



**Sri Lanka Institute of Information Technology**

**IT3021 - Data warehousing and  
Business Intelligence**

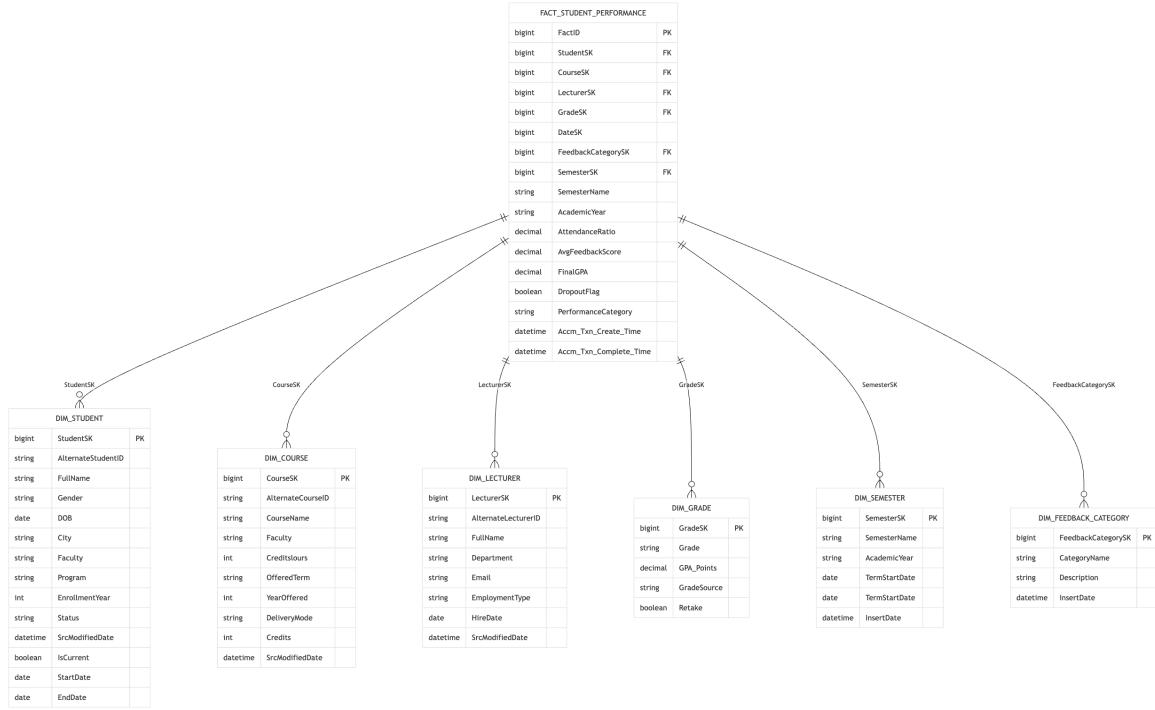
**Assignment 02**

IT22118936

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## Step 1: Data source for the assignment 2

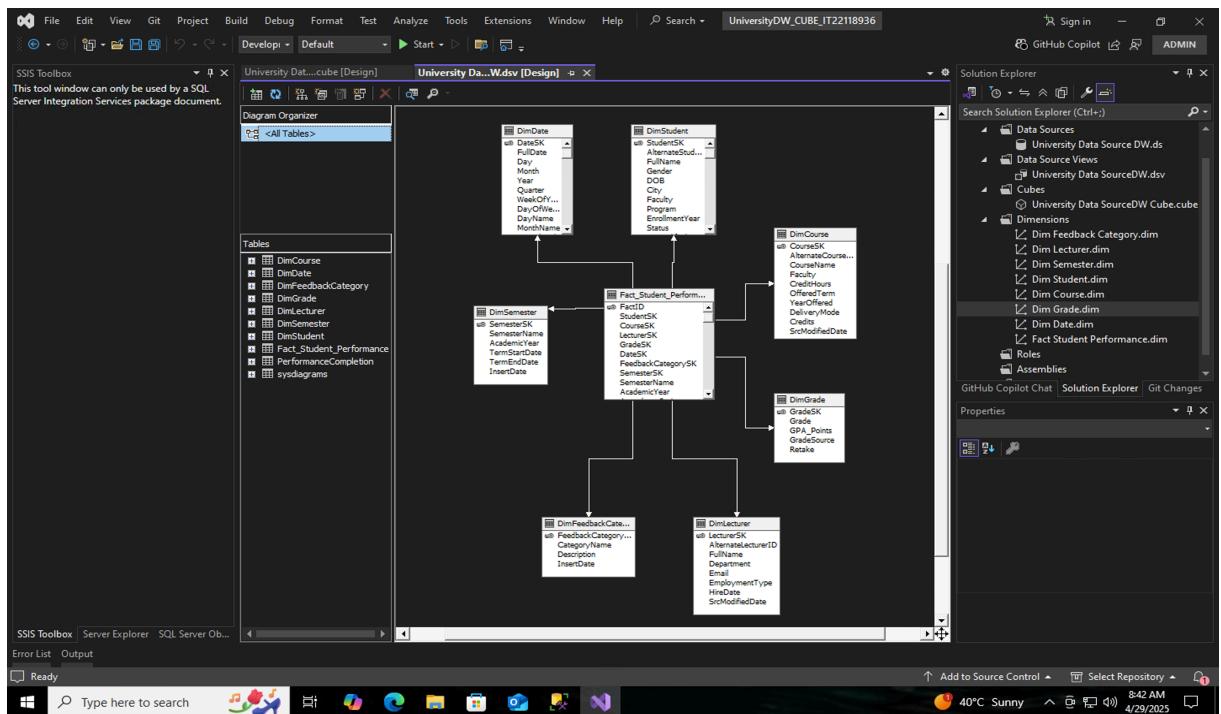
### Data Warehouse Design



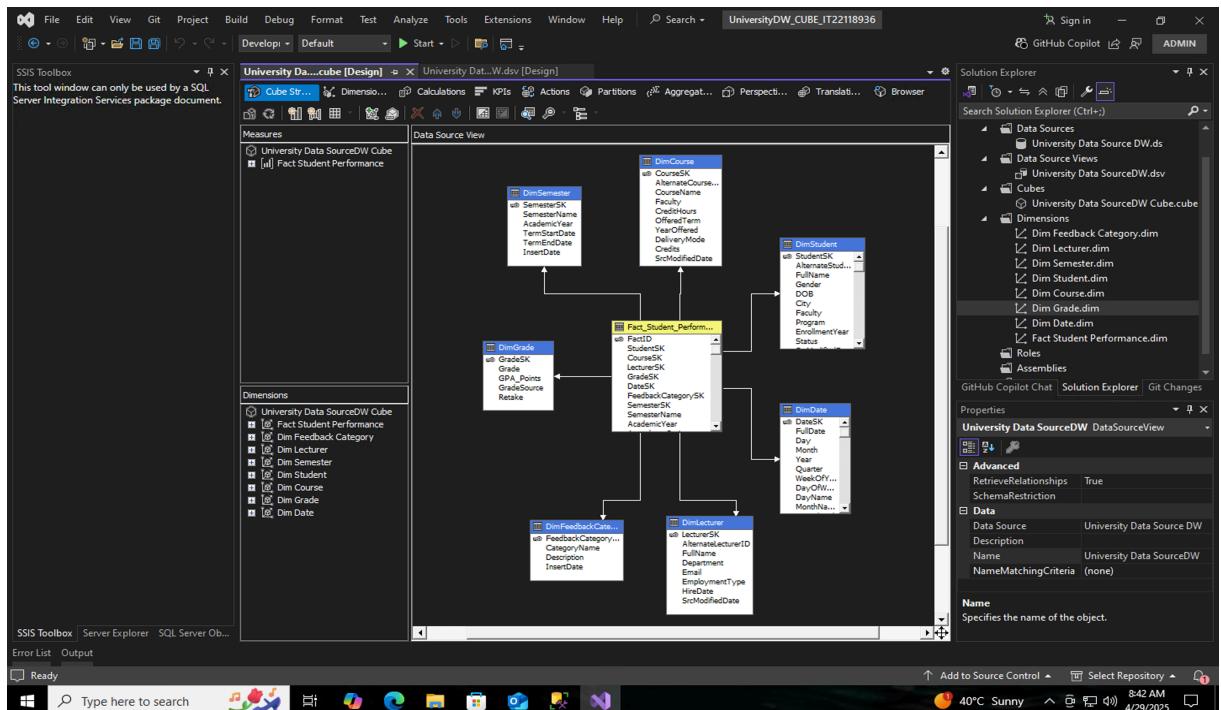
This University Data Warehouse (DW) is designed using a star schema to support performance analysis, academic monitoring, and decision-making processes. The central fact table, **Fact\_Student\_Performance**, captures key metrics such as attendance ratio, GPA, and feedback scores, and is linked to multiple 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.

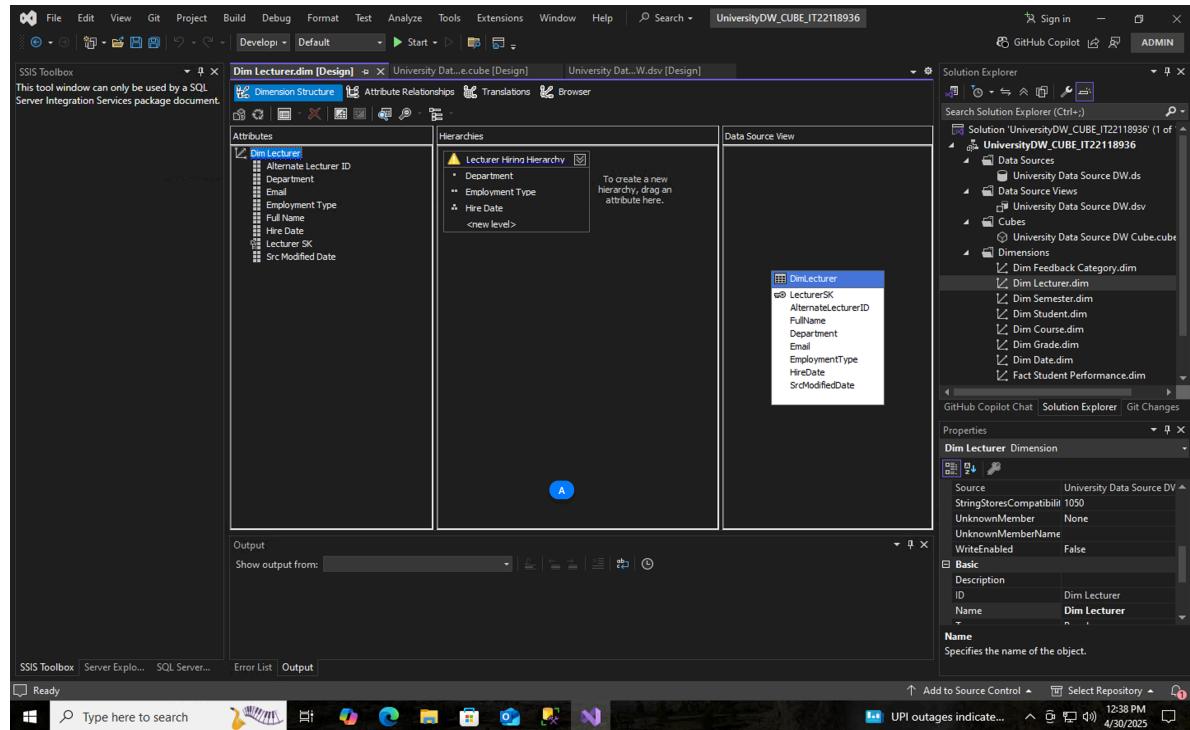


4. Initiated Cube Creation - Used the Cube Wizard with "Use existing tables" option and selected the fact table as the measure group.
5. Incorporated Dimensions - Added all dimension tables to create the star schema structure.
6. Enhanced Dimensions - Edited each dimension to include all attributes and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

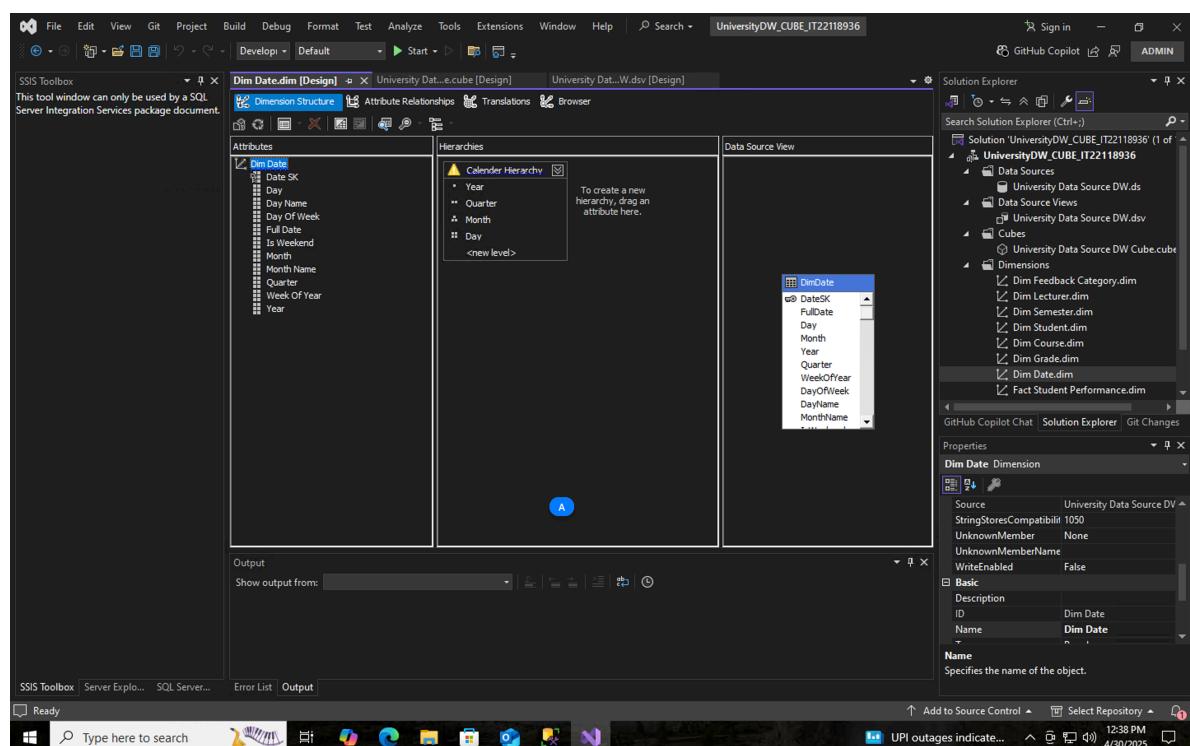


## 7. Created Hierarchies - Built user hierarchies:

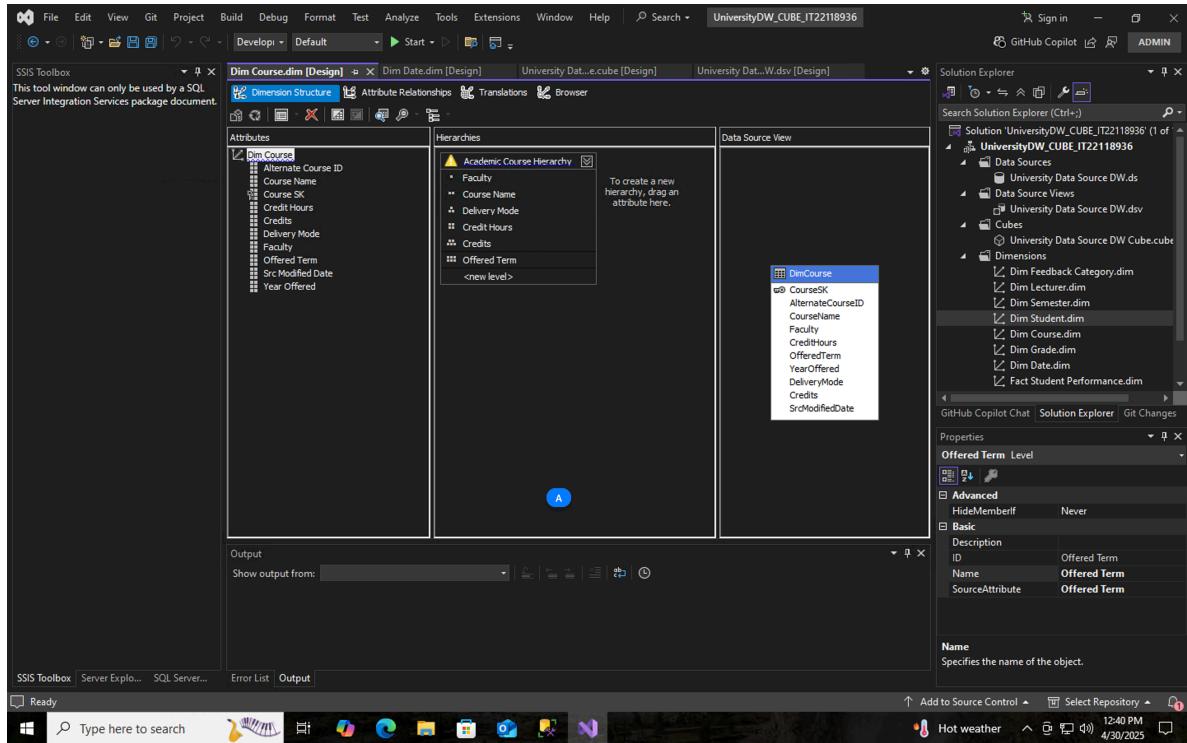
Lecturer Hiring Hierarchy → Department – Employment Type – Hire Date



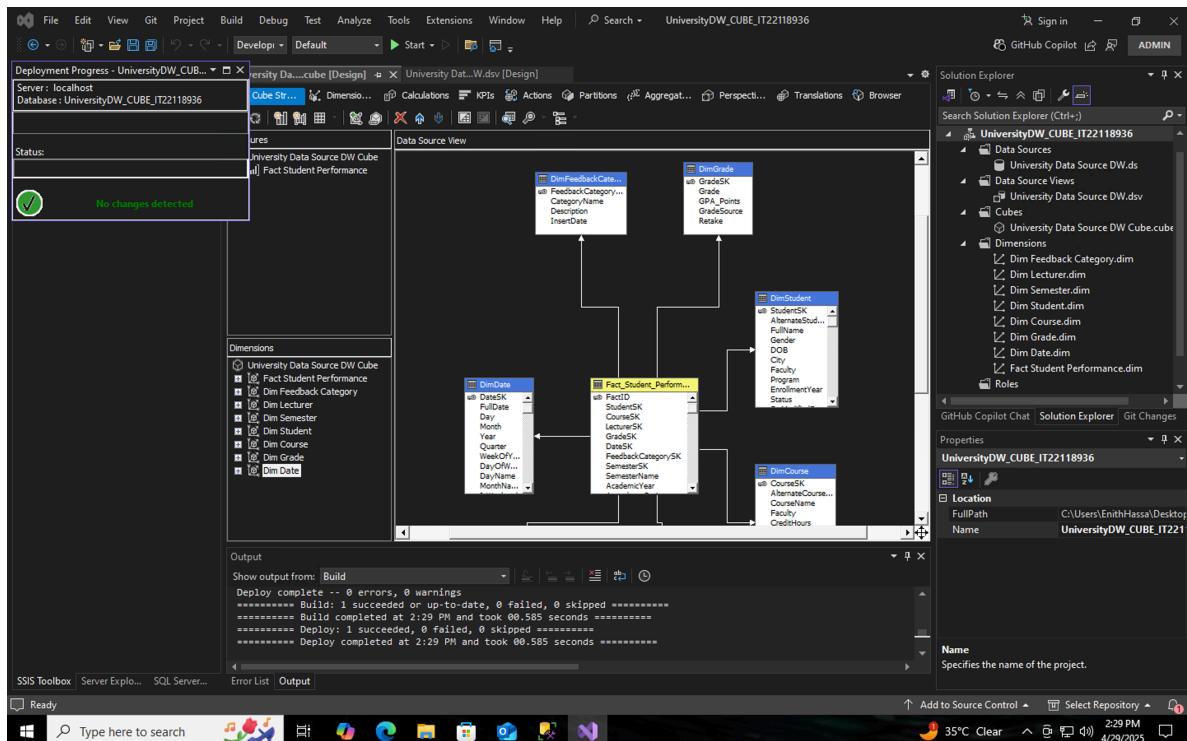
Calendar Hierarchy → Year – Quarter – Month – Day



## 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

The screenshot shows a Microsoft Excel window with a PivotTable named "pivot table 01". The PivotTable Fields pane on the right indicates that the data source is "Fact Student Performance" and includes fields for "Attendance Ratio" and "Avg Feedback Score". The main table displays data for the year 2023, broken down by month and day. The PivotTable Fields pane also shows a "Calender Hierarchy" under the "Rows" section, which is currently set to "Attendance Ratio" and "Avg Feedback Score". The status bar at the bottom shows the date as 4/30/2025 and the time as 12:52 PM.

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

The screenshot shows a Microsoft Excel window with a PivotTable named "pivot table 01". The PivotTable Fields pane on the right indicates that the data source is "Dim Course" and includes fields for "Academic Course Hierarchy" and "More Fields". The main table displays data for the year 2023, broken down by course categories like Agriculture, Architecture, Arts, Business, Computing, Engineering, Law, Medicine, Science, and Social Sciences. The PivotTable Fields pane shows an expanded "Academic Course Hierarchy" under the "Rows" section, with "Attendance Ratio" and "Avg Feedback Score" selected as values. The status bar at the bottom shows the date as 4/30/2025 and the time as 12:56 PM.

## 5. Applied Slice Operation – Filtered data using a single criterion

- Filters to only "Female" students

The screenshot shows a Microsoft Excel spreadsheet titled "pivot table 01". The PivotTable Fields pane on the right indicates that the "Gender" field is selected. The PivotTable itself displays data grouped by "Gender" (Female) and "Academic Course". The data includes fields like "Attendance Ratio" and "Avg Feedback Score". The PivotTable Fields pane also shows other fields available for selection: "Dim Student" and "Gender".

Gender	Academic Course	Attendance Ratio	Avg Feedback Score
Female	Agriculture	15972	27676
Female	Architecture	3993	6710
Female	Business	1287	2134
Female	Computing	132	198
Female	Engineering	165	99
Female	Law	132	66
Female	Medicine	154	132
Female	Science	99	154
Female	Social Sciences	143	99
Female		154	1287
Female		121	66
Female	Agriculture	0	0
Female	Architecture	55	33
Female	Business	0	0
Female	Engineering	0	0
Female	Social Sciences	66	33
Female		143	66
Female	Architecture	0	33
Female	Business	0	88
Female	Computing	0	0
Female	Medicine	0	0
Female	Science	0	0
Female	Social Sciences	55	33

## 6. Executed Dice Operation – Created a sub cube by applying multiple filters

- Filters to Academic Year -2023
- Performance Year -Excellent

The screenshot shows a Microsoft Excel spreadsheet titled "pivot table 01". The PivotTable Fields pane on the right indicates that the "Performance Category" field is selected. The PivotTable itself displays data grouped by "Academic Year" (2023) and "Performance Category" (Excellent). The data includes fields like "Attendance Ratio" and "Avg Feedback Score". The PivotTable Fields pane also shows other fields available for selection: "Avg Feedback Score", "Dropout Flag", "Fact ID", "Final GPA", "Semester Name", and "Txn Process Time Hours".

Performance Category	Academic Year	Attendance Ratio	Avg Feedback Score
Excellent	2023	1419	3916
Excellent	1	297	803
Excellent	2	231	627
Excellent	10	33	88
Excellent	18	33	88
Excellent	Architecture	33	88
Excellent	22	33	88
Excellent	25	33	88
Excellent	Medicine	33	88
Excellent	4	33	99
Excellent	6	33	88
Excellent	7	33	88
Excellent	3	66	176
Excellent	Architecture	33	88
Excellent	Business	33	88
Excellent	2	429	1199
Excellent	Agriculture	33	88
Excellent	Arts	33	88
Excellent	Business	99	275
Excellent	Computing	33	99

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

This screenshot shows a Microsoft Excel spreadsheet titled "pivot table 01". The PivotTable Fields pane on the right indicates that "Semester Name" is selected under "Rows". The data shows attendance ratios and average feedback scores for different academic years and courses. The PivotTable structure includes columns for "Attendance Ratio", "Avg Feedback Score", "Total Attendance Ratio", and "Total Avg Feedback Score". The data is organized by semester (2023, 2024) and academic year (1, 2, 3). Courses listed include Computing, Law, Science, Medicine, Architecture, Business, Agriculture, and Arts.

	Attendance Ratio	Avg Feedback Score	Total Attendance Ratio	Total Avg Feedback Score
Row Labels	semester 1	semester 1	semester 1	semester 1
2023	1023	396	2827	1089
1	231	66	627	176
2	165	66	461	176
10	33	88	33	88
18	33	88	33	88
22	33	88	33	88
25	33	88	33	88
26	33	88	33	88
27	33	88	33	88
28	297	132	836	363
29	33	88	33	88
30	33	88	33	88

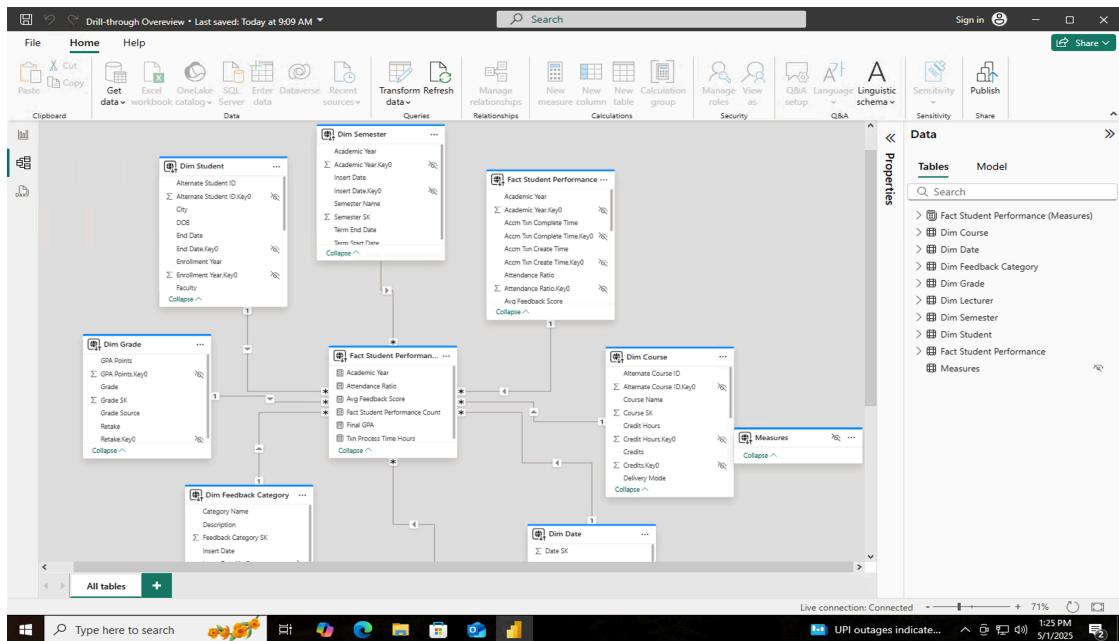
- Academic Courses Hierarchy as Column and Semester as Row

This screenshot shows a Microsoft Excel spreadsheet titled "pivot table 01". The PivotTable Fields pane on the right indicates that "Faculty" is selected under "Columns". The data shows attendance ratios and average feedback scores for different academic years and courses. The PivotTable structure includes columns for "Attendance Ratio", "Avg Feedback Score", and "Total Avg Feedback Score". The data is organized by semester (2023, 2024) and academic year (1, 2, 3). Courses listed include Computing, Law, Science, Medicine, Architecture, Business, Agriculture, and Arts.

	Attendance Ratio	Avg Feedback Score	Total Avg Feedback Score
Row Labels	Architecture Arts Business Computing Engineering Law Medicine Science Social Sciences Agr		
2023	132	198 264 99 231 99 99 132 99 66	66
1	33 66 33 33 33 33 33 33 33	33 33 33 33 33 33 33 33 33	33 33 33 33 33 33 33 33 33
2	33 33 33 33 33 33 33 33 33	33 33 33 33 33 33 33 33 33	33 33 33 33 33 33 33 33 33
10	33	33	33
18	33	33	33
22	33	33	33
25	33	33	33
26	33	33	33
27	33	33	33
28	33	33	33
29	33	33	33
30	33	33	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

The screenshot shows a completed Power BI report titled "Student Performance Matrix". The main area features a matrix visualization with rows grouped by "Year Offered Program" and columns grouped by "Year 1", "Year 2", and "Year 3". The values represent "Attendance Ratio" and "Avg Feedback Score". The report also includes a "Visualizations" pane on the right showing other available charts and a "Data" pane showing the underlying data source. The ribbon at the top includes tabs for Home, Insert, Modeling, View, Optimize, Help, Format, Data / Drill, and various data-related icons.

	Year 1	Year 2	Year 3
Total	7,590.00	13,145.00	9,438.00
	Attendance Ratio	Avg Feedback Score	Attendance Ratio
BA Anthropology	132.00	209.00	132.00
BA Archaeology	99.00	165.00	77.00
BA Communication Studies	99.00	187.00	231.00
BA Criminology	198.00	308.00	451.00
BA Drama	33.00	44.00	33.00
BA English	132.00	231.00	165.00
BA Geography	66.00	154.00	132.00
BA History	99.00	165.00	33.00
BA International Relations	132.00	242.00	198.00
BA Latin American Studies	33.00	60.00	66.00
BA Music	99.00	107.00	195.00
BA Philosophy	66.00	121.00	123.00
BA Political Science	66.00	66.00	99.00
BA Sociology	99.00	187.00	165.00
Bachelor of Interior Design	132.00	275.00	198.00
Bachelor of Landscape Architecture	99.00	176.00	33.00
Bar	132.00	220.00	132.00
BA Economics	132.00	209.00	66.00
BA Psychology	33.00	55.00	66.00
BA Entrepreneurship	33.00	55.00	66.00
BBA Analytics	198.00	252.00	33.00
BBA Accounting	33.00	88.00	66.00
BBA Finance	99.00	143.00	297.00
BBA Human Resource Management	0.00	0.00	66.00
BBA International Business	165.00	275.00	99.00
BBA Management Information Systems	198.00	363.00	132.00
BBA Marketing	132.00	264.00	132.00
BCom	165.00	286.00	132.00
<b>Total</b>	<b>7,590.00</b>	<b>13,145.00</b>	<b>9,438.00</b>
			<b>17,039.00</b>
			<b>7,491.00</b>

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.

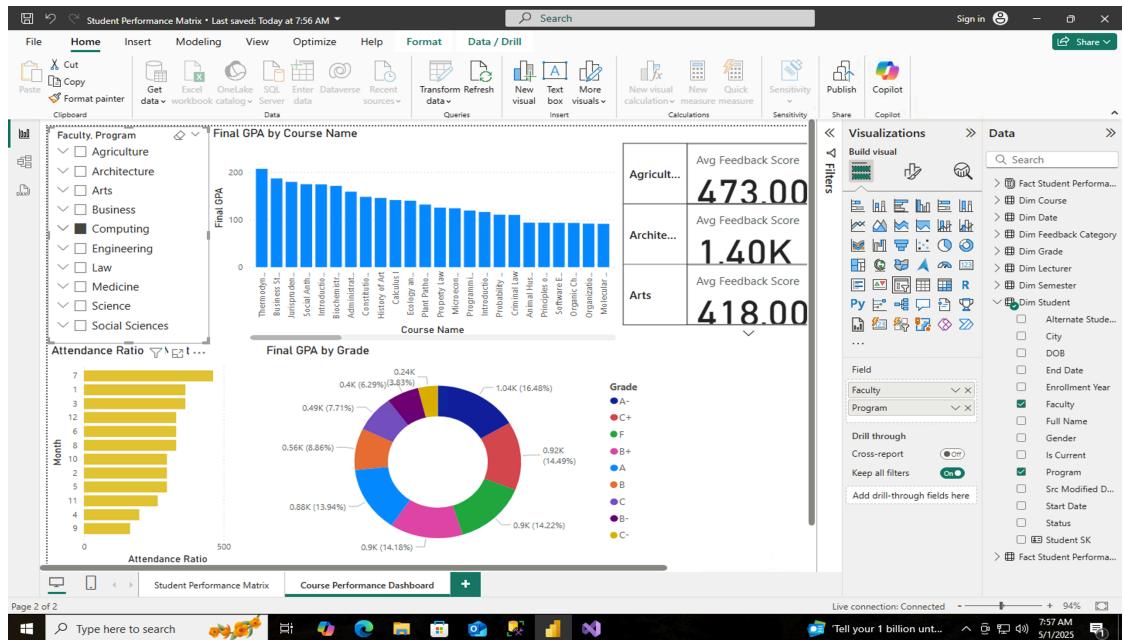
The screenshot shows a Microsoft Power BI report titled "Student Performance Matrix". The report contains a matrix table with columns for Year 3, Year 4, and Total, and rows for various performance metrics like Avg Feedback Score and Attendance Ratio. The data is color-coded based on conditional formatting rules. To the right of the table, there are panes for Filters, Visualizations, and Data, which show various dimensions and measures used in the report. The bottom of the screen shows the Windows taskbar with the Power BI icon.

## 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

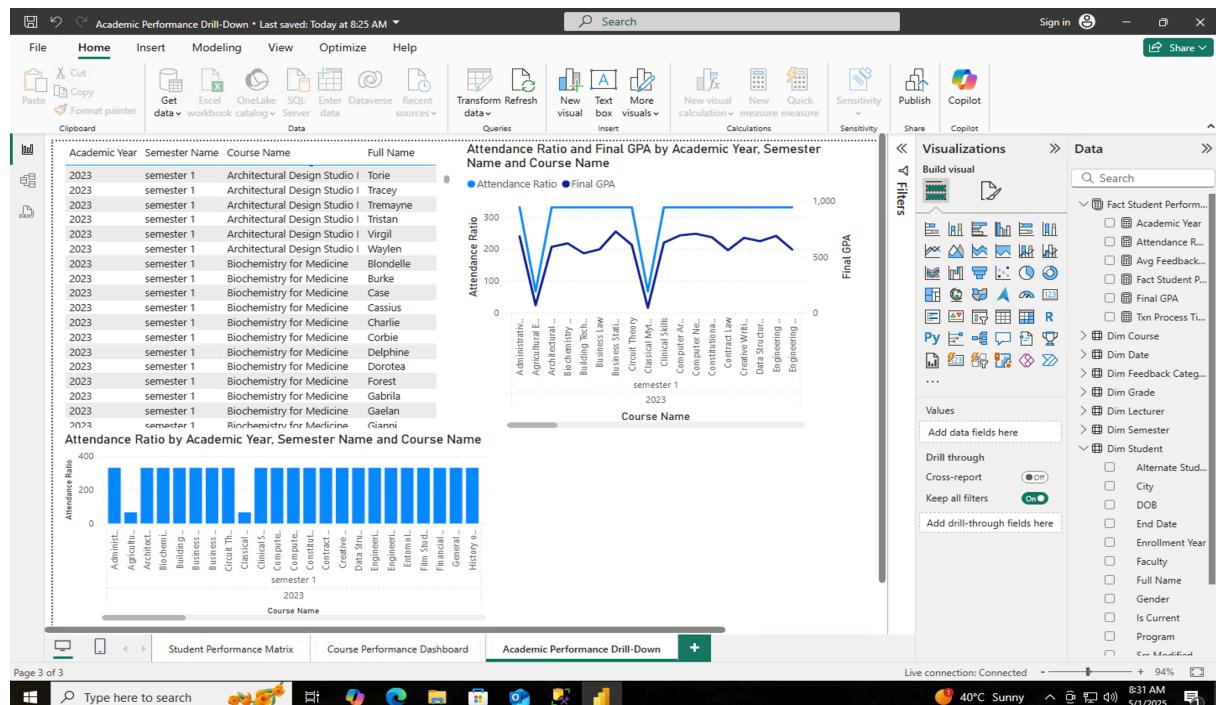
The screenshot shows a Microsoft Power BI report titled "Course Performance Dashboard". The dashboard includes a slicer for "Program" (with options like BA Anthropology, BA Archaeology, etc.), a bar chart titled "Final GPA by Course Name" showing values for various courses, a line chart titled "Attendance Ratio by Month" showing a downward trend over time, and three card visualizations for "Avg Feedback Score" for "Agriculture" (4.38K), "Architecture" (10.52K), and "Arts" (5.78K). The right side of the screen shows a pane for "Visualizations" and another for "Data", both listing various dimensions and measures. The bottom of the screen shows the Windows taskbar with the Power BI icon.

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



## 5. Report 3: Drill-Down Report.

- Built Hierarchical Visual – Configured a column chart with drill-down levels.  
Academic year → Semester Name → Course name → Full name
- Added a column chart with the same hierarchy levels.
- Added a line char with the same hierarchy levels.
- Set up the drill-down functionality.



## 6. Report 4: Drill-Through Report

- Create a main overview page with summary visuals like final GPA by course name, and attendance ratio by month.
- Create a detail page named “Student Detail” and “Course Detail”, including specific information.
- 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.
- Test by right-clicking a data point and selecting; Drill through → "Course Detail"

The screenshot shows a Microsoft Power BI dashboard titled "Academic Performance Drill-Down". The dashboard features two main visualizations:

- Pie Chart:** Titled "Attendance Ratio by Month", it displays the distribution of attendance across 12 months. The data points are labeled with values such as "0.03K (0.1%)", "0.03K (0.1%)", "OK (0%)", "OK (0%)", "OK (0%)", "0.07K (0.2%)", "0.03K (0.1%)", "OK (0%)", "OK (0%)", "OK (0%)", "OK (0%)", and "OK (0%)".
- Bar Chart:** Titled "Final GPA by Course Name", it shows the final GPA for various courses. The top course listed is "Property Law" with a final GPA of approximately 900. Other courses include "Human Resource M...", "Criminal Law", "Web Development", "Sustainable Agricult...", "Landscape Architect...", "Entomology", "Ecology and Evolution" (Final GPA: 758.78), "Music Theory", "Pharmacology", "Soil Science", "Business Statistics", "Architectural Theory", and "Microeconomics for...".

The dashboard also includes a sidebar for "Visualizations" and "Data", and a bottom navigation bar with links to "Drill-through Overview", "Course Detail", and "Student D". The status bar at the bottom indicates "Page 4 of 6" and "9:04 AM 5/1/2025".

The screenshot shows a Microsoft Power BI report titled "Academic Performance Drill-Down". The report displays a detailed table of course offerings:

Course Name	Faculty	Offered Term	Year Offered	Delivery Mode	Credit Hours	Credits	Lecturers
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Abigale Tuffey
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Akim Bowkett
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Alma Farney
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Beale Beed
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Claudius Wolseley
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Dorise Penneyman
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Evarnia Cowdry
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Fritz Plak
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Gilli Bidnall
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Ignacio Swindlehurst
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Joletta Castella
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Lana Beven
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Larina Borrie
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Lesya Rooksky
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Lettia Basil
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Liane Aiston
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Melina Broxton
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Nettle Millea
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Neva Brandone
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Pearle Canadine
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Pier Tuson
Ecology and Evolution	Agriculture	semester 2	Year 2	Hybrid	20	4	Rearde Serrant

The report also includes a sidebar for "Visualizations" and "Data", and a bottom navigation bar with links to "Drill-through Overview", "Course Detail", and "Student D". The status bar at the bottom indicates "Page 5 of 6" and "9:06 AM 5/1/2025".

## Drill through → "Student Detail"

The screenshot shows a Microsoft Power BI interface. On the left, a pie chart titled "Attendance Ratio by Month" displays various percentages. A context menu is open over one of the pie slices, with the option "Drill through" highlighted. To the right, a bar chart titled "Final GPA by Course Name" is displayed. A context menu is also open over one of the bars, with the option "Student Detail" highlighted. The Power BI ribbon at the top includes tabs like File, Home, Insert, Modeling, View, Optimize, Help, Format, Data / Drill, and Publish. The Data pane on the right lists various dimensions and measures used in the report.

The screenshot shows a Microsoft Power BI interface displaying a table of student records. The columns include Full Name, Gender, DOB, City, Program, Status, Enrollment Year, Start Date, and Attendance Ratio. A total value of 2,376.00 is shown at the bottom. A context menu is open over a specific row in the table, with the option "Drill through" highlighted. The Power BI ribbon and Data pane are visible, showing the same setup as the previous screenshot but with a different data focus.

## 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])