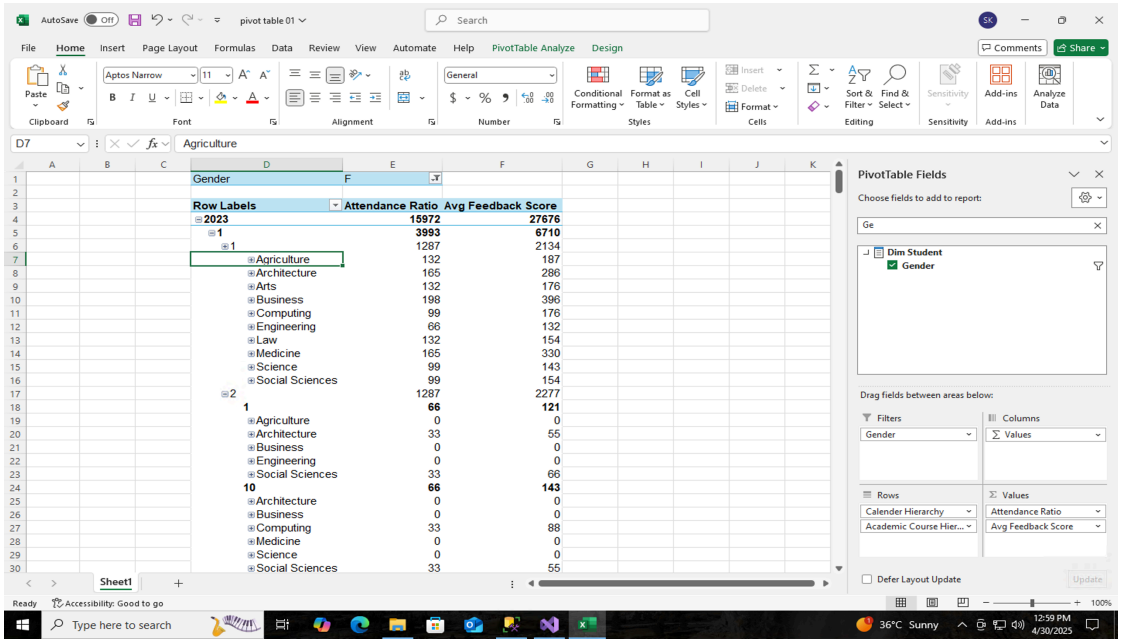
1. Connected Excel to SSAS Cube – Used Excel's Get Data feature to establish a connection to the deployed SSAS cube.
2. Created PivotTable – Generated a PivotTable report in Excel linked to the cube for OLAP analysis.
3. Demonstrated Roll-up – Aggregated data from lower levels to higher levels
   - Daily Attendance Ratio to Yearly Counts
   - Monthly Average Feedback Score to Yearly Averages



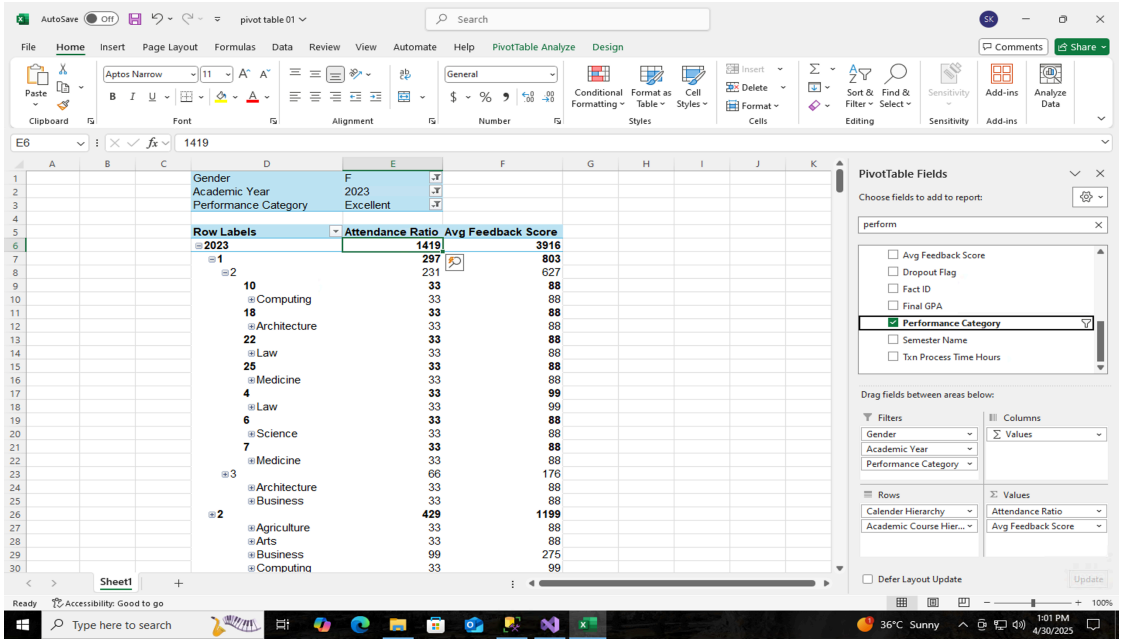
4. Performed Drill-down – Expanded hierarchies to analyze granular details.
   - Academic Courses Hierarchy: Faculty – Course Name – Delivery Mode – Credit Hours – Credits – Offered Term



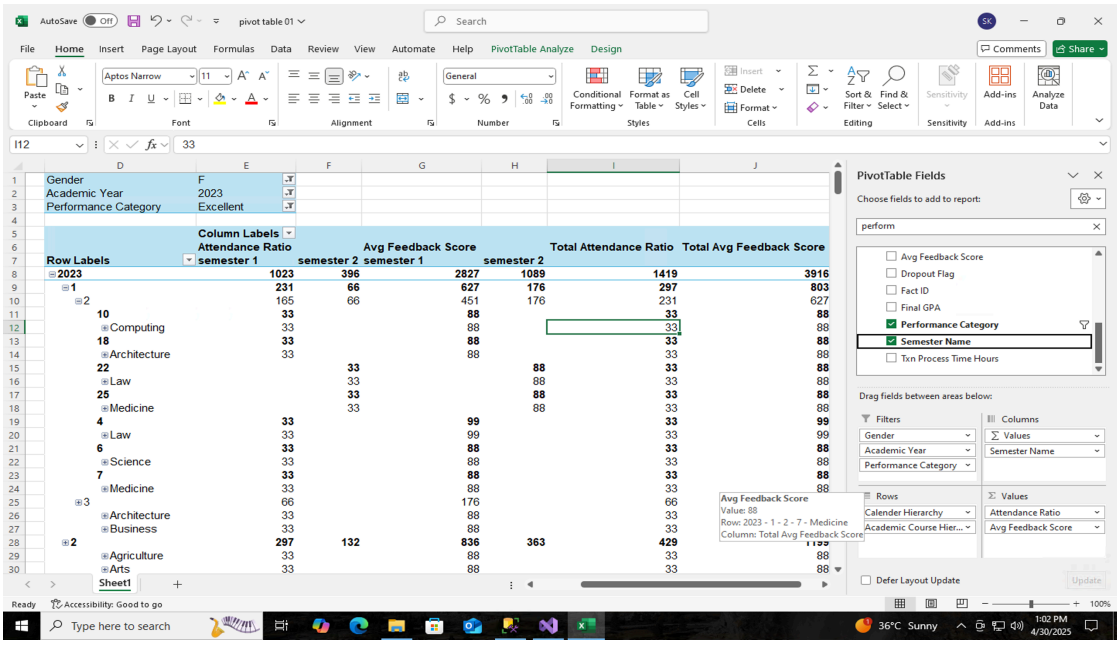
5. Applied Slice Operation – Filtered data using a single criterion
   - Filters to only "Female" students



6. Executed Dice Operation – Created a sub cube by applying multiple filters
   - Filters to Academic Year -2023
   - Performance Year -Excellent



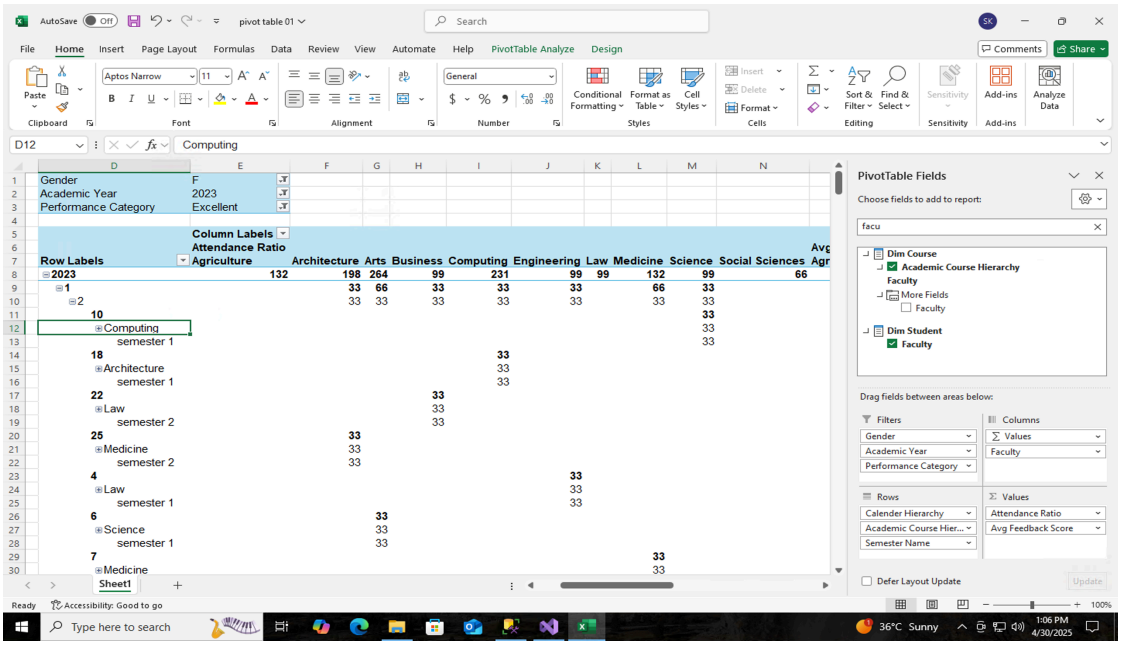
7. Showed Pivot Functionality – Rotated rows and columns to change data perspective.
   - Semester as Column and Academic Courses Hierarchy as Row



Gender	F
Academic Year	2023
Performance Category	Excellent

	Column Labels					
	Attendance Ratio		Avg Feedback Score		Total Attendance Ratio	Total Avg Feedback Score
Row Labels	semester 1	semester 2	semester 1	semester 2		
2023	1023	396	2827	1089	1419	3916
1	231	66	627	176	297	803
2	165	66	451	176	231	627
10	33		88		33	88
Computing	33		88		33	88
18	33		88		33	88
Architecture	33		88		33	88
22		33		88	33	88
Law		33		88	33	88
25		33		88	33	88
Medicine		33		88	33	88
4	33		99		33	99
Law	33		99		33	99
6	33		88		33	88
Science	33		88		33	88
7	33		88		33	88
Medicine	33		88		33	88
3	66		176		66	
Architecture	33		88		33	
Business	33		88		33	
2	297	132	836	363	429	
Agriculture	33		88		33	88
Arts	33		88		33	88

   - Academic Courses Hierarchy as Column and Semester as Row

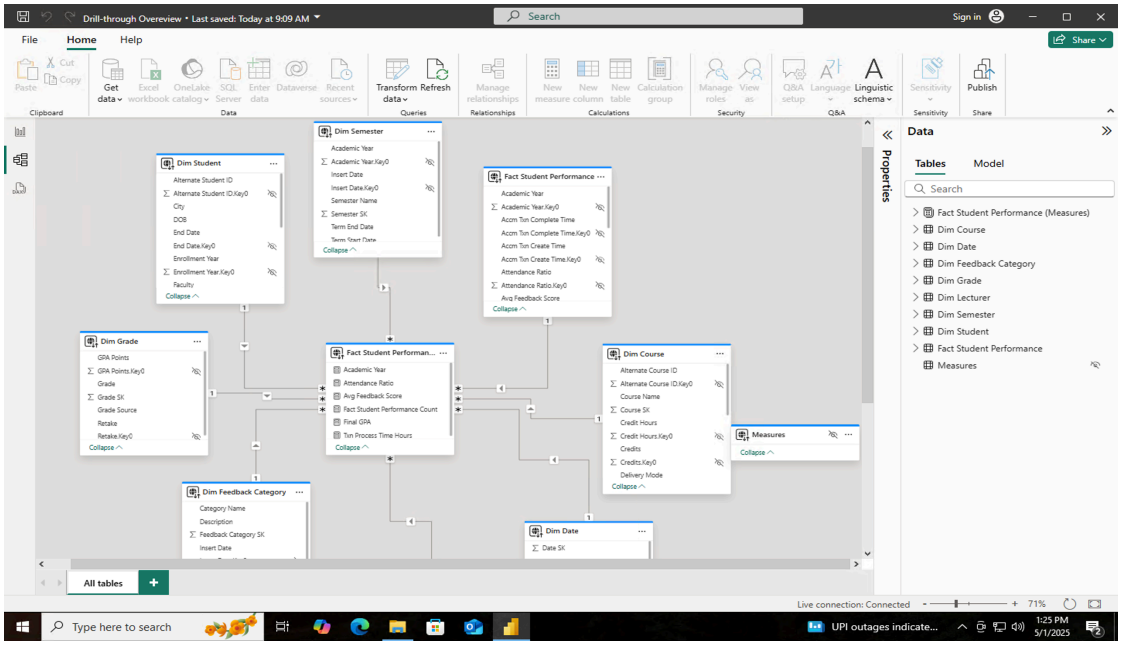


Gender	F
Academic Year	2023
Performance Category	Excellent

	Column Labels										
	Attendance Ratio										Avg
Row Labels	Agriculture	Architecture	Arts	Business	Computing	Engineering	Law	Medicine	Science	Social Sciences	Agr
2023	132	198	264	99	231	99	99	132	99	66	
1		33	66	33	33	33		66	33		
2		33	33	33	33	33		33	33		
10									33		
Computing									33		
semester 1									33		
18					33						
Architecture					33						
semester 1					33						
22				33							
Law				33							
semester 2				33							
25		33									
Medicine		33									
semester 2		33									
4							33				
Law							33				
semester 1							33				
6			33								
Science			33								
semester 1			33								
7								33			
Medicine								33			

Step 4: PowerBI Reports

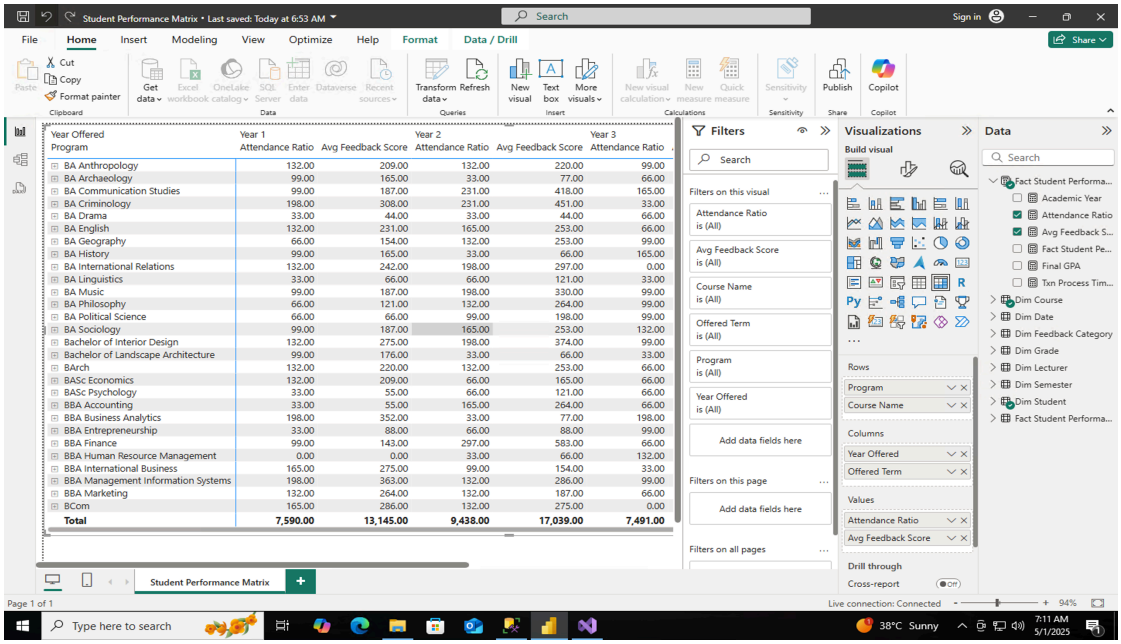
1. Connected to Data Source – Imported fact and dimension tables from the SQL Server Analysis Services Cube into Power BI Desktop.
2. The star schema was already linked with the fact table to the dimension tables using key columns since we uploaded the cube in the last step.



3. Report 1: Matrix Visual

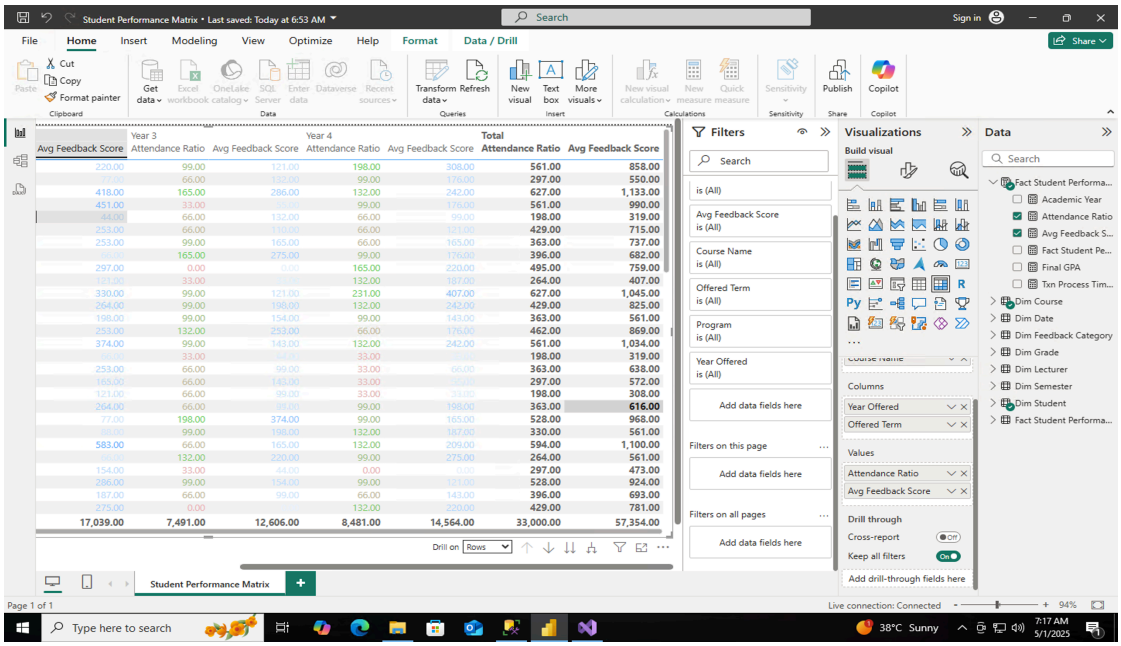
a) Designed Matrix Layout:

- Added Hierarchical Rows → Program, Course Name
- And Columns → Year Offered, Offered Term
- And Values → Attendance Ratio, Avg Feedback Score



b) Configure the Matrix:

- Applied Conditional Formatting to the Attendance Ratio values (dark green for high, light green for lower) and Avg Feedback Score values (dark blue for high, light blue for lower).
- Add totals and subtotals, and adjust column widths and text alignment.

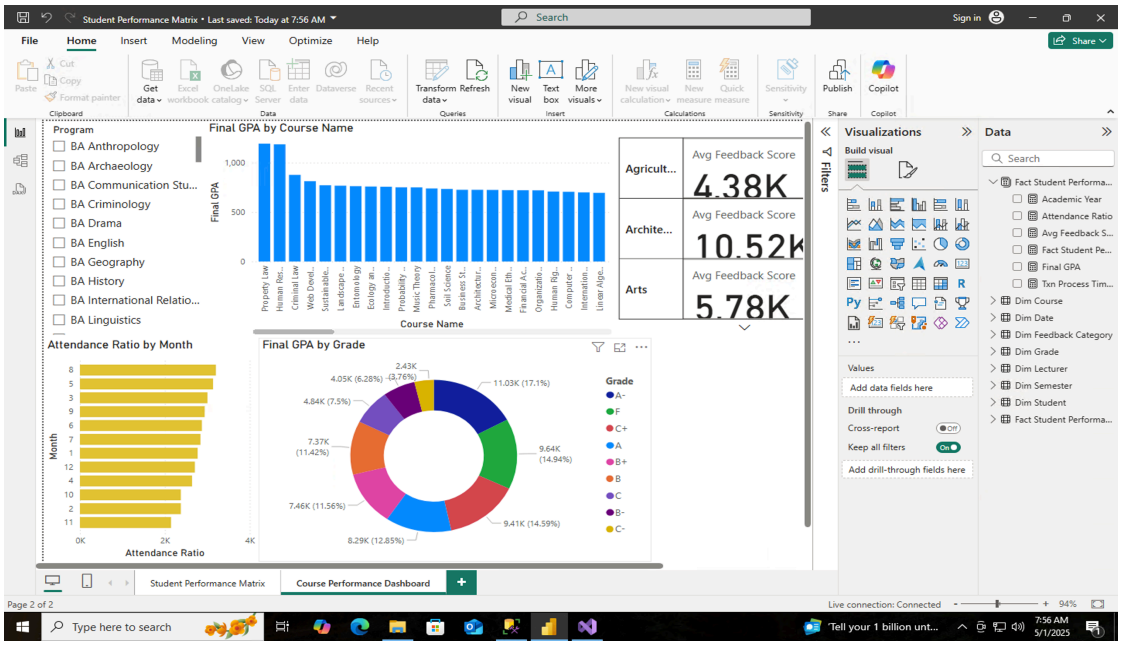


4. Report 2: Multiple Slicers with Cascading Filters

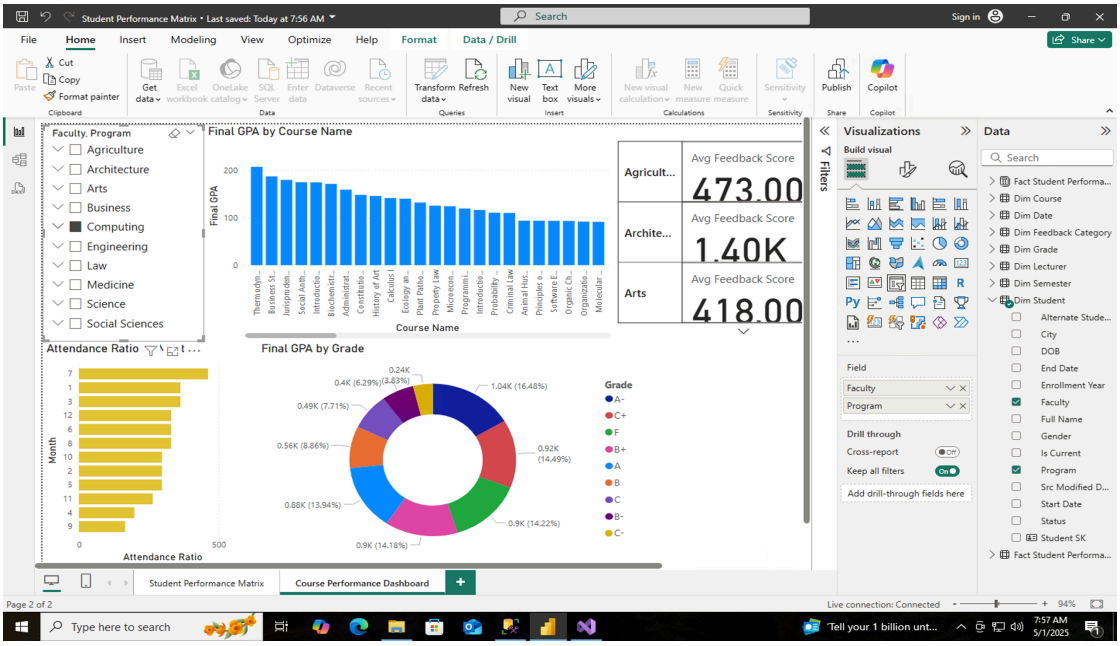
a) Created Interactive Filters - Added slicers for Faculty and Program, with dynamic filtering.

b) Added Supporting Visuals:

- Bar chart: Final GPA by Course name
- Line chart: Attendance Ratio trend over time
- Card visuals: Program, feedback score count
- Donut chart: Grade distribution



c) Test the filters: Verify that selecting items in the slicers filters all visuals



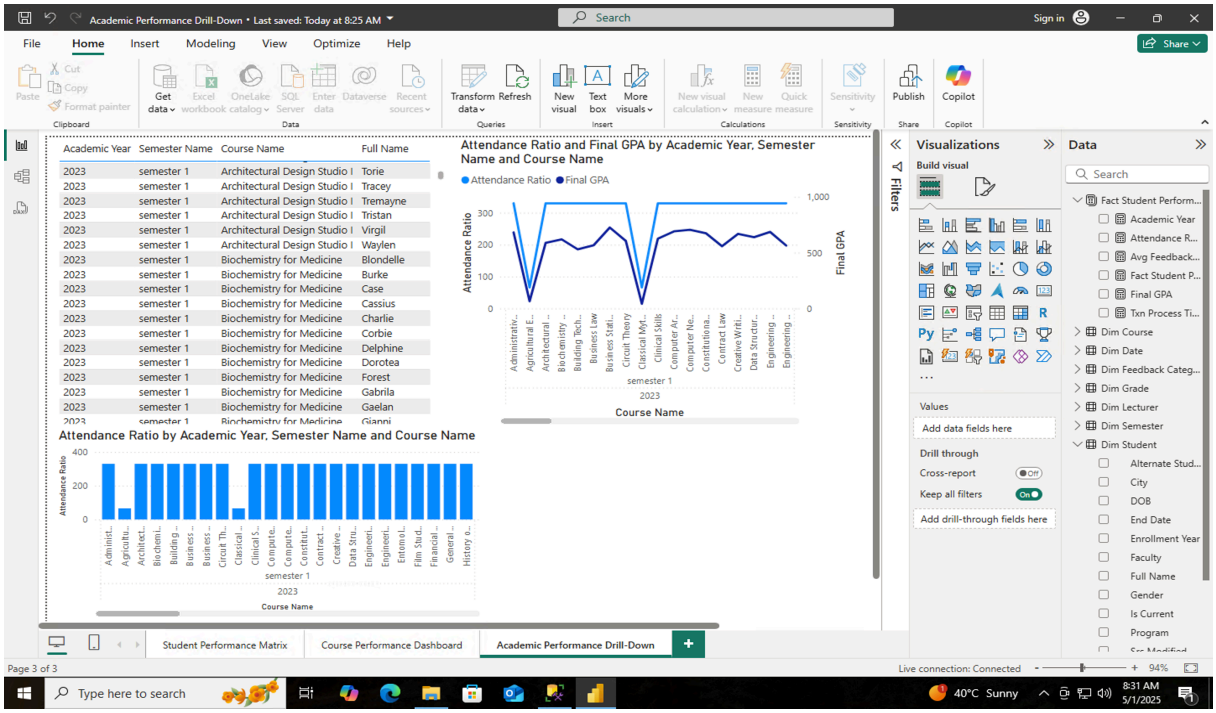
5. Report 3: Drill-Down Report.

a) Built Hierarchical Visual – Configured a column chart with drill-down levels. Academic year → Semester Name → Course name → Full name

b) Added a column chart with the same hierarchy levels.

c) Added a line char with the same hierarchy levels.

d) Set up the drill-down functionality.



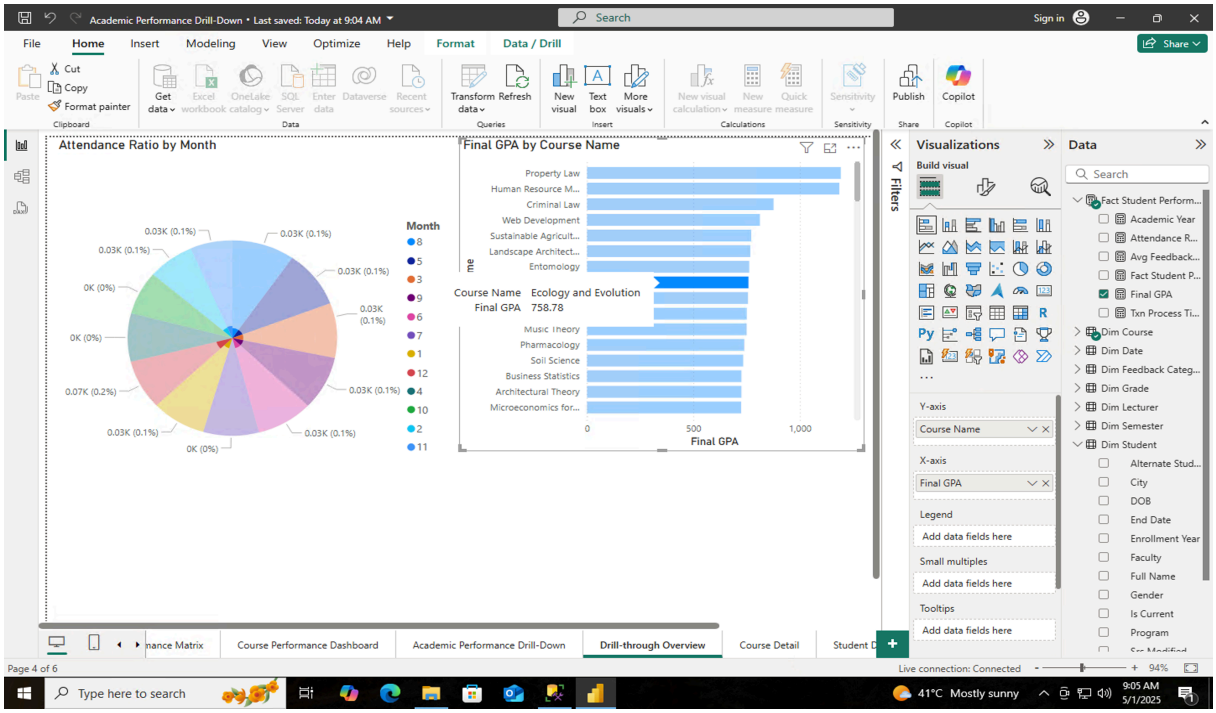
6. Report 4: Drill-Through Report

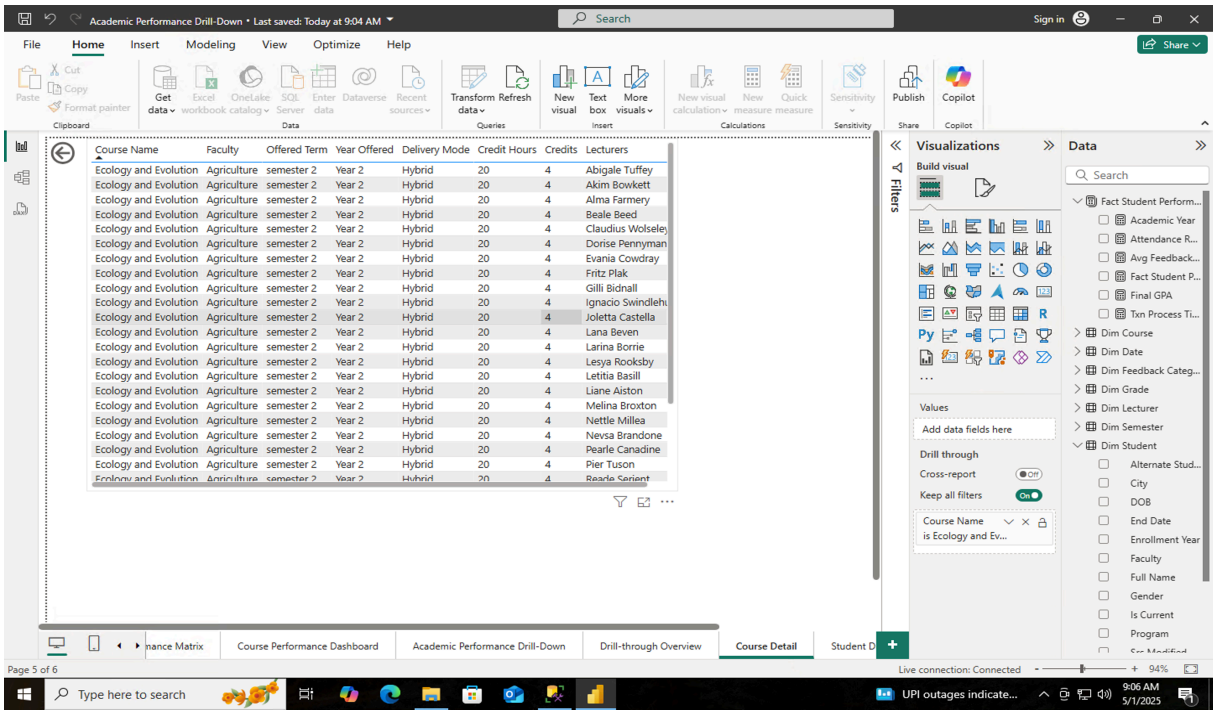
a) Create a main overview page with summary visuals like final GPA by course name, and attendance ratio by month.

b) Create a detail page named “Student Detail” and “Course Detail”, including specific information.

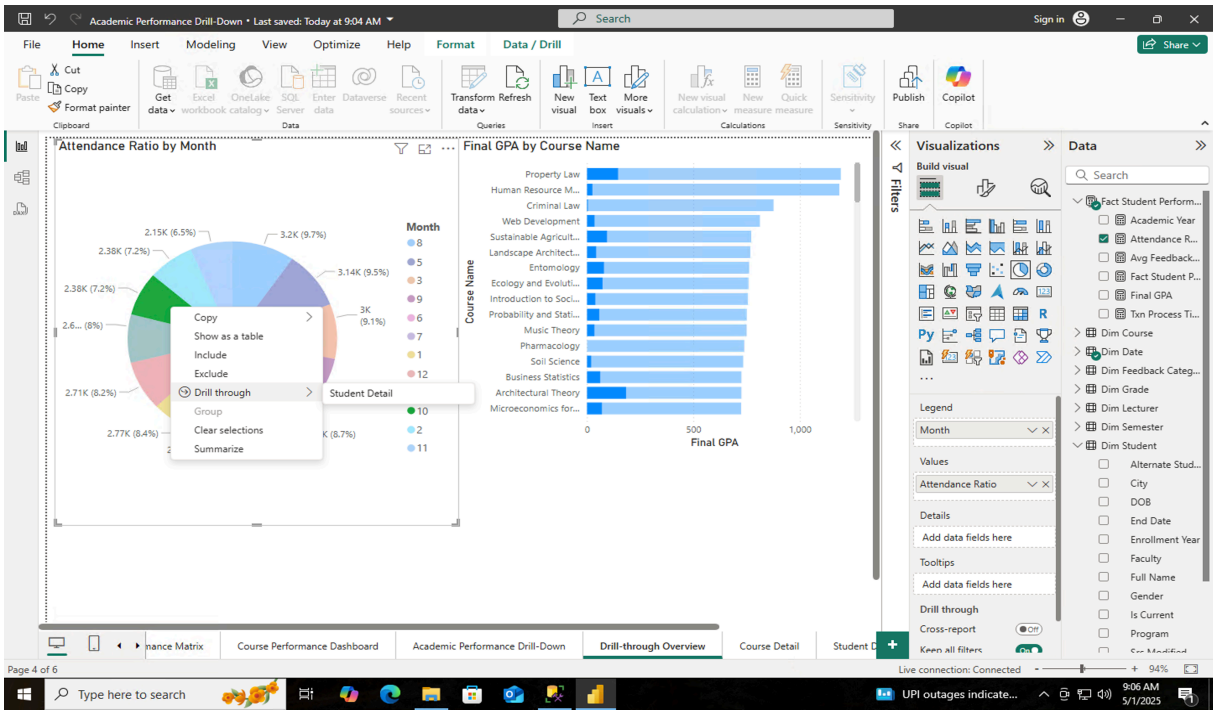
c) Set up the drill-through: On the detail page, add Attendance Ratio in the Student Detail page and Lecturer Name in the Course Detail page as the drill-through filter for each page.

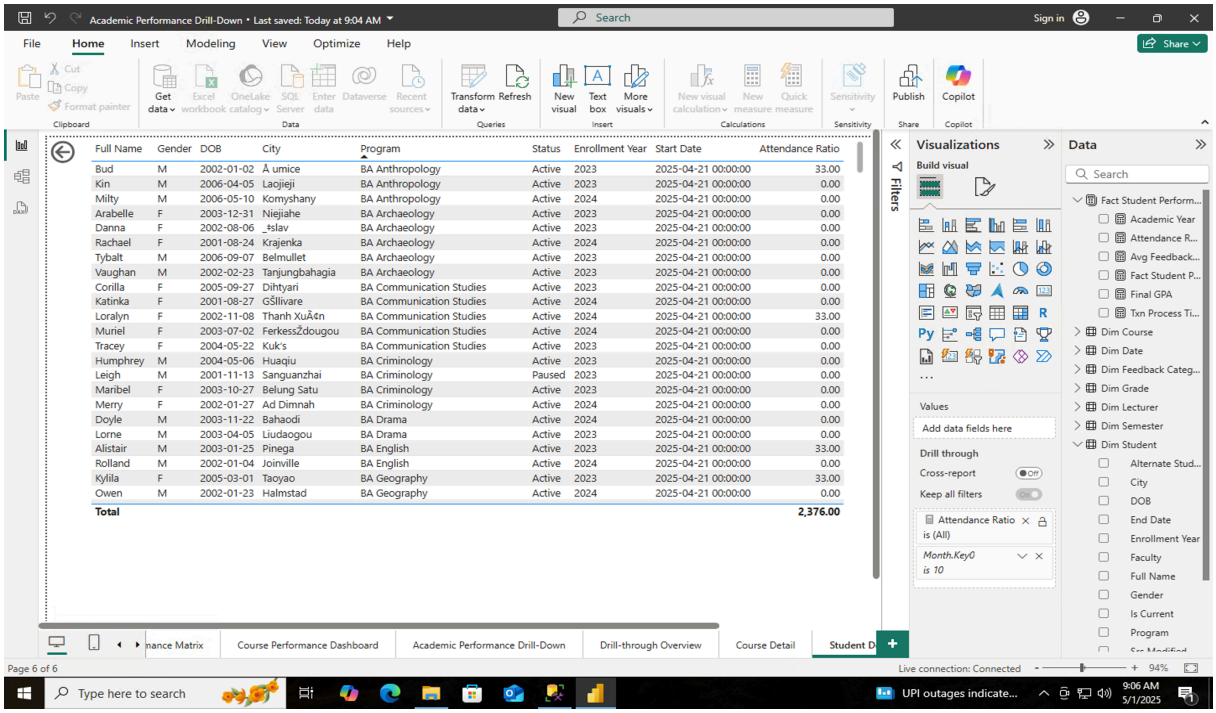
d) Test by right-clicking a data point and selecting;
Drill through → "Course Detail"





Drill through → "Student Detail"





DAX Measures used for University Performance Analysis

- Average GPA:
  Average GPA = AVERAGE('Fact_Student_Performance'[FinalGPA])
- Average Attendance Ratio
  Average Attendance = AVERAGE('Fact_Student_Performance'[AttendanceRatio])