KELOMPOK 2:

1. **Abit Ahmad Oktarian (122450042)**
2. **Tesalonika Hutajulu (123450033)**
3. **Rahmah Gustriana Deka (123450102)**
4. **Sarah Wasti (123450057)**

UNIT: Akademik
MISI 2: DESAIN FISIKAL DAN DEVELOPMENT

Step 1: Physical Database Design

1. Database Setup

Query:

```
CREATE DATABASE akademik
GO
use akademik
GO
```

Kode diatas digunakan untuk membuat database bernama Akademik, lalu menggunakannya untuk proses selanjutnya.

2. Create Dimension Tables

Query:

```
-- Buat Tabel Dimensi
-- Dim_Program
CREATE TABLE dbo.Dim_Program (
   ProgramKey      INT IDENTITY(1,1) PRIMARY KEY,
   ProgramCode     VARCHAR(20)  NOT NULL,
   ProgramName     VARCHAR(100) NOT NULL,
   Faculty         VARCHAR(100) NOT NULL,
   CONSTRAINT UQ_Dim_Program_Code UNIQUE (ProgramCode)
);
GO

-- Dim_Date
CREATE TABLE dbo.Dim_Date (
   DateKey      INT PRIMARY KEY,      -- yyyymmdd
   [Date]       DATE NOT NULL,
   [Day]        INT  NOT NULL,
   [Month]      INT  NOT NULL,
```

```
    [Quarter]     INT  NOT NULL,
    [Year]        INT  NOT NULL,
    SemesterCode  VARCHAR(20) NULL,
    CONSTRAINT UQ_Dim_Date UNIQUE ([Date]),
    CONSTRAINT CHK_Dim_Date_Month   CHECK ([Month] BETWEEN 1 AND 12),
    CONSTRAINT CHK_Dim_Date_Quarter CHECK ([Quarter] BETWEEN 1 AND 4)
);
GO

-- Dim_Semester
CREATE TABLE dbo.Dim_Semester (
    SemesterKey  INT IDENTITY(1,1) PRIMARY KEY,
    SemesterCode VARCHAR(20) NOT NULL,
    StartDate    DATE NOT NULL,
    EndDate      DATE NOT NULL,
    CONSTRAINT UQ_Dim_Semester_Code UNIQUE (SemesterCode),
    CONSTRAINT CHK_Dim_Semester_Dates CHECK (EndDate > StartDate)
);
GO

-- Dim_Student
CREATE TABLE dbo.Dim_Student (
    StudentKey       INT IDENTITY(1,1) PRIMARY KEY,
    StudentNaturalID VARCHAR(20) NOT NULL,   -- NIM
    FullName         VARCHAR(100) NOT NULL,
    DOB              DATE NOT NULL,
    Gender           CHAR(1) NOT NULL CHECK (Gender IN ('M','F')),
    EntryYear        INT NOT NULL,
    [Status]         VARCHAR(20) NOT NULL,
    ProgramNaturalID VARCHAR(20) NOT NULL,
    CONSTRAINT UQ_Dim_Student_NIM      UNIQUE (StudentNaturalID),
    CONSTRAINT CHK_Dim_Student_EntryYr CHECK (EntryYear >= 1900)
);
GO

-- Dim_Course
CREATE TABLE dbo.Dim_Course (
    CourseKey       INT IDENTITY(1,1) PRIMARY KEY,
    CourseCode      VARCHAR(20) NOT NULL,
    CourseName      VARCHAR(150) NOT NULL,
    Credits         INT NOT NULL,
    ProgramNaturalID VARCHAR(20) NOT NULL,
    CONSTRAINT UQ_Dim_Course_Code UNIQUE (CourseCode),
```

```
    CONSTRAINT CHK_Dim_Course_Credits CHECK (Credits > 0)
);
GO

-- Dim_Instructor
CREATE TABLE dbo.Dim_Instructor (
    InstructorKey       INT IDENTITY(1,1) PRIMARY KEY,
    InstructorNaturalID VARCHAR(20) NOT NULL,
    [Name]              VARCHAR(100) NOT NULL,
    [Rank]              VARCHAR(50) NULL,
    Dept                VARCHAR(100) NULL,
    FTE                 DECIMAL(3,2) NOT NULL DEFAULT 1.00,
    CONSTRAINT UQ_Dim_Instructor_ID UNIQUE (InstructorNaturalID),
    CONSTRAINT CHK_Dim_Instructor_FTE CHECK (FTE BETWEEN 0 AND 1)
);
GO
```

Setelah itu dibuat berbagai dimension tables seperti program studi, tanggal, semester, mahasiswa, mata kuliah, dan dosen. Setiap tabel dimensi memiliki atribut penting, aturan validasi, serta unique constraint untuk menjaga kualitas data.

Memasukkan data ke dalam tabel dimensi

Query:

```
-- ISI DATA KEDALAM DIMENSI
-- Dim_Program
INSERT INTO dbo.Dim_Program (ProgramCode, ProgramName, Faculty)
VALUES
('TI',  'Teknik Informatika',       'Fakultas Sains dan Teknologi'),
('SI',  'Sistem Informasi',         'Fakultas Sains dan Teknologi'),
('MI',  'Manajemen Informatika',    'Fakultas Vokasi'),
('KM',  'Kimia',                    'Fakultas Sains dan Teknologi'),
('FI',  'Fisika',                   'Fakultas Sains and Teknologi');
GO


-- Dim_Date (tahun 2018–2025)
DECLARE @Start DATE = '2018-01-01';
DECLARE @End   DATE = '2025-12-31';

WHILE @Start <= @End
BEGIN
    INSERT INTO dbo.Dim_Date (DateKey, [Date], [Day], [Month], [Quarter], [Year],
SemesterCode)
```

```
    VALUES (
        CONVERT(INT, FORMAT(@Start, 'yyyyMMdd')),
        @Start,
        DATEPART(DAY, @Start),
        DATEPART(MONTH, @Start),
        DATEPART(QUARTER, @Start),
        DATEPART(YEAR, @Start),
        NULL -- bisa diupdate nanti sesuai mapping semester
    );

    SET @Start = DATEADD(DAY, 1, @Start);
END;
GO

-- Dim_Semester
INSERT INTO dbo.Dim_Semester (SemesterCode, StartDate, EndDate)
VALUES
('2018-Ganjil', '2018-08-01', '2019-01-31'),
('2018-Genap',  '2019-02-01', '2019-07-31'),
('2019-Ganjil', '2019-08-01', '2020-01-31'),
('2019-Genap',  '2020-02-01', '2020-07-31'),
('2020-Ganjil', '2020-08-01', '2021-01-31'),
('2020-Genap',  '2021-02-01', '2021-07-31'),
('2021-Ganjil', '2021-08-01', '2022-01-31'),
('2021-Genap',  '2022-02-01', '2022-07-31'),
('2022-Ganjil', '2022-08-01', '2023-01-31'),
('2022-Genap',  '2023-02-01', '2023-07-31'),
('2023-Ganjil', '2023-08-01', '2024-01-31'),
('2023-Genap',  '2024-02-01', '2024-07-31');
GO

-- Dim_Instructor
INSERT INTO dbo.Dim_Instructor (
    InstructorNaturalID, [Name], [Rank], Dept, FTE
)
VALUES
('INS001', 'Dr. Andi',     'Lektor Kepala', 'Teknik Informatika', 1.00),
('INS002', 'Dr. Budi',     'Lektor',        'Sistem Informasi',   1.00),
('INS003', 'Dr. Citra',    'Lektor',        'Manajemen Informatika', 0.75),
('INS004', 'Dr. Diana',    'Guru Besar',    'Kimia',              1.00),
('INS005', 'Dr. Eko',      'Asisten Ahli',  'Fisika',             0.50),
('INS006', 'Dr. Fitri',    'Lektor',        'Teknik Informatika', 1.00),
('INS007', 'Dr. Gita',     'Lektor',        'Sistem Informasi',   1.00),
```

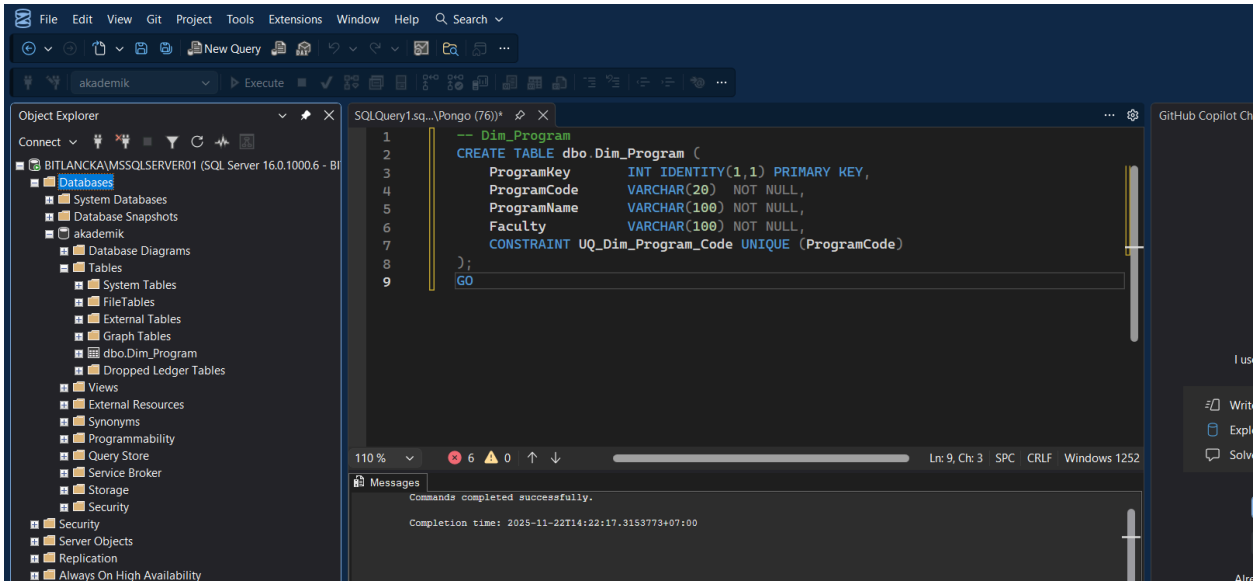
```
('INS008', 'Dr. Hasan',    'Lektor Kepala', 'Kimia',              1.00),
('INS009', 'Dr. Intan',    'Asisten Ahli',  'Fisika',            0.80),
('INS010', 'Dr. Joko',     'Lektor',        'Manajemen Informatika', 1.00);
GO

-- Dim_Course
INSERT INTO dbo.Dim_Course (CourseCode, CourseName, Credits, ProgramNaturalID)
VALUES
('TI101', 'Pengantar Pemrograman',        3, 'TI'),
('TI102', 'Struktur Data',                3, 'TI'),
('TI201', 'Basis Data',                   3, 'TI'),
('SI101', 'Dasar Sistem Informasi',       3, 'SI'),
('SI102', 'Analisis Proses Bisnis',       3, 'SI'),
('MI101', 'Algoritma dan Logika',         3, 'MI'),
('KM101', 'Kimia Dasar',                  3, 'KM'),
('KM201', 'Kimia Organik',                3, 'KM'),
('FI101', 'Fisika Dasar',                 3, 'FI'),
('FI201', 'Fisika Modern',                3, 'FI');
GO


--Dim_Student (1.000 mahasiswa)
;WITH N AS (
   SELECT TOP (1000)
      ROW_NUMBER() OVER (ORDER BY (SELECT NULL)) AS n
   FROM sys.all_objects
)
INSERT INTO dbo.Dim_Student (
   StudentNaturalID, FullName, DOB, Gender, EntryYear, [Status], ProgramNaturalID
)
SELECT
   CONCAT('NIM', RIGHT('000000' + CAST(n AS VARCHAR(6)), 6)) AS StudentNaturalID,
   CONCAT('Mahasiswa ', n) AS FullName,
   DATEADD(DAY, -1 * (ABS(CHECKSUM(NEWID())) % 9000), '2000-01-01') AS DOB,
   CASE WHEN ABS(CHECKSUM(NEWID())) % 2 = 0 THEN 'M' ELSE 'F' END AS
Gender,
   2018 + (ABS(CHECKSUM(NEWID())) % 6) AS EntryYear,  -- 2018–2023
   CASE
      WHEN ABS(CHECKSUM(NEWID())) % 100 < 80 THEN 'Aktif'
      WHEN ABS(CHECKSUM(NEWID())) % 100 < 90 THEN 'Cuti'
      ELSE 'Lulus'
   END AS [Status],
   CASE
```

```
            WHEN n % 5 = 1 THEN 'TI'
            WHEN n % 5 = 2 THEN 'SI'
            WHEN n % 5 = 3 THEN 'MI'
            WHEN n % 5 = 4 THEN 'KM'
            ELSE 'FI'
        END AS ProgramNaturalID;
    GO
```

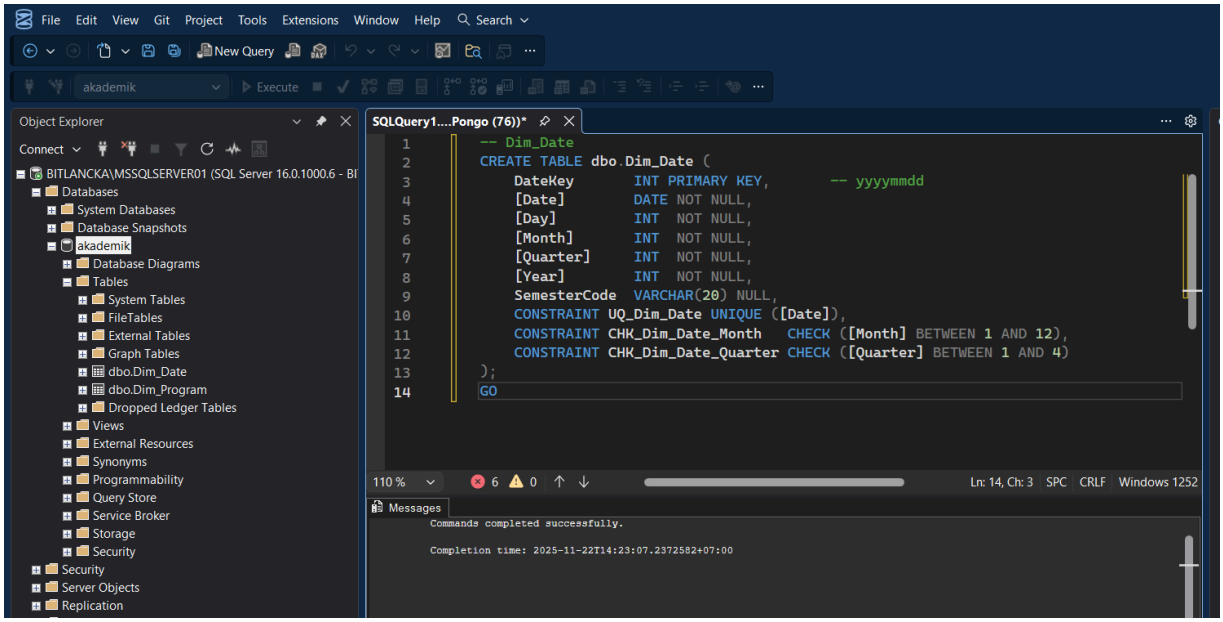
Setelah semua dimensi dibuat, kode tersebut memasukkan data contoh, mulai dari daftar program studi, kalender tanggal secara lengkap dari 2018 hingga 2025, daftar semester, instruktur, mata kuliah, hingga 1000 mahasiswa dengan atribut acak seperti gender, DOB, entry year, status, dan program.

Dokumentasi:

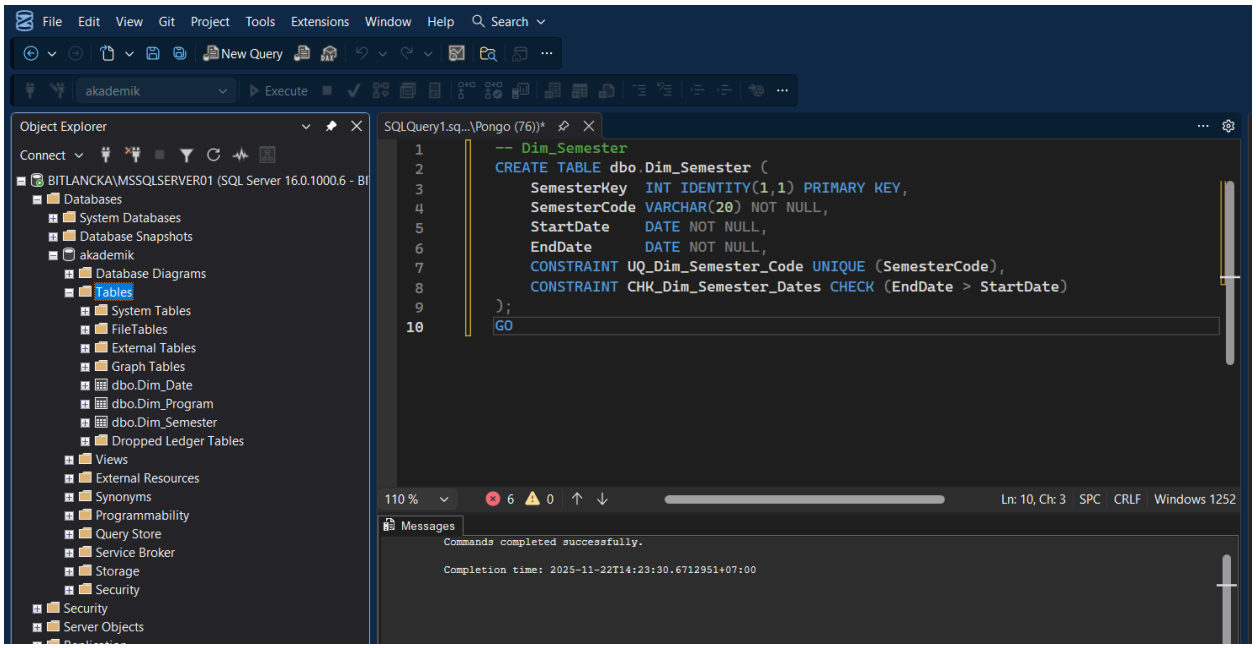
Dimensi program



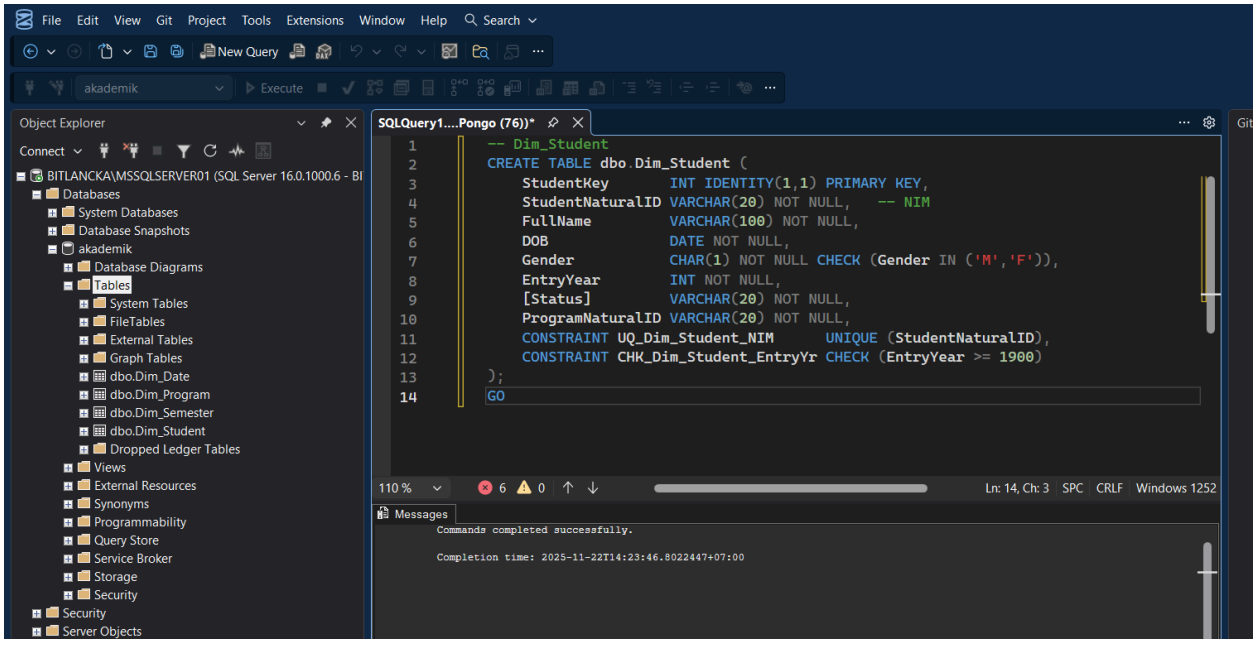
Dimensi Date



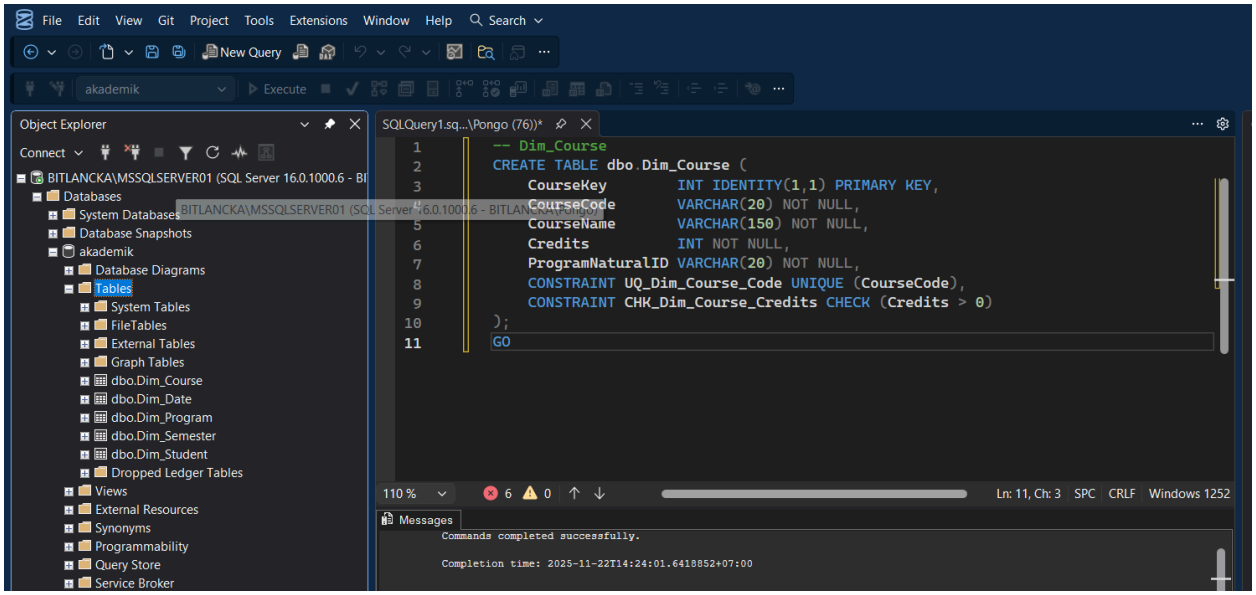
Dimensi Semester



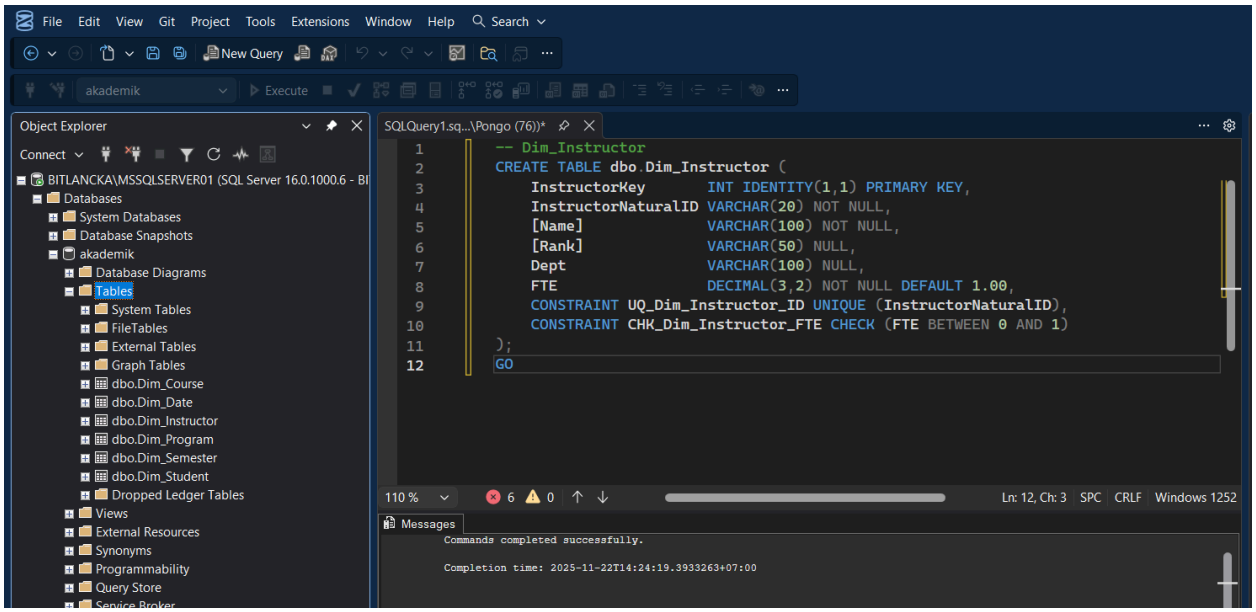
Dimensi Student



Dimensi Course



Dimensi Instructor



3. Create Fact Tables

Rincian data untuk tiap tabel fact adalah sebagai berikut:
- fact enrollment: 20.000 data
- fact_admission: 8000 data
- fact_graduation: 3000 data

Query:

```
-- Buat Tabel Fakta
-- Fact_Enrollment
CREATE TABLE dbo.Fact_Enrollment (
   EnrollmentID   INT IDENTITY(1,1) PRIMARY KEY,
   StudentKey     INT NOT NULL,
   CourseKey      INT NOT NULL,
   SemesterKey    INT NOT NULL,
   InstructorKey  INT NOT NULL,
   DateKey        INT NOT NULL,
   Grade          VARCHAR(2)  NULL,
   NumericGrade   DECIMAL(4,2) NULL,
   AttendanceRate DECIMAL(5,2) NULL,
   [Status]       VARCHAR(20)  NULL,
   CONSTRAINT FK_Fact_Enroll_Student    FOREIGN KEY (StudentKey)    REFERENCES
dbo.Dim_Student(StudentKey),
   CONSTRAINT FK_Fact_Enroll_Course     FOREIGN KEY (CourseKey)     REFERENCES
dbo.Dim_Course(CourseKey),
   CONSTRAINT FK_Fact_Enroll_Semester   FOREIGN KEY (SemesterKey)
REFERENCES dbo.Dim_Semester(SemesterKey),
   CONSTRAINT FK_Fact_Enroll_Instructor FOREIGN KEY (InstructorKey)
REFERENCES dbo.Dim_Instructor(InstructorKey),
   CONSTRAINT FK_Fact_Enroll_Date       FOREIGN KEY (DateKey)       REFERENCES
dbo.Dim_Date(DateKey),
   CONSTRAINT CHK_Fact_Enroll_Grade     CHECK (NumericGrade BETWEEN 0 AND
4),
   CONSTRAINT CHK_Fact_Enroll_Attend    CHECK (AttendanceRate BETWEEN 0 AND
100)
);
GO

-- Fact_Graduation
CREATE TABLE dbo.Fact_Graduation (
   GraduationID      INT IDENTITY(1,1) PRIMARY KEY,
   StudentKey        INT NOT NULL,
```

```
    DateKey          INT NOT NULL,         -- mis. tanggal yudisium
    ProgramKey       INT NOT NULL,
    GraduationDateKey INT NOT NULL,        -- tanggal wisuda
    GPA              DECIMAL(4,2) NOT NULL,
    TotalCredits     INT NOT NULL,
    StudyDuration    INT NULL,             -- bulan
    Honors           VARCHAR(50) NULL,
    ThesisScore      DECIMAL(5,2) NULL,
    CONSTRAINT FK_Fact_Grad_Student   FOREIGN KEY (StudentKey)
REFERENCES dbo.Dim_Student(StudentKey),
    CONSTRAINT FK_Fact_Grad_Date      FOREIGN KEY (DateKey)         REFERENCES
dbo.Dim_Date(DateKey),
    CONSTRAINT FK_Fact_Grad_GradDate  FOREIGN KEY (GraduationDateKey)
REFERENCES dbo.Dim_Date(DateKey),
    CONSTRAINT FK_Fact_Grad_Program   FOREIGN KEY (ProgramKey)
REFERENCES dbo.Dim_Program(ProgramKey),
    CONSTRAINT CHK_Fact_Grad_GPA      CHECK (GPA BETWEEN 0 AND 4),
    CONSTRAINT CHK_Fact_Grad_Credits  CHECK (TotalCredits > 0)
);
GO

-- Fact_Admission
CREATE TABLE dbo.Fact_Admission (
    AdmissionID      INT IDENTITY(1,1) PRIMARY KEY,
    StudentKey       INT NOT NULL,
    ProgramKey       INT NOT NULL,
    ApplicationDateKey INT NOT NULL,
    AdmissionDateKey  INT NOT NULL,
    TestScore        DECIMAL(5,2) NULL,
    InterviewScore   DECIMAL(5,2) NULL,
    HighSchoolGPA    DECIMAL(4,2) NULL,
    AdmissionStatus  VARCHAR(20) NOT NULL,
    AdmissionType    VARCHAR(50) NULL, -- SNMPTN/SBMPTN/Mandiri
    ProcessingDays   INT NULL,
    CONSTRAINT FK_Fact_Adm_Student   FOREIGN KEY (StudentKey)
REFERENCES dbo.Dim_Student(StudentKey),
    CONSTRAINT FK_Fact_Adm_Program   FOREIGN KEY (ProgramKey)
REFERENCES dbo.Dim_Program(ProgramKey),
    CONSTRAINT FK_Fact_Adm_AppDate   FOREIGN KEY (ApplicationDateKey)
REFERENCES dbo.Dim_Date(DateKey),
    CONSTRAINT FK_Fact_Adm_AdmDate   FOREIGN KEY (AdmissionDateKey)
REFERENCES dbo.Dim_Date(DateKey),
    CONSTRAINT CHK_Fact_Adm_Test     CHECK (TestScore     >= 0),
```

```
    CONSTRAINT CHK_Fact_Adm_Interview CHECK (InterviewScore >= 0),
    CONSTRAINT CHK_Fact_Adm_HSGPA     CHECK (HighSchoolGPA BETWEEN 0 AND
4)
);
GO
```

Kode selanjutnya membuat tiga tabel fakta utama, yakni Fact_Enrollment, Fact_Graduation, dan Fact_Admission. Masing-masing tabel menghubungkan *surrogate keys* dari dimensi dan menyimpan data transaksi seperti KRS mahasiswa, informasi kelulusan, dan proses penerimaan mahasiswa baru.

Memasukkan data

```
-- data untuk Fact_Admission 8.000 baris
USE DM_AKADEMIK_DW;
GO

DECLARE @RowCountAdm INT = 8000;   -- ubah kalau mau jumlah lain

;WITH Numbers AS (
    SELECT TOP (@RowCountAdm)
        ROW_NUMBER() OVER (ORDER BY (SELECT NULL)) AS n
    FROM sys.all_objects ao1
    CROSS JOIN sys.all_objects ao2
)
INSERT INTO dbo.Fact_Admission (
    StudentKey,
    ProgramKey,
    ApplicationDateKey,
    AdmissionDateKey,
    TestScore,
    InterviewScore,
    HighSchoolGPA,
    AdmissionStatus,
    AdmissionType,
    ProcessingDays
)
SELECT
    s.StudentKey,
    p.ProgramKey,
    app.DateKey        AS ApplicationDateKey,
    adm.DateKey        AS AdmissionDateKey,
    -- skor 0–100 (dua desimal)
```

```
    CAST((ABS(CHECKSUM(NEWID())) % 10001) / 100.0 AS DECIMAL(5,2)) AS
TestScore,
    CAST((ABS(CHECKSUM(NEWID())) % 10001) / 100.0 AS DECIMAL(5,2)) AS
InterviewScore,
    -- HighSchoolGPA 2.00–4.00
    CAST((200 + (ABS(CHECKSUM(NEWID())) % 201)) / 100.0 AS DECIMAL(4,2)) AS
HighSchoolGPA,
    CASE
        WHEN randStatus.RandStatus < 60 THEN 'Accepted'
        WHEN randStatus.RandStatus < 85 THEN 'Rejected'
        ELSE 'Waiting List'
    END AS AdmissionStatus,
    CASE
        WHEN randType.RandType < 35 THEN 'SNMPTN'
        WHEN randType.RandType < 70 THEN 'SBMPTN'
        WHEN randType.RandType < 90 THEN 'Mandiri'
        ELSE 'Beasiswa'
    END AS AdmissionType,
    DATEDIFF(DAY, app.[Date], adm.[Date]) AS ProcessingDays
FROM Numbers n
-- ambil student + program natural ID-nya
CROSS APPLY (
    SELECT TOP 1 StudentKey, ProgramNaturalID
    FROM dbo.Dim_Student
    ORDER BY NEWID()
) AS s
-- map ProgramNaturalID -> ProgramKey
CROSS APPLY (
    SELECT TOP 1 ProgramKey
    FROM dbo.Dim_Program
    WHERE ProgramCode = s.ProgramNaturalID
    ORDER BY ProgramKey
) AS p
-- pilih application date (dibatasi supaya +60 hari masih dalam range dim tanggal)
CROSS APPLY (
    SELECT TOP 1 DateKey, [Date]
    FROM dbo.Dim_Date
    WHERE [Date] <= '2025-10-31'
    ORDER BY NEWID()
) AS app
-- random offset 0–60 hari
CROSS APPLY (
    SELECT ABS(CHECKSUM(NEWID())) % 61 AS DaysOffset
```

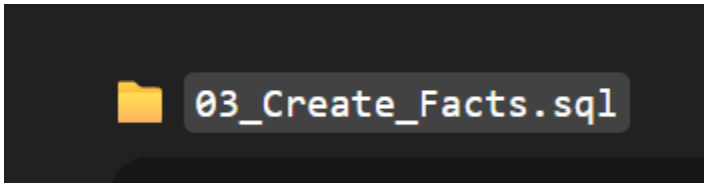
```
) AS ofs
-- admission date = application date + offset
CROSS APPLY (
   SELECT DateKey, [Date]
   FROM dbo.Dim_Date
   WHERE [Date] = DATEADD(DAY, ofs.DaysOffset, app.[Date])
) AS adm
-- random status dan admission type
CROSS APPLY (SELECT ABS(CHECKSUM(NEWID())) % 100 AS RandStatus) AS
randStatus
CROSS APPLY (SELECT ABS(CHECKSUM(NEWID())) % 100 AS RandType)   AS
randType;
GO


-- check hasilnya
SELECT COUNT(*) AS JumlahAdmission
FROM dbo.Fact_Admission;


-- data untuk Fact_Graduation 3.000 baris
USE DM_AKADEMIK_DW;
GO

DECLARE @RowCountGrad INT = 3000;   -- ubah kalau mau jumlah lain

;WITH Numbers AS (
   SELECT TOP (@RowCountGrad)
      ROW_NUMBER() OVER (ORDER BY (SELECT NULL)) AS n
   FROM sys.all_objects ao1
   CROSS JOIN sys.all_objects ao2
)
INSERT INTO dbo.Fact_Graduation (
   StudentKey,
   DateKey,
   ProgramKey,
   GraduationDateKey,
   GPA,
   TotalCredits,
   StudyDuration,
   Honors,
   ThesisScore
)
```

```
SELECT
   s.StudentKey,
   yud.DateKey       AS DateKey,          -- tanggal yudisium
   p.ProgramKey,
   grad.DateKey      AS GraduationDateKey, -- tanggal wisuda
   -- GPA 2.00–4.00
   CAST((200 + (ABS(CHECKSUM(NEWID())) % 201)) / 100.0 AS DECIMAL(4,2)) AS
GPA,
   -- total SKS 120–160
   120 + (ABS(CHECKSUM(NEWID())) % 41)  AS TotalCredits,
   -- lama studi 36–72 bulan
   36  + (ABS(CHECKSUM(NEWID())) % 37)  AS StudyDuration,
   CASE
      WHEN randHonors.RandHonors < 50 THEN NULL
      WHEN randHonors.RandHonors < 80 THEN 'Cum Laude'
      WHEN randHonors.RandHonors < 95 THEN 'Magna Cum Laude'
      ELSE 'Summa Cum Laude'
   END AS Honors,
   -- nilai skripsi 60–100
   CAST((6000 + (ABS(CHECKSUM(NEWID())) % 4001)) / 100.0 AS DECIMAL(5,2)) AS
ThesisScore
FROM Numbers n
-- ambil student + ProgramNaturalID
CROSS APPLY (
   SELECT TOP 1 StudentKey, ProgramNaturalID, EntryYear
   FROM dbo.Dim_Student
   WHERE [Status] = 'Lulus' OR [Status] = 'Aktif'
   ORDER BY NEWID()
) AS s
-- map ProgramNaturalID -> ProgramKey
CROSS APPLY (
   SELECT TOP 1 ProgramKey
   FROM dbo.Dim_Program
   WHERE ProgramCode = s.ProgramNaturalID
   ORDER BY ProgramKey
) AS p
-- pilih graduation date antara 2022–2025
CROSS APPLY (
   SELECT TOP 1 DateKey, [Date]
   FROM dbo.Dim_Date
   WHERE [Date] BETWEEN '2022-01-01' AND '2025-12-31'
   ORDER BY NEWID()
) AS grad
```

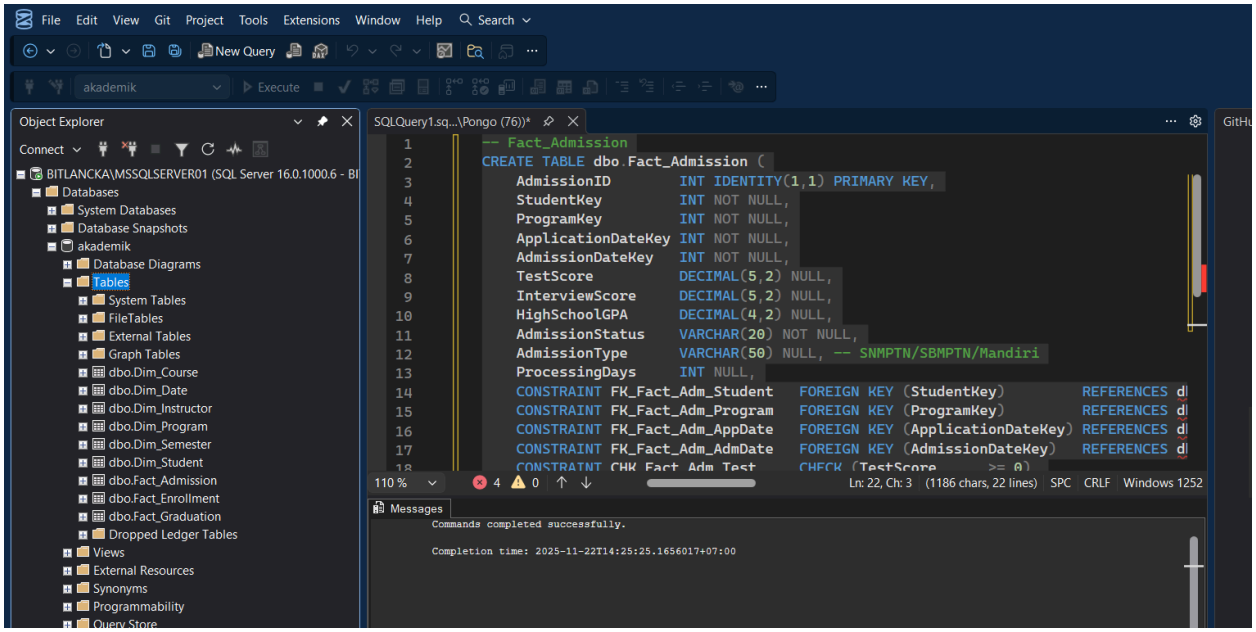
```
-- offset yudisium 0–90 hari sebelum wisuda
CROSS APPLY (
   SELECT ABS(CHECKSUM(NEWID())) % 91 AS OffsetDays
) AS ofs
CROSS APPLY (
   SELECT TOP 1 DateKey, [Date]
   FROM dbo.Dim_Date
   WHERE [Date] = DATEADD(DAY, -ofs.OffsetDays, grad.[Date])
   ORDER BY [Date]
) AS yud
CROSS APPLY (
   SELECT ABS(CHECKSUM(NEWID())) % 100 AS RandHonors
) AS randHonors;
GO

-- check jumlahnya
SELECT COUNT(*) AS JumlahGraduation
FROM dbo.Fact_Graduation;
```

Setelah struktur DW selesai, kode melakukan proses *data generation* untuk membuat ribuan baris data fiktif dengan menggunakan randomisasi terkontrol (melalui NEWID, RAND, dan CROSS APPLY), sehingga menghasilkan dataset analitis yang realistis.

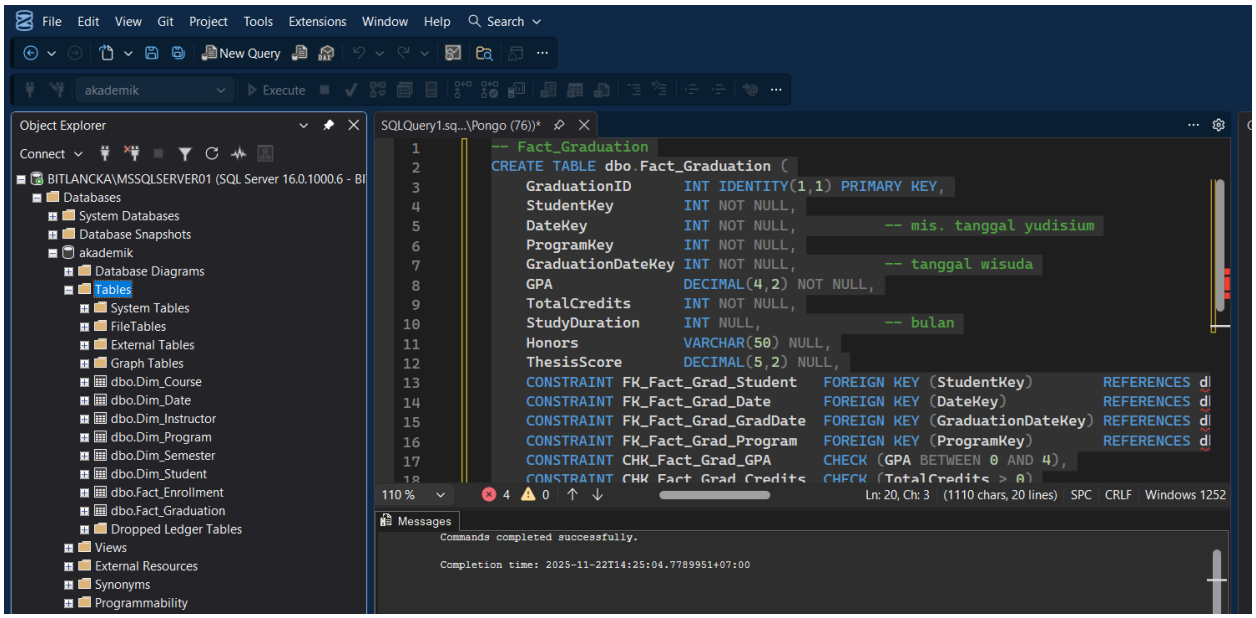
Dokumentasi:



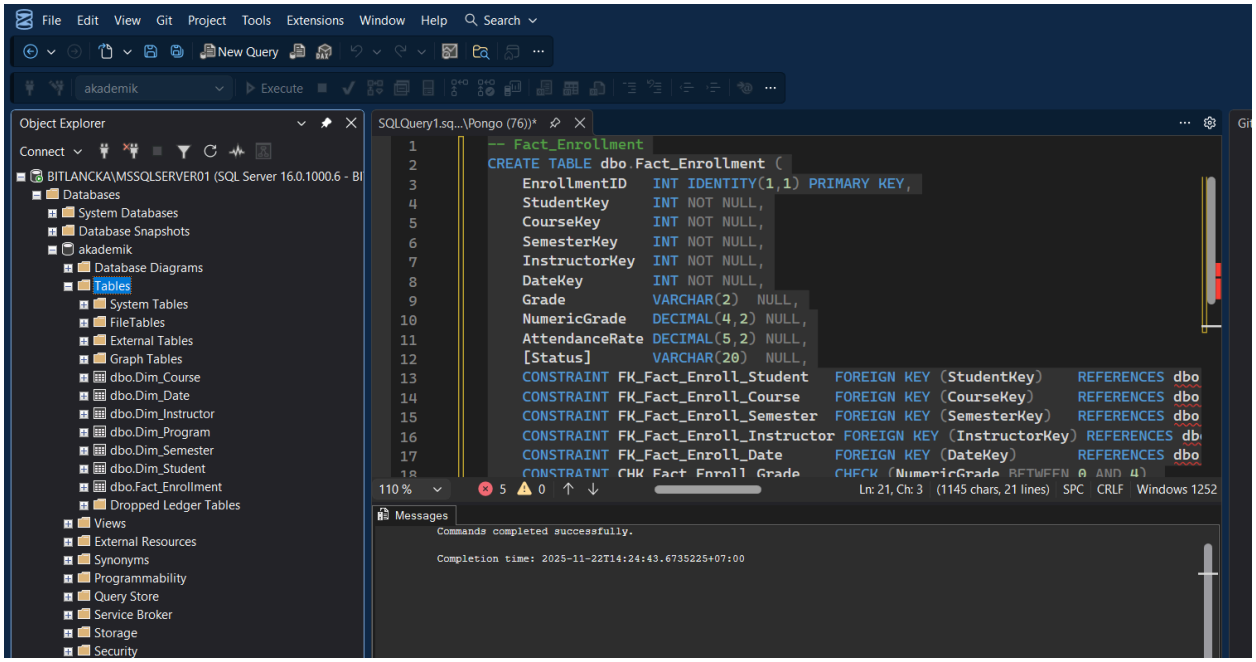
Fakta Admission



Fakta Graduation



Fakta Enrollment



Step 2: Indexing Strategy

Setelah itu dibuat berbagai indeks, baik *nonclustered* maupun *columnstore*, untuk memastikan performa analitik tetap cepat meskipun data besar.

1. Clustered Index on Fact Table

```
-- 1. NONCLUSTERED INDEXES (DateKey + PK)
-- (PK tetap clustered)

CREATE NONCLUSTERED INDEX IX_Fact_Enrollment_DateKey
ON dbo.Fact_Enrollment(DateKey, EnrollmentID);
GO

CREATE NONCLUSTERED INDEX IX_Fact_Graduation_DateKey
ON dbo.Fact_Graduation(GraduationDateKey, GraduationID);
GO

CREATE NONCLUSTERED INDEX IX_Fact_Admission_DateKey
ON dbo.Fact_Admission(AdmissionDateKey, AdmissionID);
GO
```

2. Non-Clustered Indexes

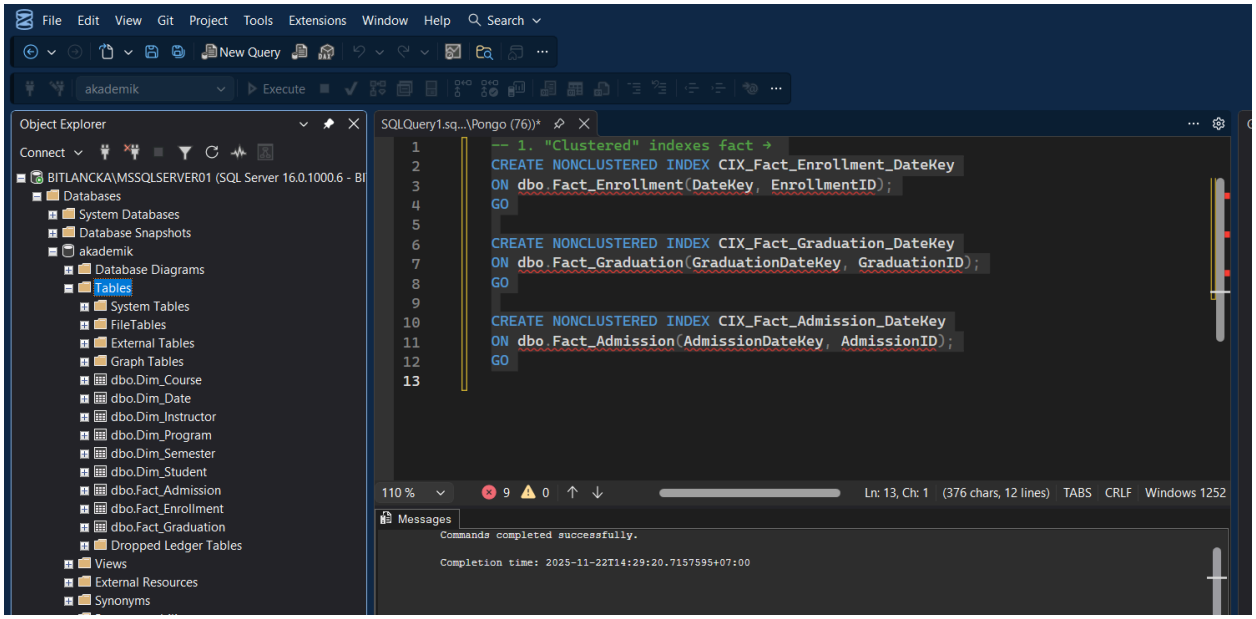
```
-----------------------------------
-- 2. NONCLUSTERED INDEXES (join + analytics)
-----------------------------------

-- Fact_Enrollment
CREATE NONCLUSTERED INDEX IX_Fact_Enroll_Student
ON dbo.Fact_Enrollment(StudentKey)
INCLUDE (CourseKey, SemesterKey, NumericGrade);
GO

CREATE NONCLUSTERED INDEX IX_Fact_Enroll_Course
ON dbo.Fact_Enrollment(CourseKey)
INCLUDE (StudentKey, NumericGrade, AttendanceRate);
GO

CREATE NONCLUSTERED INDEX IX_Fact_Enroll_Semester
ON dbo.Fact_Enrollment(SemesterKey, DateKey)
INCLUDE (StudentKey, CourseKey);
GO

-- Fact_Graduation
CREATE NONCLUSTERED INDEX IX_Fact_Grad_Student
ON dbo.Fact_Graduation(StudentKey)
INCLUDE (GPA, TotalCredits, StudyDuration);
GO

CREATE NONCLUSTERED INDEX IX_Fact_Grad_Program
ON dbo.Fact_Graduation(ProgramKey, GraduationDateKey);
GO

-- Fact_Admission
CREATE NONCLUSTERED INDEX IX_Fact_Adm_Student
ON dbo.Fact_Admission(StudentKey)
INCLUDE (AdmissionStatus, AdmissionType);
GO

CREATE NONCLUSTERED INDEX IX_Fact_Adm_Program
ON dbo.Fact_Admission(ProgramKey, AdmissionDateKey)
INCLUDE (AdmissionStatus);
GO
```

3. Columnstore Index (for large fact tables)

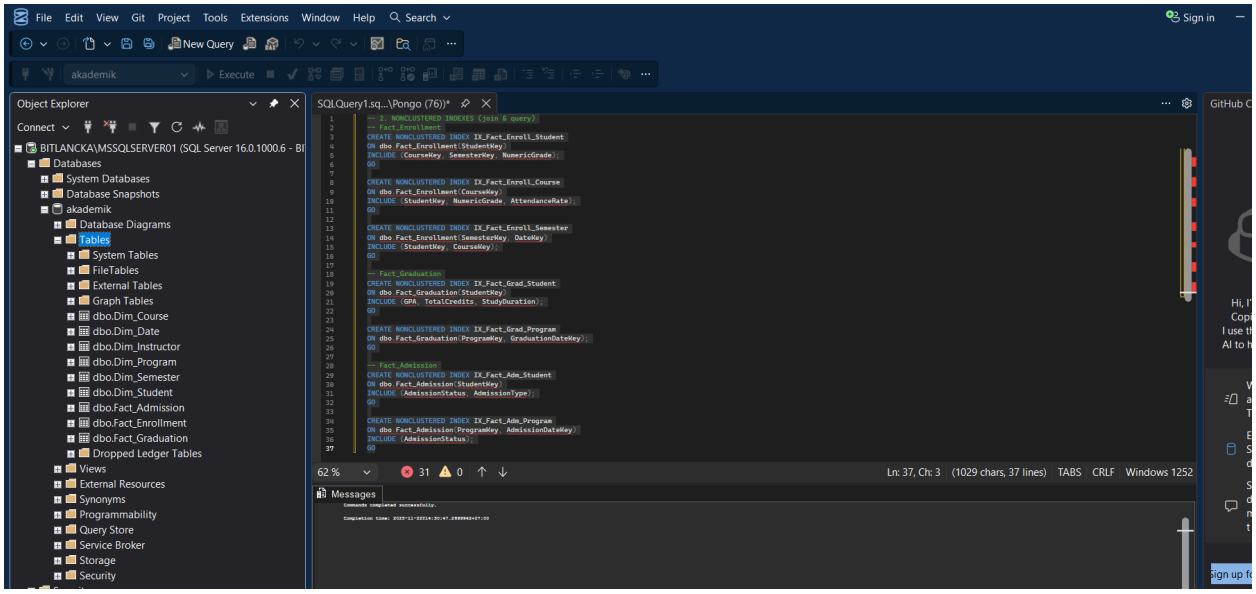
```
-----------------------------------
-- 3. COLUMNSTORE INDEX (analytical)
-----------------------------------
IF OBJECT_ID('dbo.Fact_Enrollment_Partitioned', 'U') IS NOT NULL
   DROP TABLE dbo.Fact_Enrollment_Partitioned;
GO

CREATE TABLE dbo.Fact_Enrollment_Partitioned (
   EnrollmentID   INT IDENTITY(1,1) NOT NULL,
   StudentKey     INT NOT NULL,
   CourseKey      INT NOT NULL,
   SemesterKey    INT NOT NULL,
   InstructorKey  INT NOT NULL,
   DateKey        INT NOT NULL,
   Grade          VARCHAR(2)  NULL,
   NumericGrade   DECIMAL(4,2) NULL,
   AttendanceRate DECIMAL(5,2) NULL,
   [Status]       VARCHAR(20)  NULL,
   CONSTRAINT PK_Fact_Enrollment_Part
      PRIMARY KEY CLUSTERED (DateKey, EnrollmentID)
) ON PS_AcademicYear(DateKey);
GO
```

Dokumentasi:

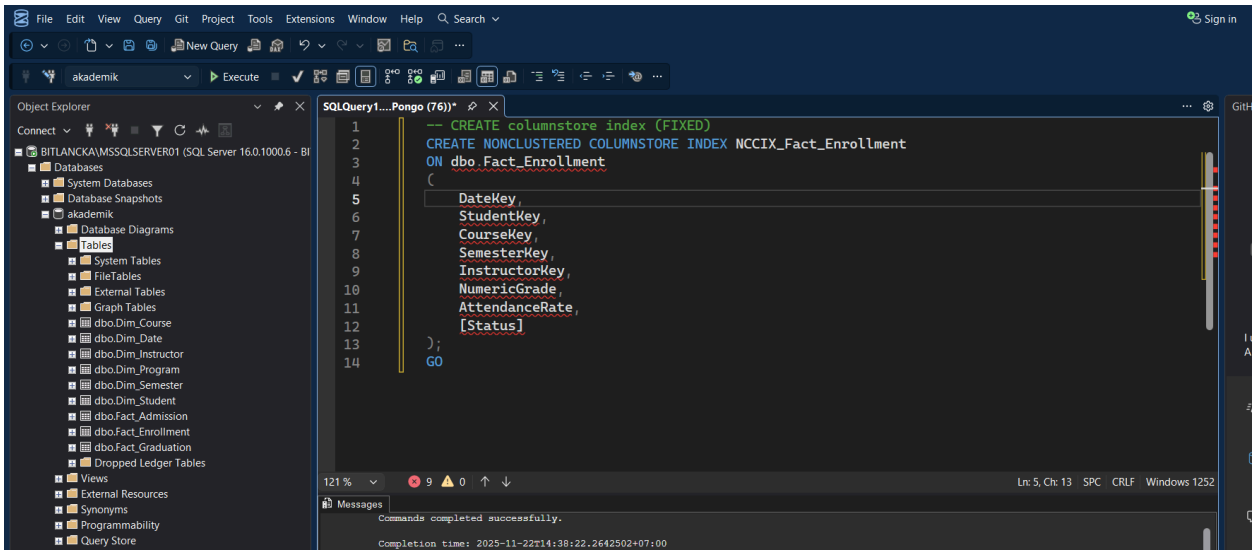
1. Clustered Index on Fact Table



2. Non-Clustered Indexes



3. Columnstore Index (for large fact tables)



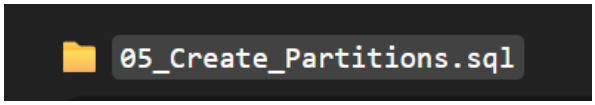
Step 3: Partitioning Strategy

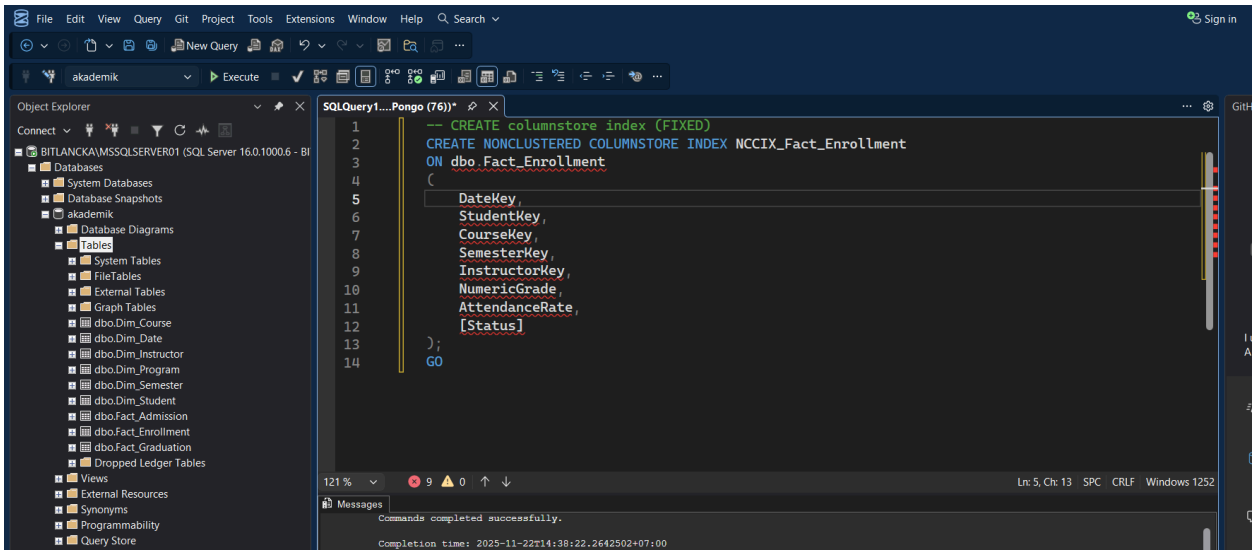
Kode juga membuat *partitioning* berdasarkan tahun akademik agar tabel fakta bisa di-*scale* dengan efisien. Misalkan yang akan dipartisi adalah Fact_Enrolment per tahun akademik berbasis DateKey (yyyymmdd)

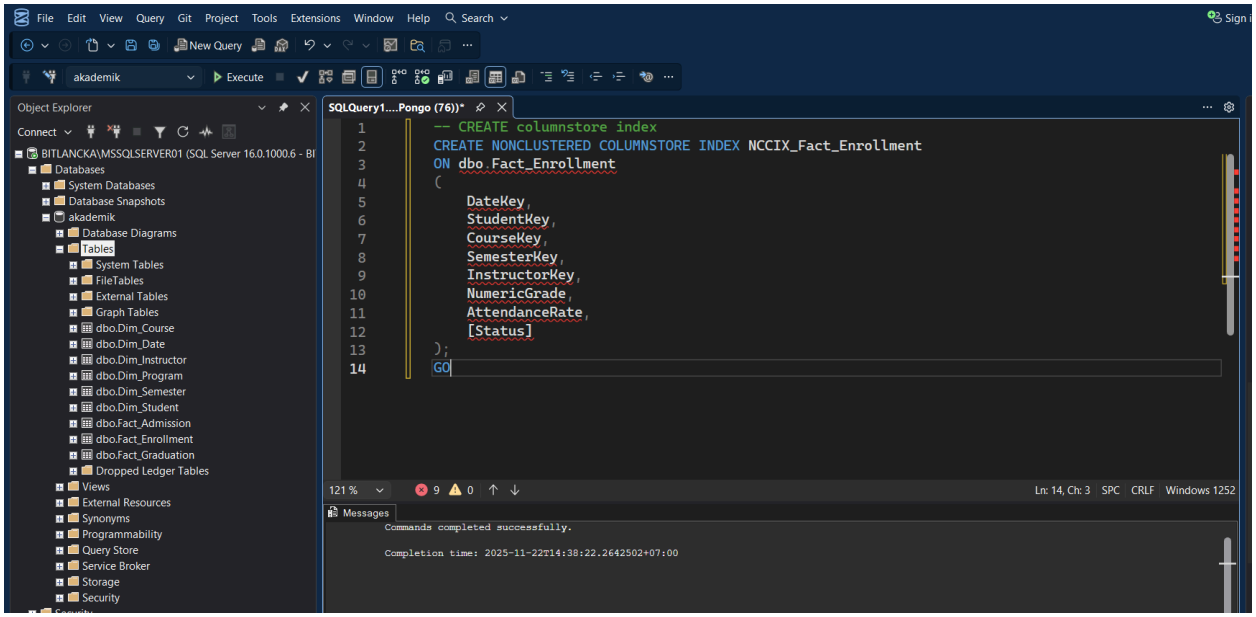
Query:

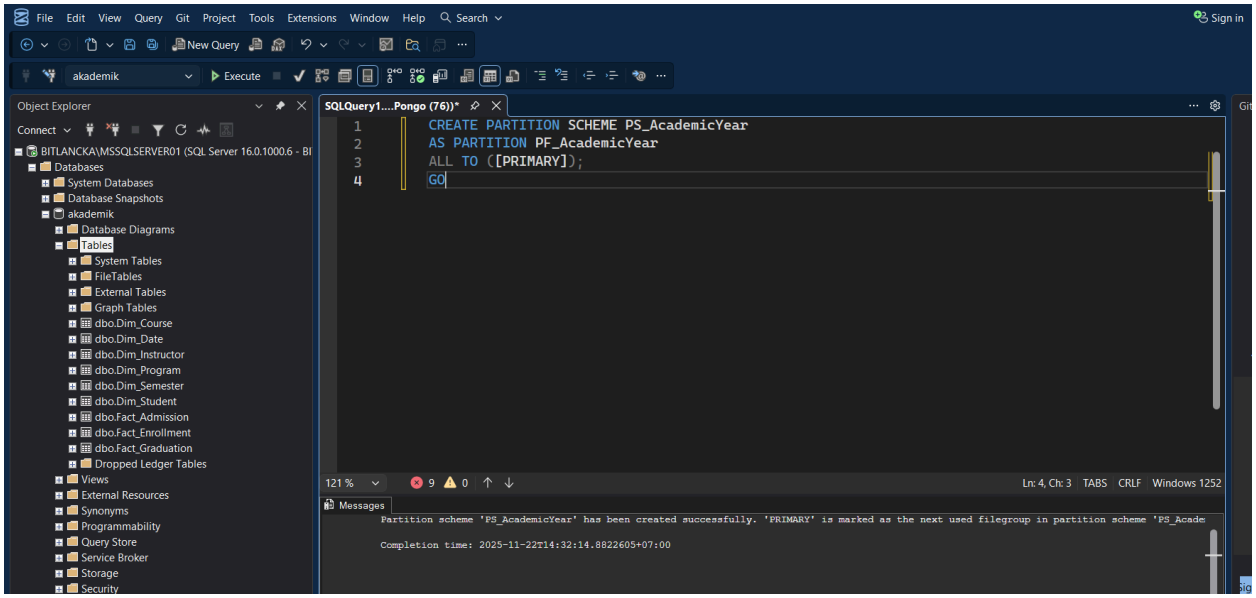
```
-----------------------------------
-- Partitioning
-----------------------------------

-- Partition function for Academic Year
CREATE PARTITION FUNCTION PF_AcademicYear (INT)
AS RANGE RIGHT FOR VALUES
(
   20200801, -- 2020/2021
   20210801, -- 2021/2022
   20220801, -- 2022/2023
   20230801, -- 2023/2024
   20240801, -- 2024/2025
   20250801  -- 2025/2026
);
GO

CREATE PARTITION SCHEME PS_AcademicYear
AS PARTITION PF_AcademicYear
ALL TO ([PRIMARY]);
GO

-- Example partitioned version of Fact_Enrollment
CREATE TABLE dbo.Fact_Enrollment_Partitioned (
   EnrollmentID   INT IDENTITY(1,1) PRIMARY KEY,
   StudentKey     INT NOT NULL,
   CourseKey      INT NOT NULL,
   SemesterKey    INT NOT NULL,
   InstructorKey  INT NOT NULL,
   DateKey        INT NOT NULL,
   Grade          VARCHAR(2),
   NumericGrade   DECIMAL(4,2),
   AttendanceRate DECIMAL(5,2),
   [Status]       VARCHAR(20)
) ON PS_AcademicYear(DateKey);
GO
```

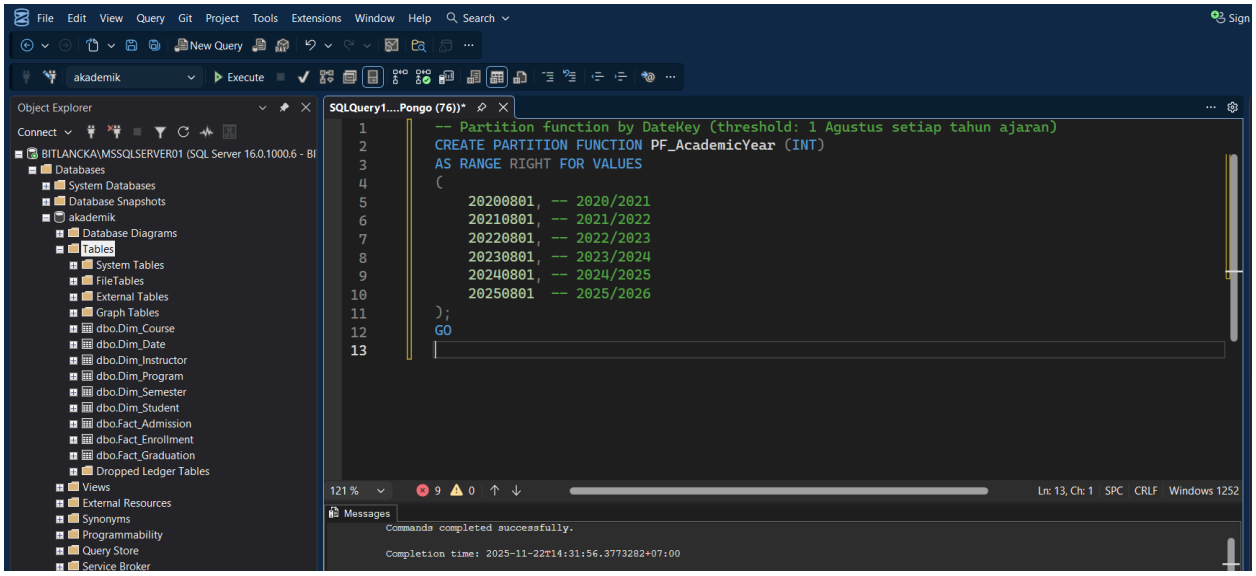
Dokumentasi:











Step 4: ETL Design

Kode kemudian mendefinisikan *staging area* serta *stored procedure* untuk proses ETL, termasuk proses MERGE untuk sinkronisasi data dimensi dan proses insert terkontrol ke tabel fakta.

1. ETL Architecture Design

Memakai OPSI 2: T-SQL Stored Procedure karena lebih mudah dikerjakan.

2. Create Staging Tables

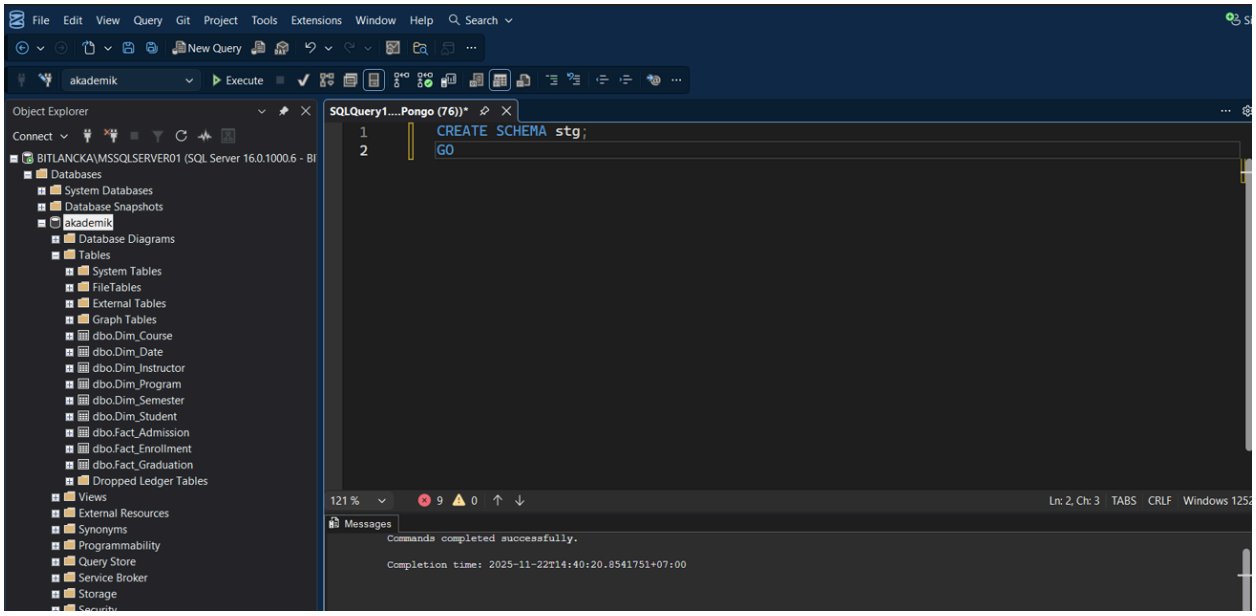
Query:

```
-----------------------------------
-- Staging Area
-----------------------------------
CREATE SCHEMA stg;
GO

-- Staging Program
CREATE TABLE stg.Program (
   ProgramCode  VARCHAR(20),
   ProgramName  VARCHAR(100),
   Faculty      VARCHAR(100),
   LoadDate     DATETIME DEFAULT GETDATE()
);
GO

-- Staging Student
CREATE TABLE stg.Student (
   StudentNaturalID VARCHAR(20),
   FullName         VARCHAR(100),
   DOB              DATE,
   Gender           CHAR(1),
   EntryYear        INT,
   [Status]         VARCHAR(20),
   ProgramNaturalID VARCHAR(20),
   LoadDate         DATETIME DEFAULT GETDATE()
);
GO

-- Staging Course
CREATE TABLE stg.Course (
   CourseCode       VARCHAR(20),
   CourseName       VARCHAR(150),
   Credits          INT,
   ProgramNaturalID VARCHAR(20),
   LoadDate         DATETIME DEFAULT GETDATE()
);
GO

-- Staging Instructor
CREATE TABLE stg.Instructor (
```

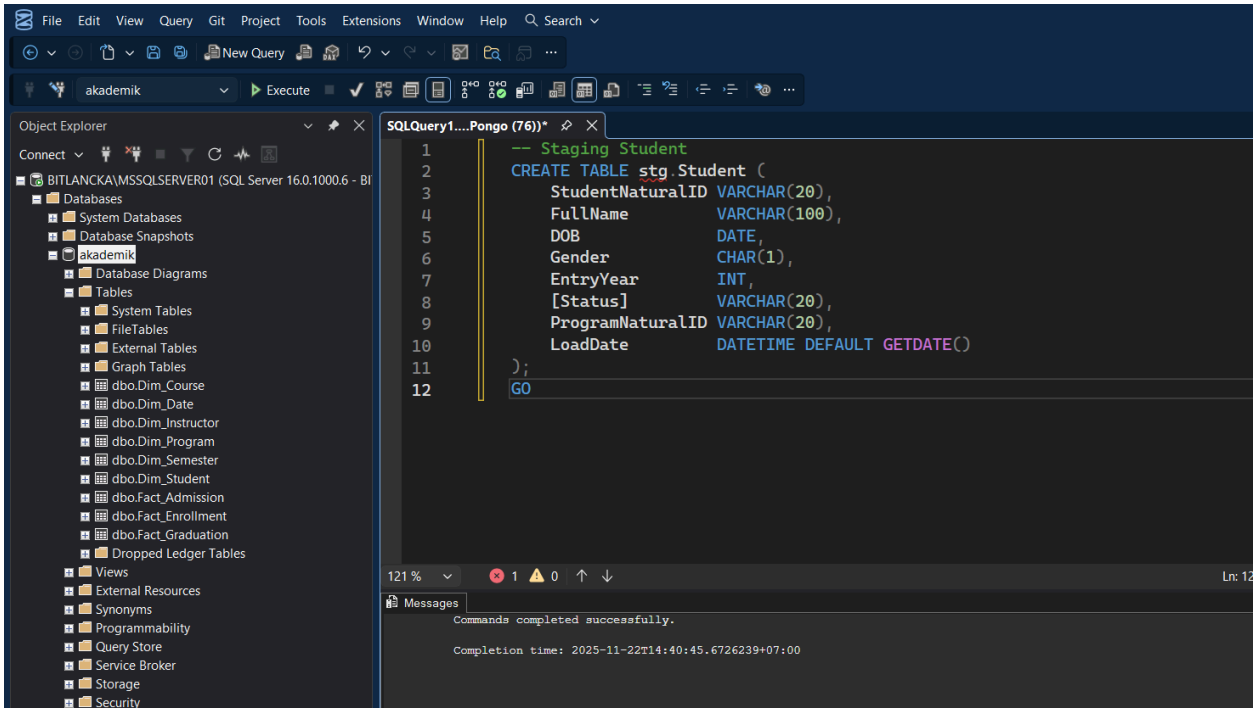
```
    InstructorNaturalID VARCHAR(20),
    [Name]              VARCHAR(100),
    [Rank]              VARCHAR(50),
    Dept                VARCHAR(100),
    FTE                 DECIMAL(3,2),
    LoadDate            DATETIME DEFAULT GETDATE()
);
GO

-- Staging Enrollment (Fact)
CREATE TABLE stg.Enrollment (
    StudentNaturalID VARCHAR(20),
    CourseCode       VARCHAR(20),
    InstructorID     VARCHAR(20),
    SemesterCode     VARCHAR(20),
    DateKey          INT,
    Grade            VARCHAR(2),
    NumericGrade     DECIMAL(4,2),
    AttendanceRate   DECIMAL(5,2),
    [Status]         VARCHAR(20),
    LoadDate         DATETIME DEFAULT GETDATE()
);
GO
```

Dokumentasi:

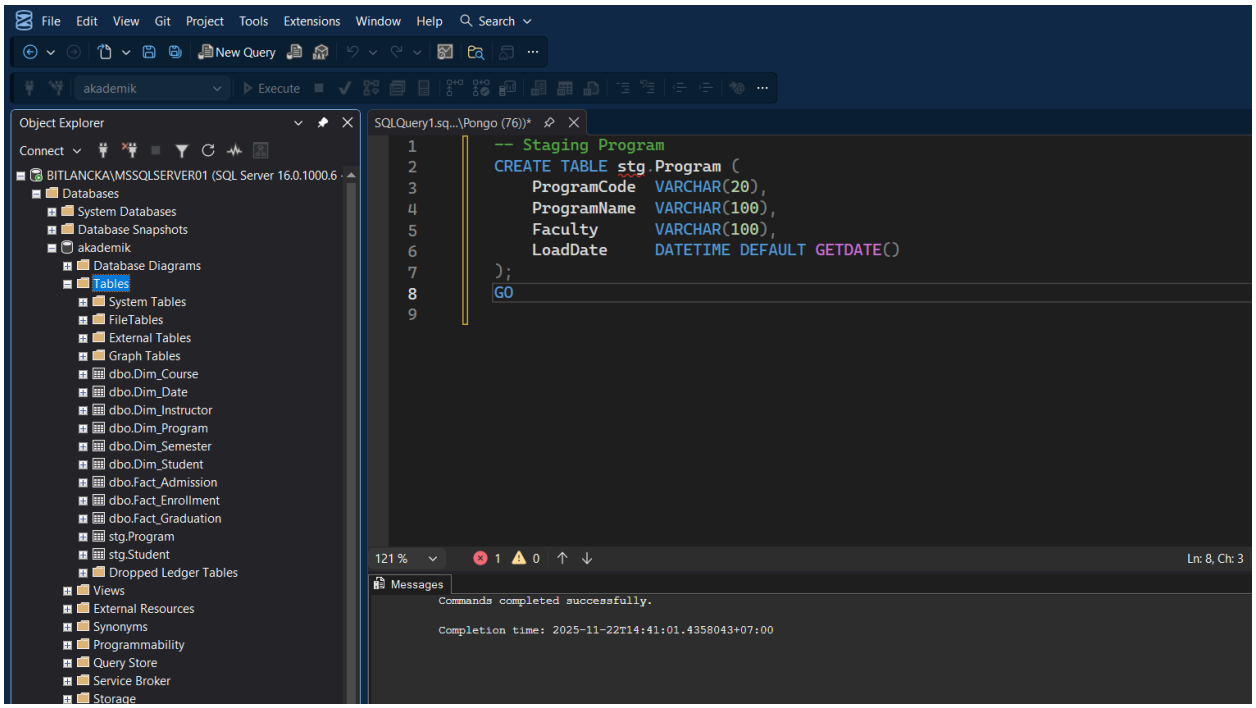
Create Schema Staging



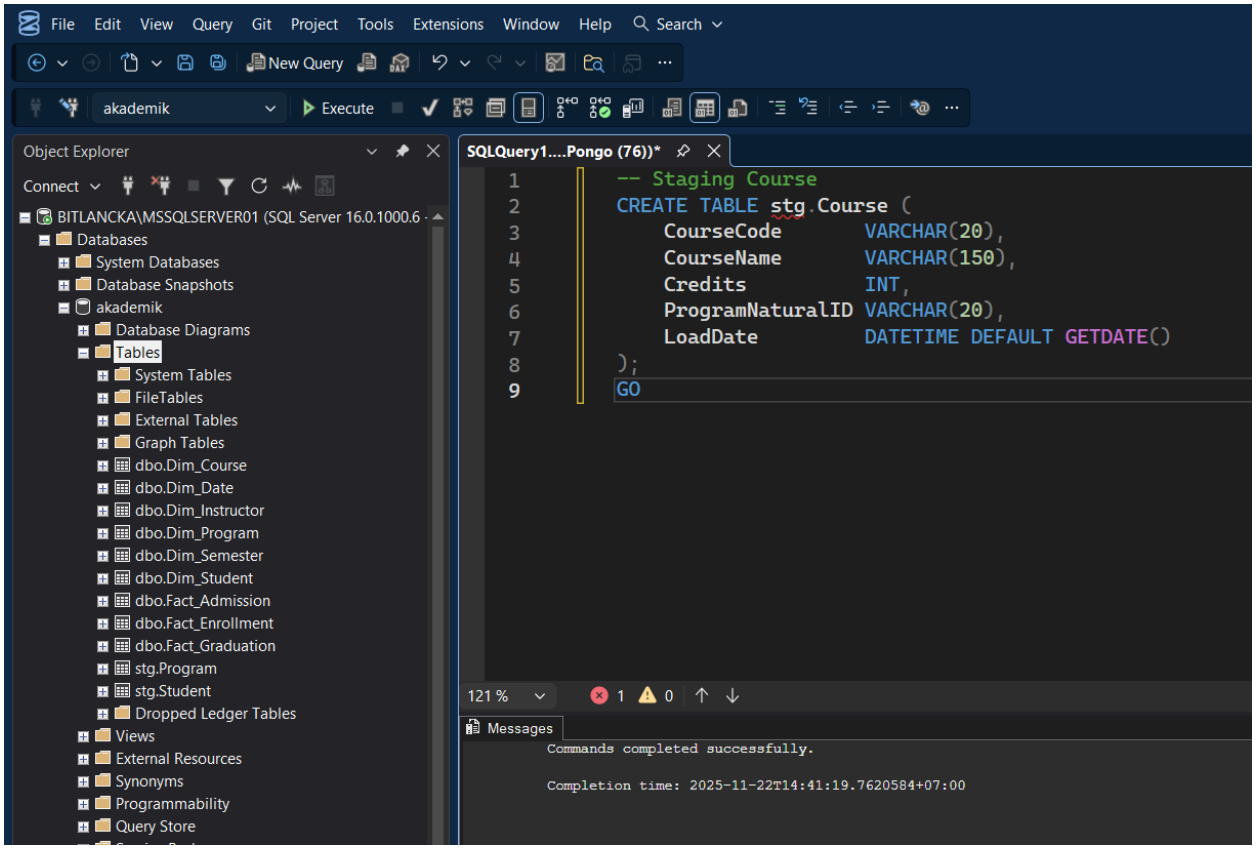
Create Table Staging Student



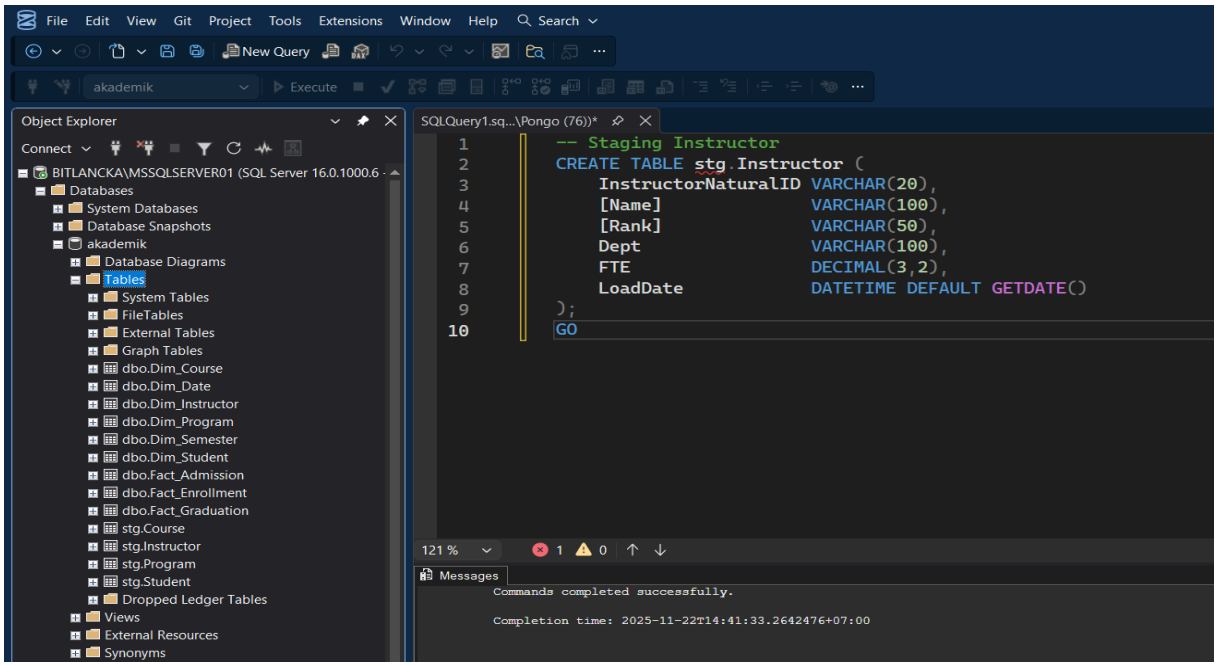
Create Table Staging Program



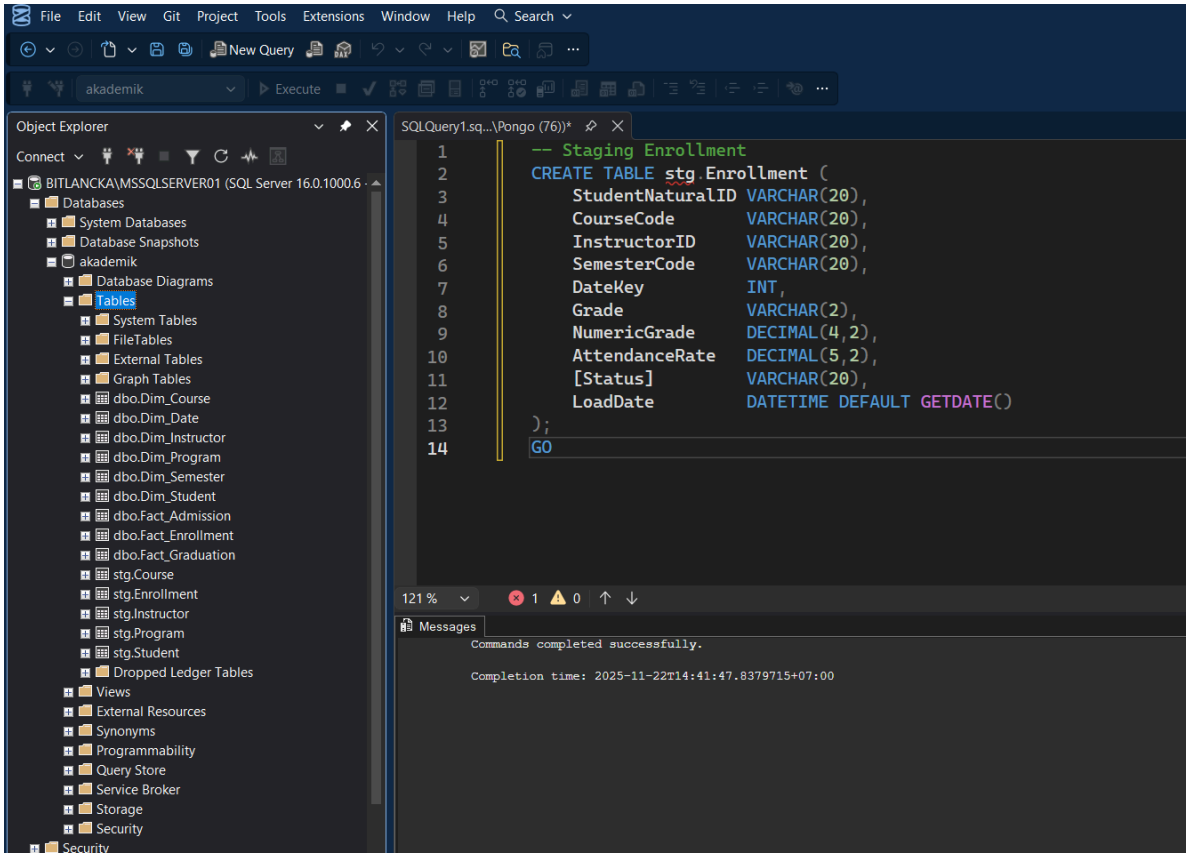
Create Table Staging Course



Create Table Staging Instructor



Create Table Staging Enrollment



3. ETL Mapping Document

ETL_Mapping

Step 5: ETL Implementation (SSIS)

1. Create SSIS Project
2. Package 1: Load Dimensions

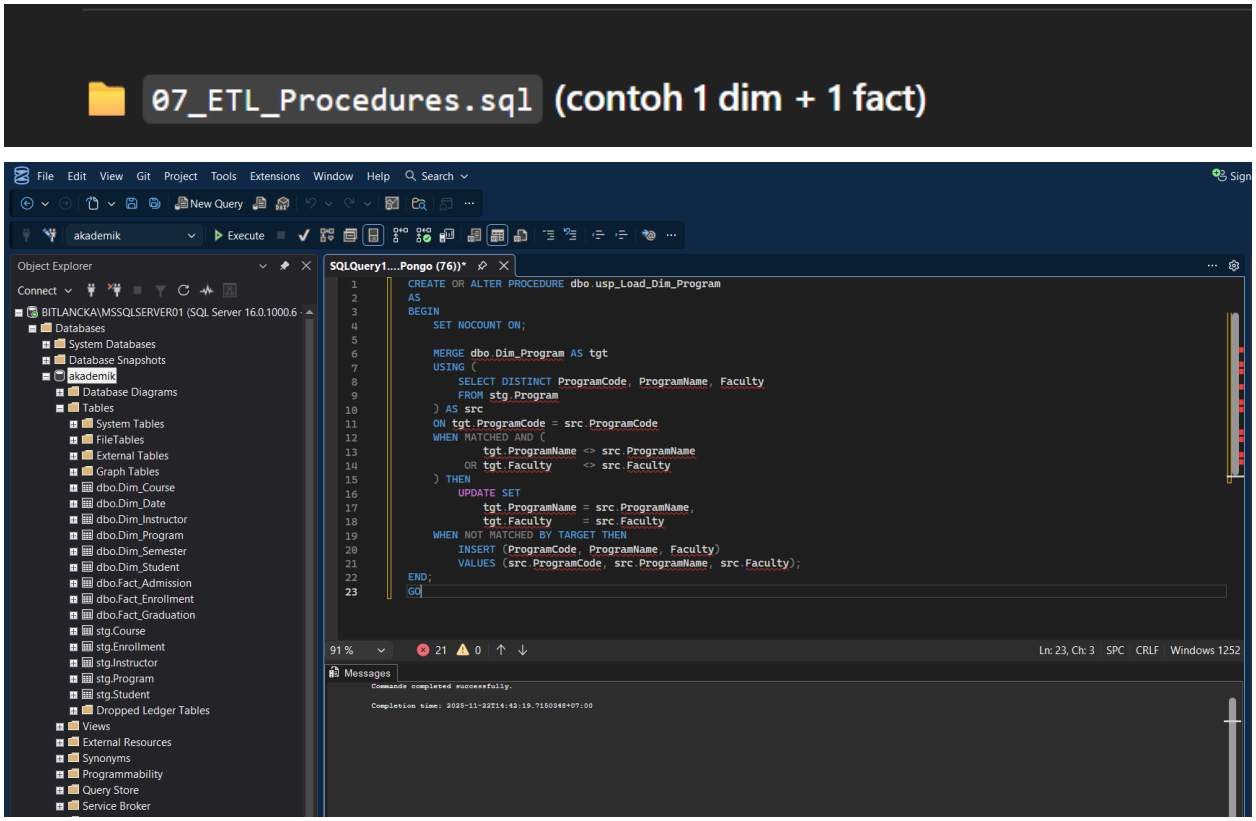
Load Dim Program

Query:

```
---------------------------------
-- ETL Logic
---------------------------------

-- Load Dim_Program
CREATE OR ALTER PROCEDURE dbo.usp_Load_Dim_Program
AS
BEGIN
```

```
    MERGE dbo.Dim_Program AS tgt
    USING (
        SELECT DISTINCT ProgramCode, ProgramName, Faculty
        FROM stg.Program
    ) AS src
    ON tgt.ProgramCode = src.ProgramCode
    WHEN MATCHED THEN
        UPDATE SET
            ProgramName = src.ProgramName,
            Faculty     = src.Faculty
    WHEN NOT MATCHED BY TARGET THEN
        INSERT (ProgramCode, ProgramName, Faculty)
        VALUES (src.ProgramCode, src.ProgramName, src.Faculty);
END;
GO
```

Dokumentasi:

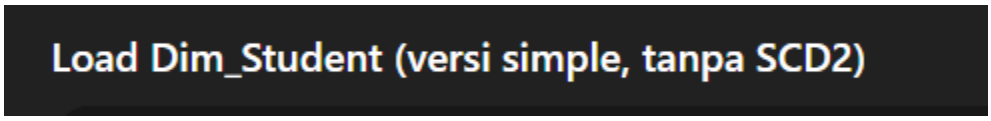


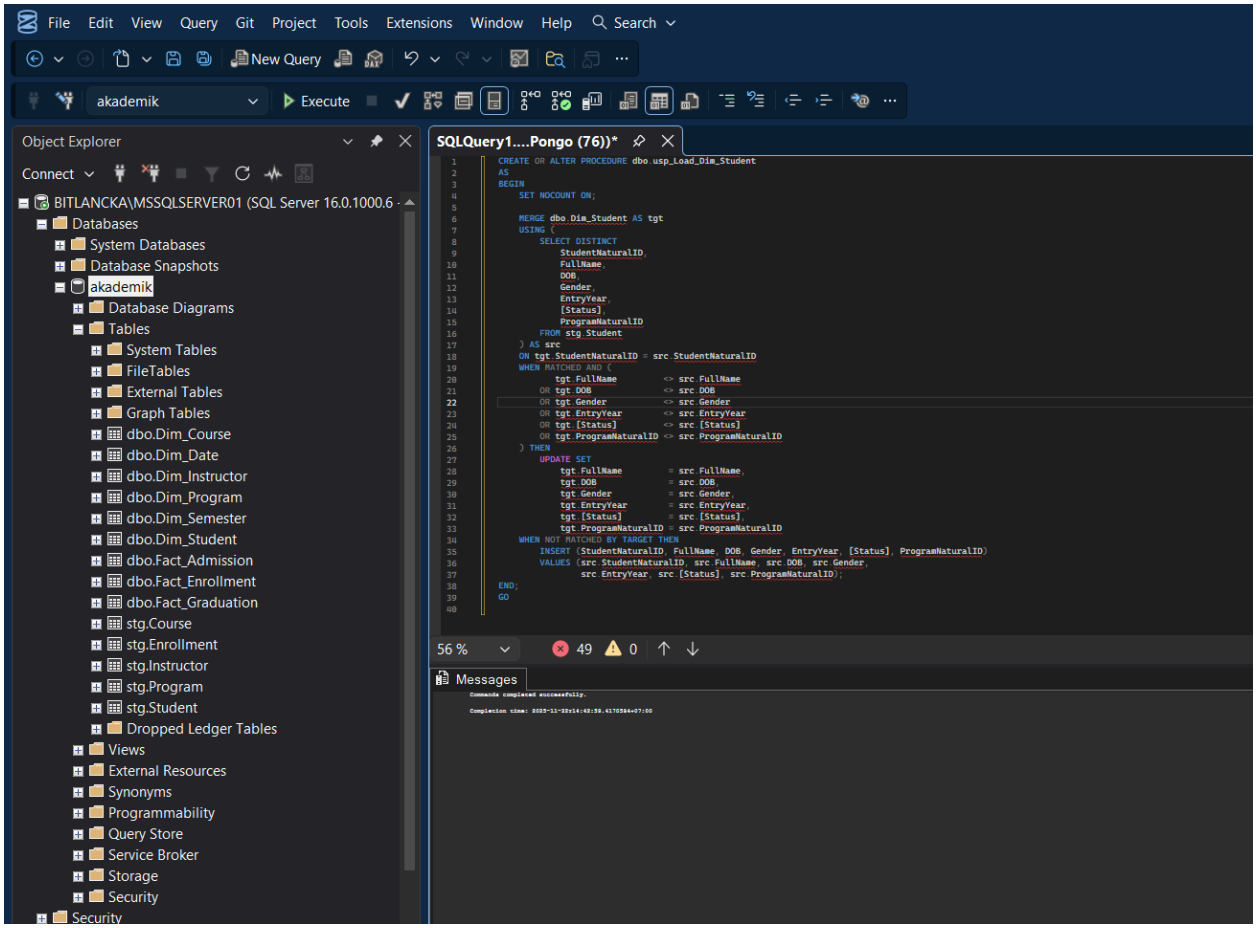
Load Dim Student

Query:

```
-- Load Dim_Student
CREATE OR ALTER PROCEDURE dbo.usp_Load_Dim_Student
AS
BEGIN
   MERGE dbo.Dim_Student AS tgt
   USING (
      SELECT DISTINCT
         StudentNaturalID, FullName, DOB, Gender,
         EntryYear, [Status], ProgramNaturalID
      FROM stg.Student
   ) AS src
   ON tgt.StudentNaturalID = src.StudentNaturalID
   WHEN MATCHED THEN
      UPDATE SET
         FullName        = src.FullName,
         DOB             = src.DOB,
         Gender          = src.Gender,
         EntryYear       = src.EntryYear,
         [Status]        = src.[Status],
         ProgramNaturalID = src.ProgramNaturalID
   WHEN NOT MATCHED BY TARGET THEN
      INSERT (StudentNaturalID, FullName, DOB, Gender,
            EntryYear, [Status], ProgramNaturalID)
      VALUES (src.StudentNaturalID, src.FullName, src.DOB,
            src.Gender, src.EntryYear, src.[Status],
            src.ProgramNaturalID);
END;
GO
```

Dokumantasi:





3. Package 2: Load Facts

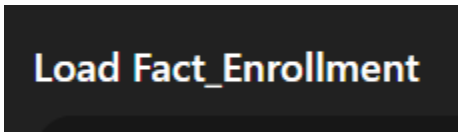
Load Fact Enrollment

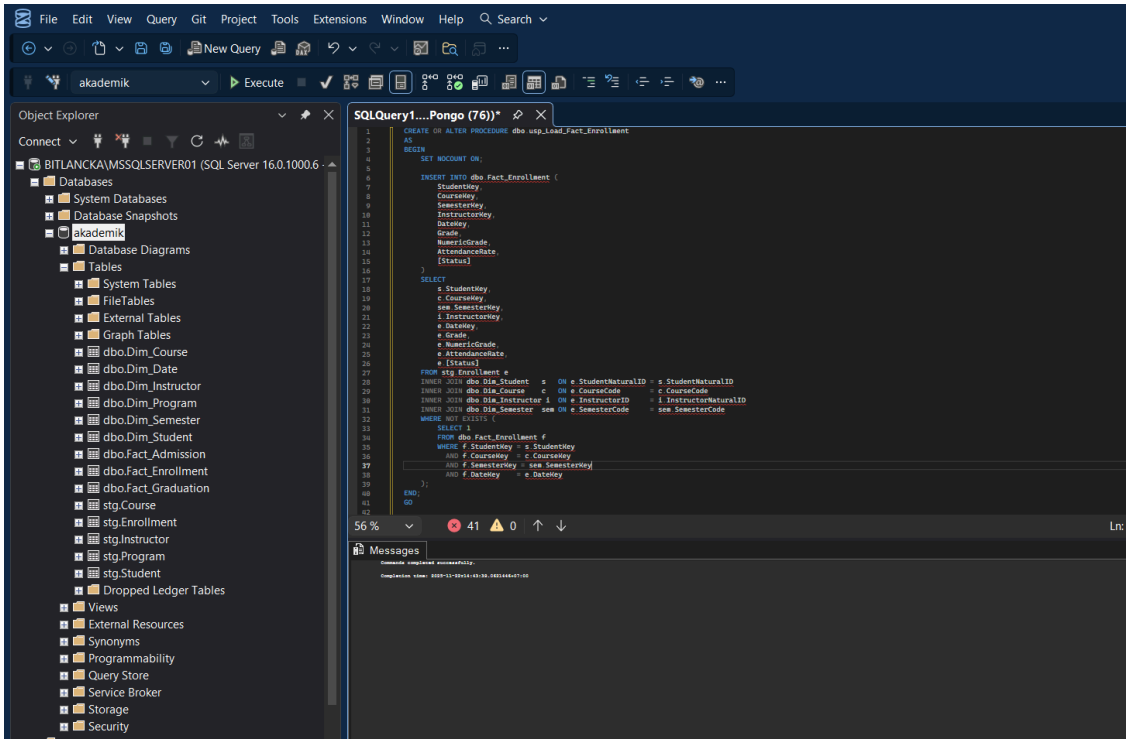
Query:

```
-- Load Fact_Enrollment
CREATE OR ALTER PROCEDURE dbo.usp_Load_Fact_Enrollment
AS
BEGIN
   INSERT INTO dbo.Fact_Enrollment (
      StudentKey, CourseKey, SemesterKey, InstructorKey,
      DateKey, Grade, NumericGrade, AttendanceRate, [Status]
   )
   SELECT
      s.StudentKey,
      c.CourseKey,
      sem.SemesterKey,
      i.InstructorKey,
      e.DateKey,
      e.Grade,
```

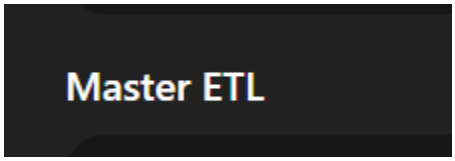
```
    e.NumericGrade,
    e.AttendanceRate,
    e.[Status]
FROM stg.Enrollment e
JOIN dbo.Dim_Student   s   ON e.StudentNaturalID = s.StudentNaturalID
JOIN dbo.Dim_Course    c   ON e.CourseCode       = c.CourseCode
JOIN dbo.Dim_Instructor i  ON e.InstructorID     = i.InstructorNaturalID
JOIN dbo.Dim_Semester  sem ON e.SemesterCode     = sem.SemesterCode
WHERE NOT EXISTS (
    SELECT 1
    FROM dbo.Fact_Enrollment fe
    WHERE fe.StudentKey = s.StudentKey
      AND fe.CourseKey  = c.CourseKey
      AND fe.DateKey    = e.DateKey
);
END;
GO
```

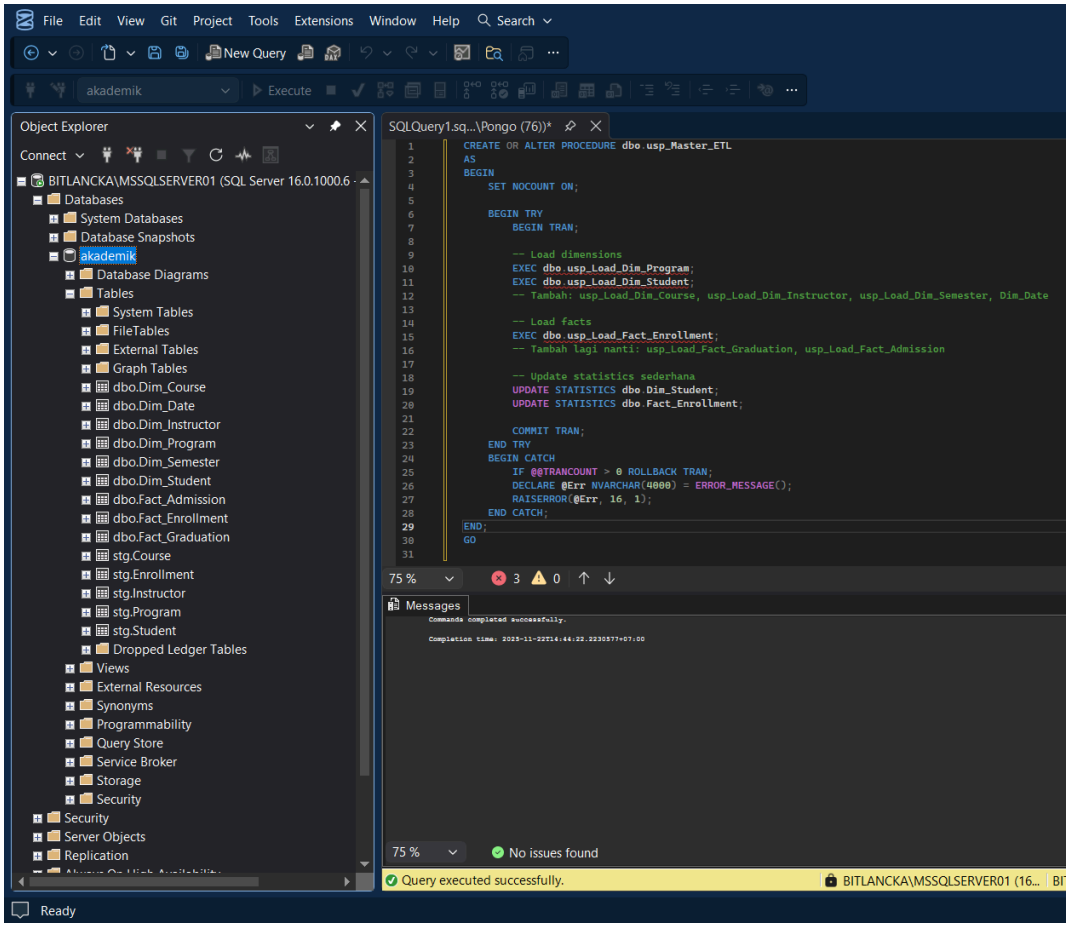
Dokumentasi:





4. Master Package

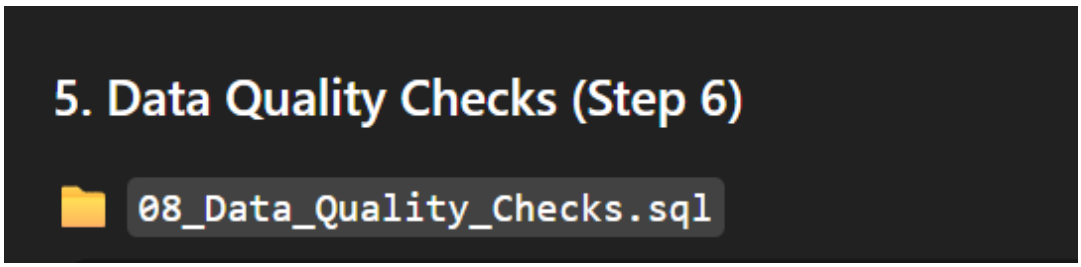




Step 6: Data Quality Assurance

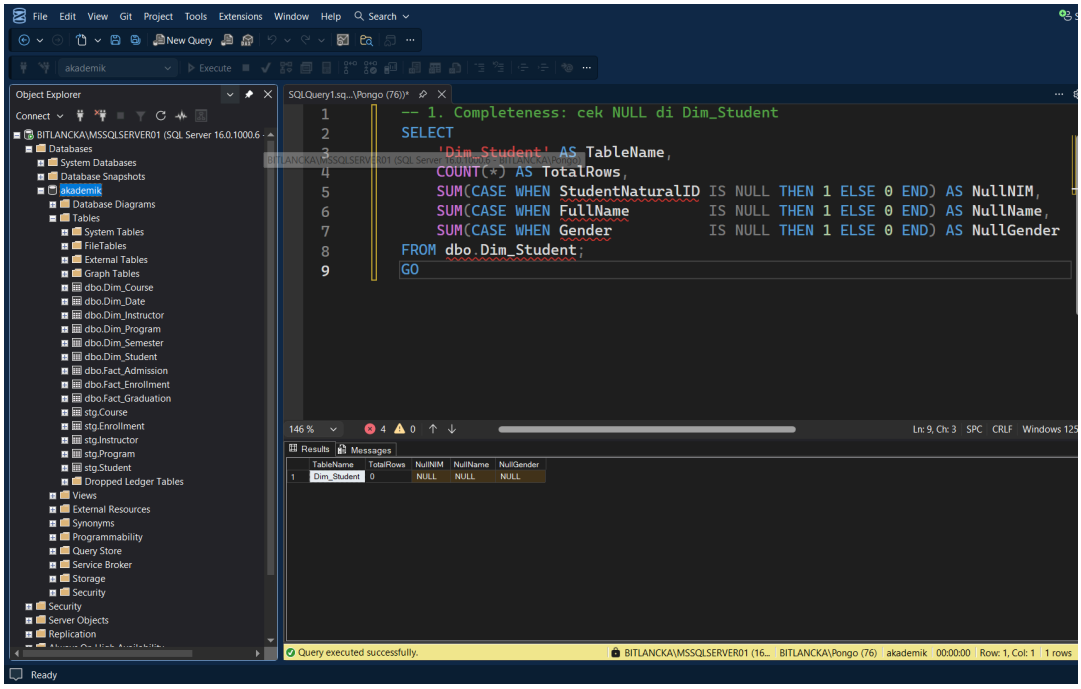
1. Data Quality Checks

Bagian akhir kode menyediakan *data quality checks* seperti pengecekan completeness, orphan records, invalid values, dan duplikasi, serta menambahkan contoh query analitik untuk menguji performa dan melihat insight seperti trend enrollment, distribusi GPA, funnel admission, hingga hubungan antara absensi dan nilai.

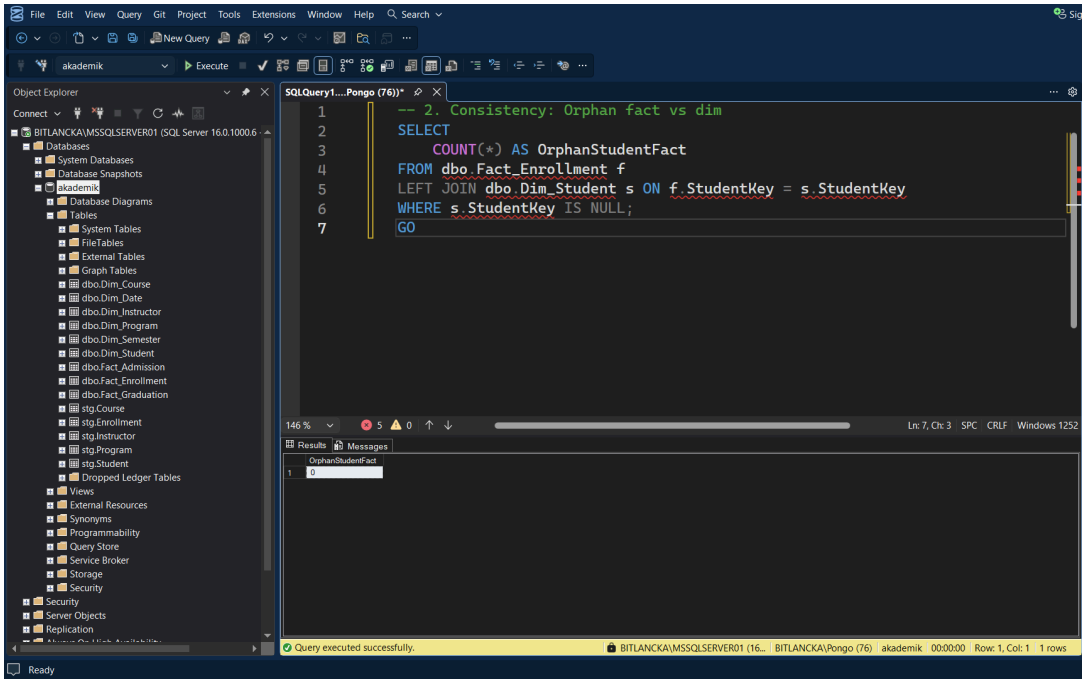


Query:

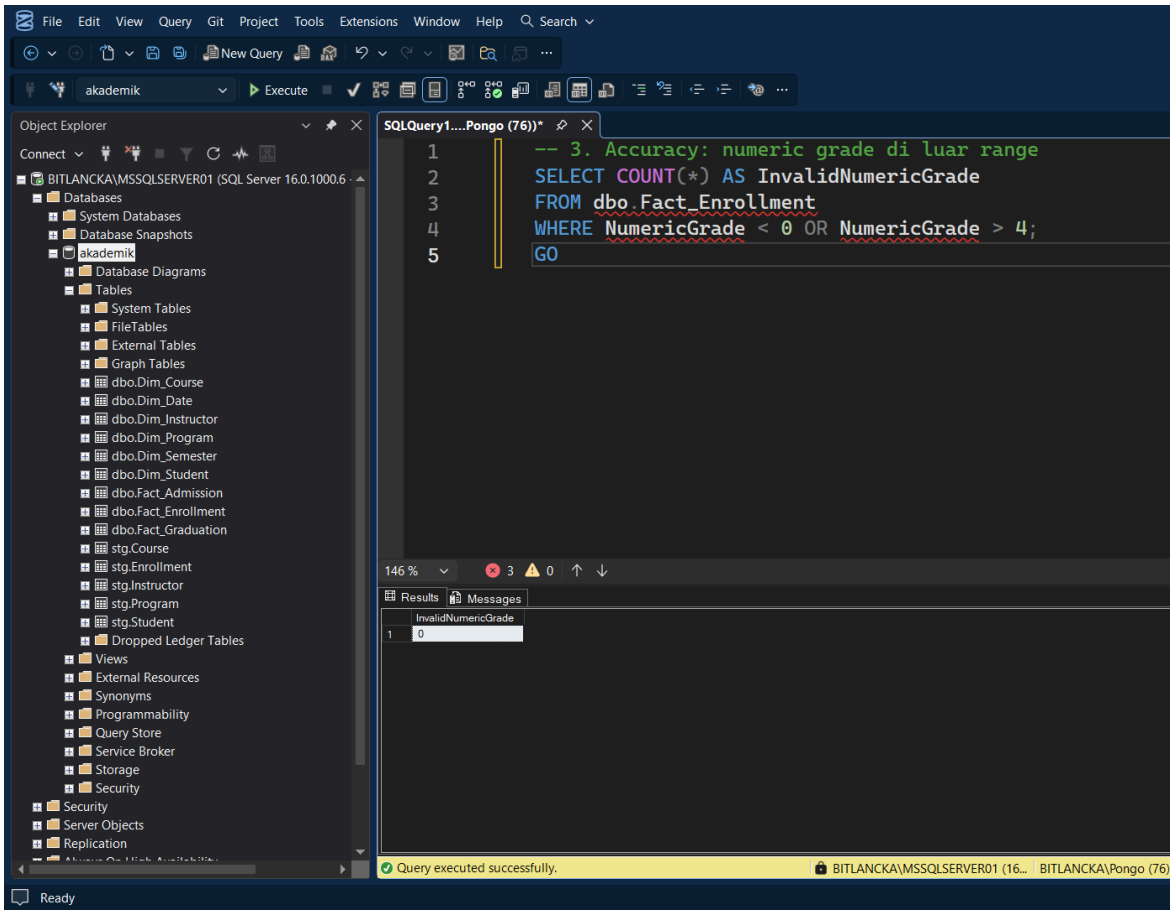
```
-----------------------------------
-- Data Quality Checks
-----------------------------------
-- 1. Completeness check
SELECT COUNT(*) AS NullName
FROM dbo.Dim_Student
WHERE FullName IS NULL;
GO

-- 2. Orphan check Fact <-> Dimension
SELECT COUNT(*) AS Orphan_Students
FROM dbo.Fact_Enrollment f
LEFT JOIN dbo.Dim_Student d ON f.StudentKey = d.StudentKey
WHERE d.StudentKey IS NULL;
GO

-- 3. Numeric grade validity
SELECT COUNT(*) AS InvalidGrades
FROM dbo.Fact_Enrollment
WHERE NumericGrade NOT BETWEEN 0 AND 4;
GO

-- 4. Duplicate fact combinations
SELECT StudentKey, CourseKey, SemesterKey, COUNT(*) AS Cnt
FROM dbo.Fact_Enrollment
GROUP BY StudentKey, CourseKey, SemesterKey
HAVING COUNT(*) > 1;
GO
```



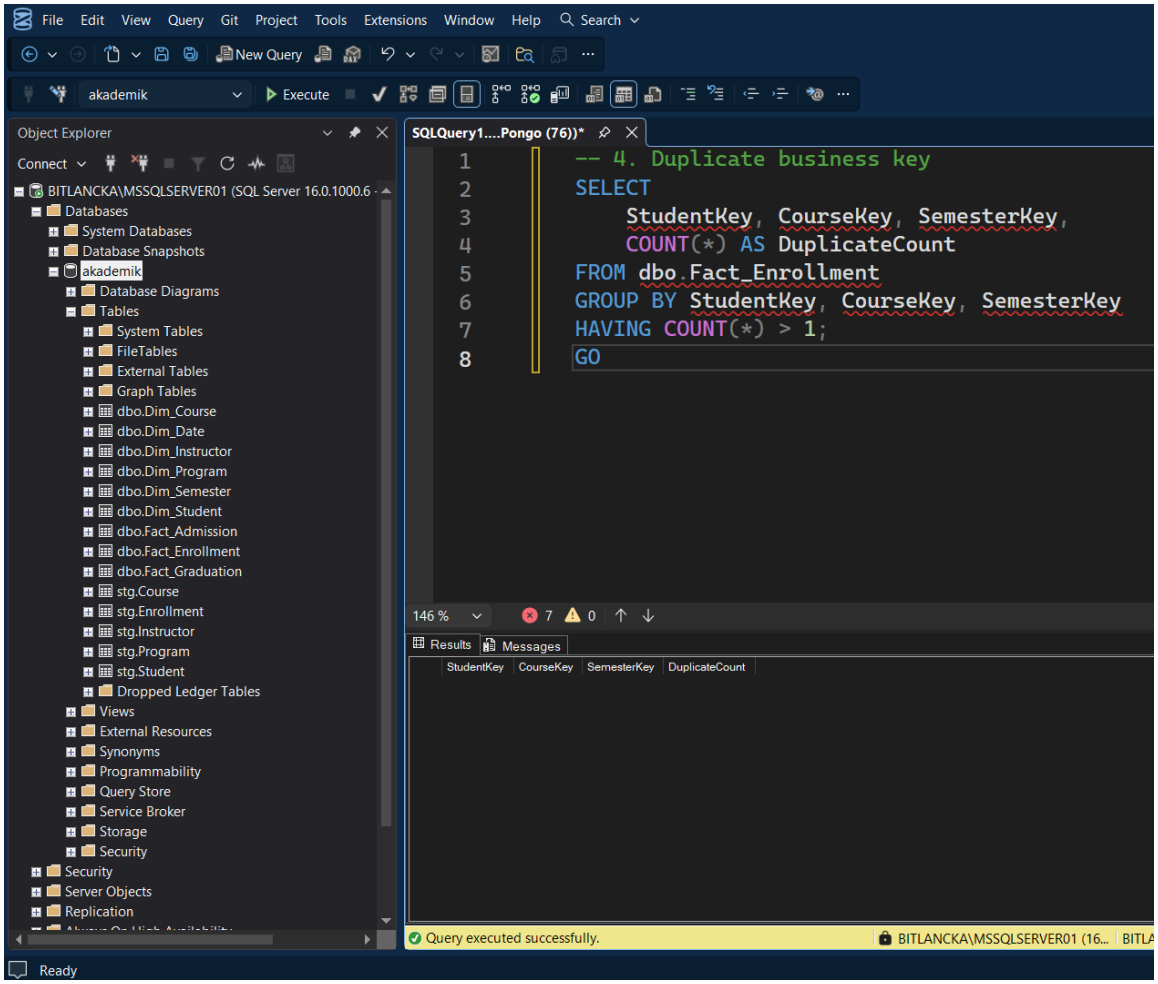
Output menunjukkan bahwa pada tabel Dim_Student tidak anda nilai NULL.



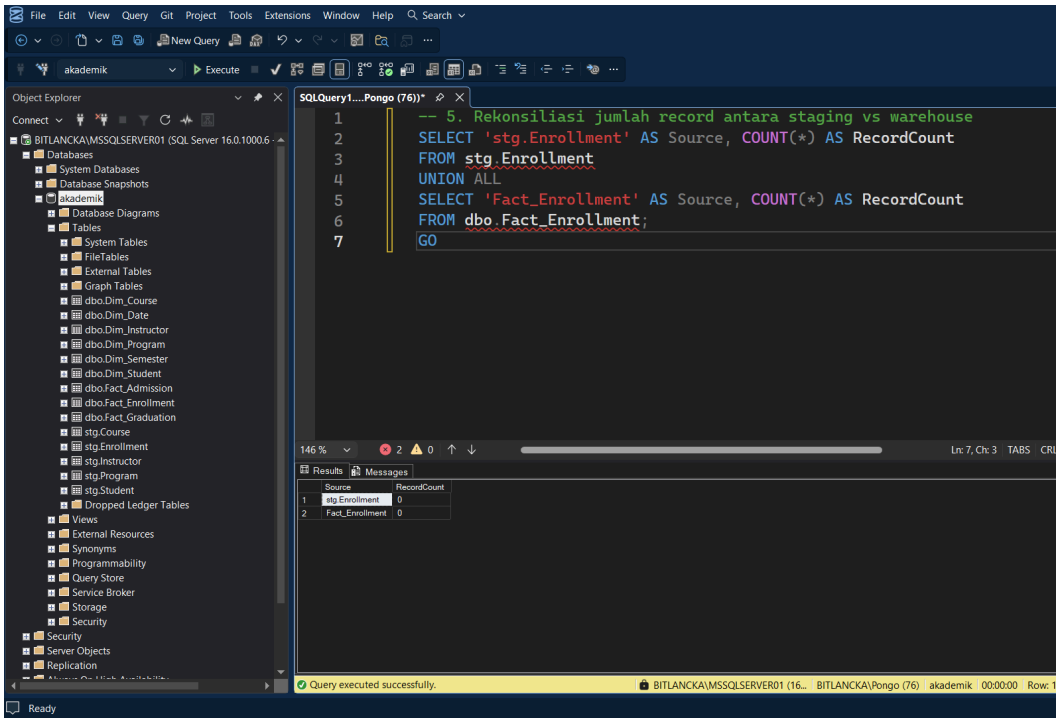
Hasil pengecekan konsistensi data menunjukkan bahwa tidak terdapat *orphan record* pada tabel *Fact_Enrollment*. Seluruh nilai *StudentKey* pada tabel fakta berhasil mencocokkan data yang ada pada tabel *Dim_Student*, sehingga integritas referensial antara fakta dan dimensi berada dalam kondisi baik.



Tidak ditemukan nilai NumericGrade yang berada di luar rentang 0 sampai 4. Semua nilai NumericGrade pada tabel Fact_Enrollment valid dan sesuai standar penilaian



Pengecekan duplikasi pada tabel Fact_Enrollment menunjukkan bahwa tidak terdapat kombinasi StudentKey, CourseKey, dan SemesterKey yang muncul lebih dari satu kali. Hal ini menandakan bahwa data transaksi enrollment tidak memiliki duplikasi dan sudah memenuhi aturan grain yang ditetapkan.



Hasil rekonsiliasi antara tabel staging dan tabel warehouse menunjukkan bahwa kedua tabel, baik stg.Enrollment maupun Fact_Enrollment, memiliki jumlah record 0. Hal ini menandakan bahwa belum terdapat data yang masuk ke staging, atau proses ETL untuk memuat data ke tabel Fact_Enrollment belum dijalankan

Step 7: Performance Testing

1. Create Test Queries
2. Analyze Query Plans
3. Performance Benchmarks

Query:

```
-----------------------------------
-- Performance Testing
-----------------------------------
-- 1. Average grade per program per year
SELECT
   p.ProgramName,
   d.[Year],
   AVG(f.NumericGrade) AS AvgGrade
FROM dbo.Fact_Enrollment f
JOIN dbo.Dim_Date d ON f.DateKey = d.DateKey
```

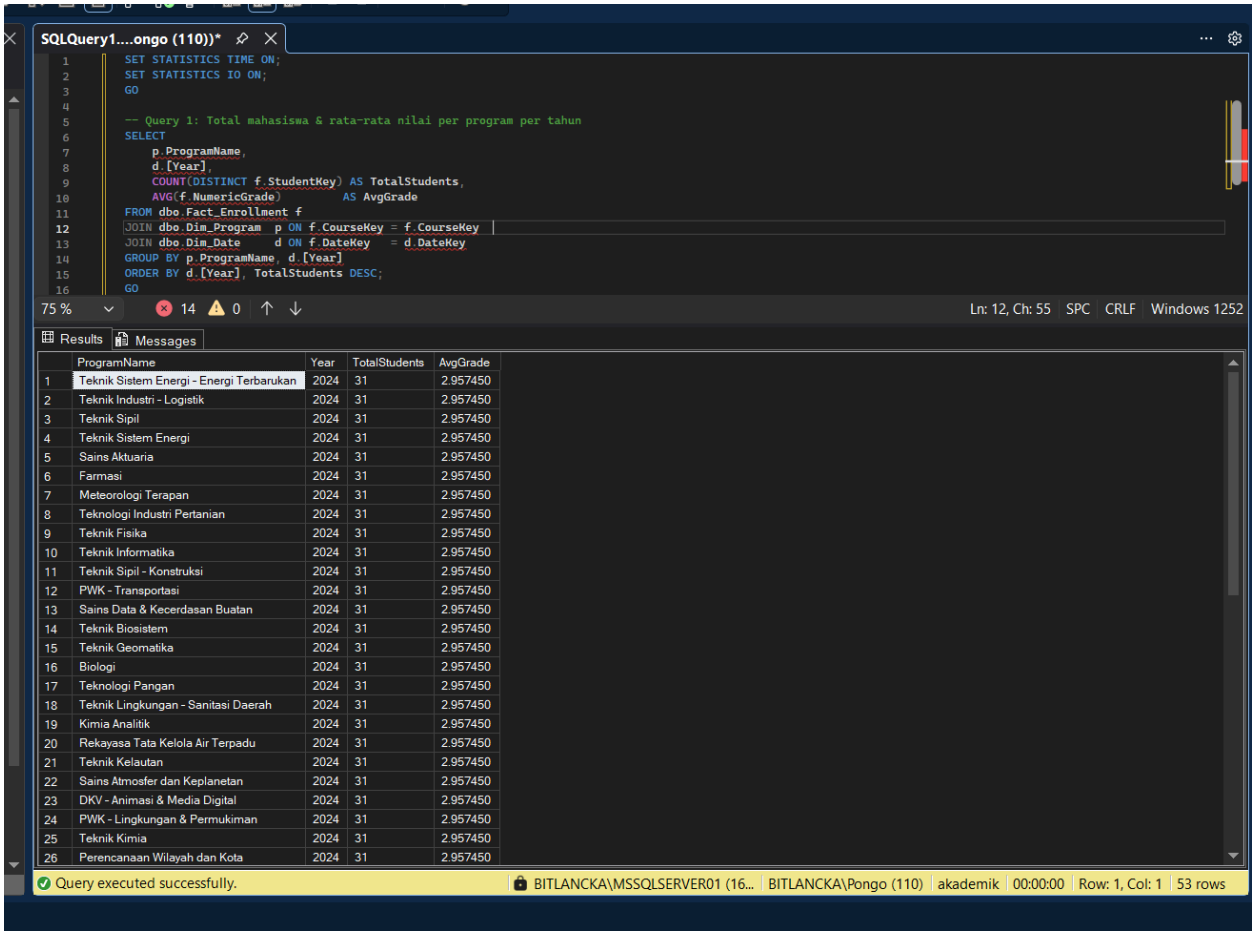
```
JOIN dbo.Dim_Course c ON f.CourseKey = c.CourseKey
JOIN dbo.Dim_Program p ON c.ProgramNaturalID = p.ProgramCode
GROUP BY p.ProgramName, d.[Year]
ORDER BY d.[Year], p.ProgramName;

-- 2. Monthly enrollment trend
SELECT
   d.[Year], d.[Month],
   COUNT(*) AS TotalEnrollments
FROM dbo.Fact_Enrollment f
JOIN dbo.Dim_Date d ON f.DateKey = d.DateKey
GROUP BY d.[Year], d.[Month]
ORDER BY d.[Year], d.[Month];
GO

-- 3. – Funnel Admission → Enrollment → Graduation per Program per Tahun
;WITH Adm AS (
   SELECT
      a.ProgramKey,
      d.[Year] AS AdmissionYear,
      COUNT(DISTINCT a.StudentKey) AS TotalApplicants
   FROM dbo.Fact_Admission a
   JOIN dbo.Dim_Date d ON a.AdmissionDateKey = d.DateKey
   GROUP BY a.ProgramKey, d.[Year]
),
Enr AS (
   SELECT
      c.ProgramNaturalID,
      d.[Year] AS EnrollmentYear,
      COUNT(DISTINCT f.StudentKey) AS TotalEnrolled
   FROM dbo.Fact_Enrollment f
   JOIN dbo.Dim_Course c ON f.CourseKey = c.CourseKey
   JOIN dbo.Dim_Date d   ON f.DateKey   = d.DateKey
   GROUP BY c.ProgramNaturalID, d.[Year]
),
Grad AS (
   SELECT
      g.ProgramKey,
      d.[Year] AS GraduationYear,
      COUNT(DISTINCT g.StudentKey) AS TotalGraduated
   FROM dbo.Fact_Graduation g
   JOIN dbo.Dim_Date d ON g.GraduationDateKey = d.DateKey
   GROUP BY g.ProgramKey, d.[Year]
```

```
)
SELECT
   p.ProgramName,
   a.AdmissionYear,
   a.TotalApplicants,
   ISNULL(e.TotalEnrolled, 0)  AS TotalEnrolled,
   ISNULL(g.TotalGraduated, 0) AS TotalGraduated,
   CASE WHEN a.TotalApplicants = 0
        THEN 0 ELSE 1.0 * ISNULL(e.TotalEnrolled, 0) / a.TotalApplicants END AS
Conv_Adm_to_Enroll,
   CASE WHEN a.TotalApplicants = 0
        THEN 0 ELSE 1.0 * ISNULL(g.TotalGraduated, 0) / a.TotalApplicants END AS
Conv_Adm_to_Grad
FROM Adm a
JOIN dbo.Dim_Program p ON a.ProgramKey = p.ProgramKey
LEFT JOIN Enr e
   ON p.ProgramCode = e.ProgramNaturalID
  AND a.AdmissionYear = e.EnrollmentYear
LEFT JOIN Grad g
   ON a.ProgramKey   = g.ProgramKey
  AND a.AdmissionYear = g.GraduationYear
ORDER BY p.ProgramName, a.AdmissionYear;
GO

-- 4: Distribusi lama studi dan GPA per program
SELECT
   p.ProgramName,
   COUNT(*)                    AS TotalGraduates,
   AVG(g.GPA)                  AS AvgGPA,
   MIN(g.GPA)                  AS MinGPA,
   MAX(g.GPA)                  AS MaxGPA,
   AVG(CAST(g.StudyDuration AS FLOAT)) AS AvgStudyMonths,
   MIN(g.StudyDuration)        AS MinStudyMonths,
   MAX(g.StudyDuration)        AS MaxStudyMonths
FROM dbo.Fact_Graduation g
JOIN dbo.Dim_Program p ON g.ProgramKey = p.ProgramKey
GROUP BY p.ProgramName
ORDER BY p.ProgramName;
GO

-- 5: Top 10 mahasiswa per program (GPA + SKS)
;WITH GradDetail AS (
   SELECT
```

```
        g.StudentKey,
        s.StudentNaturalID,
        s.FullName,
        p.ProgramName,
        g.GPA,
        g.TotalCredits,
        ROW_NUMBER() OVER (
            PARTITION BY p.ProgramName
            ORDER BY g.GPA DESC, g.TotalCredits DESC
        ) AS rn
    FROM dbo.Fact_Graduation g
    JOIN dbo.Dim_Student s ON g.StudentKey = s.StudentKey
    JOIN dbo.Dim_Program p ON g.ProgramKey = p.ProgramKey
)
SELECT
    ProgramName,
    rn AS RankInProgram,
    StudentNaturalID,
    FullName,
    GPA,
    TotalCredits
FROM GradDetail
WHERE rn <= 10
ORDER BY ProgramName, rn;
GO

-- 6: Pengaruh Attendance terhadap NumericGrade
;WITH EnrBucket AS (
    SELECT
        CASE
            WHEN AttendanceRate < 60 THEN '< 60%'
            WHEN AttendanceRate < 75 THEN '60–74%'
            WHEN AttendanceRate < 90 THEN '75–89%'
            ELSE '>= 90%'
        END AS AttendanceBucket,
        NumericGrade
    FROM dbo.Fact_Enrollment
    WHERE NumericGrade IS NOT NULL
)
SELECT
    AttendanceBucket,
    COUNT(*)              AS TotalEnrollments,
    AVG(NumericGrade)     AS AvgGrade,
```

```
    MIN(NumericGrade)       AS MinGrade,
    MAX(NumericGrade)       AS MaxGrade
FROM EnrBucket
GROUP BY AttendanceBucket
ORDER BY
    CASE AttendanceBucket
        WHEN '< 60%'  THEN 1
        WHEN '60–74%' THEN 2
        WHEN '75–89%' THEN 3
        WHEN '>= 90%' THEN 4
    END;
GO

-- 7: Trend enrollment per semester dan program
SELECT
    sem.SemesterCode,
    d.[Year],
    p.ProgramName,
    COUNT(*)                    AS TotalEnrollments,
    COUNT(DISTINCT f.StudentKey)   AS DistinctStudents,
    AVG(f.NumericGrade)         AS AvgGrade
FROM dbo.Fact_Enrollment f
JOIN dbo.Dim_Semester sem ON f.SemesterKey = sem.SemesterKey
JOIN dbo.Dim_Date d       ON f.DateKey     = d.DateKey
JOIN dbo.Dim_Course c     ON f.CourseKey   = c.CourseKey
JOIN dbo.Dim_Program p    ON c.ProgramNaturalID = p.ProgramCode
GROUP BY sem.SemesterCode, d.[Year], p.ProgramName
ORDER BY d.[Year], sem.SemesterCode, p.ProgramName;
GO
```

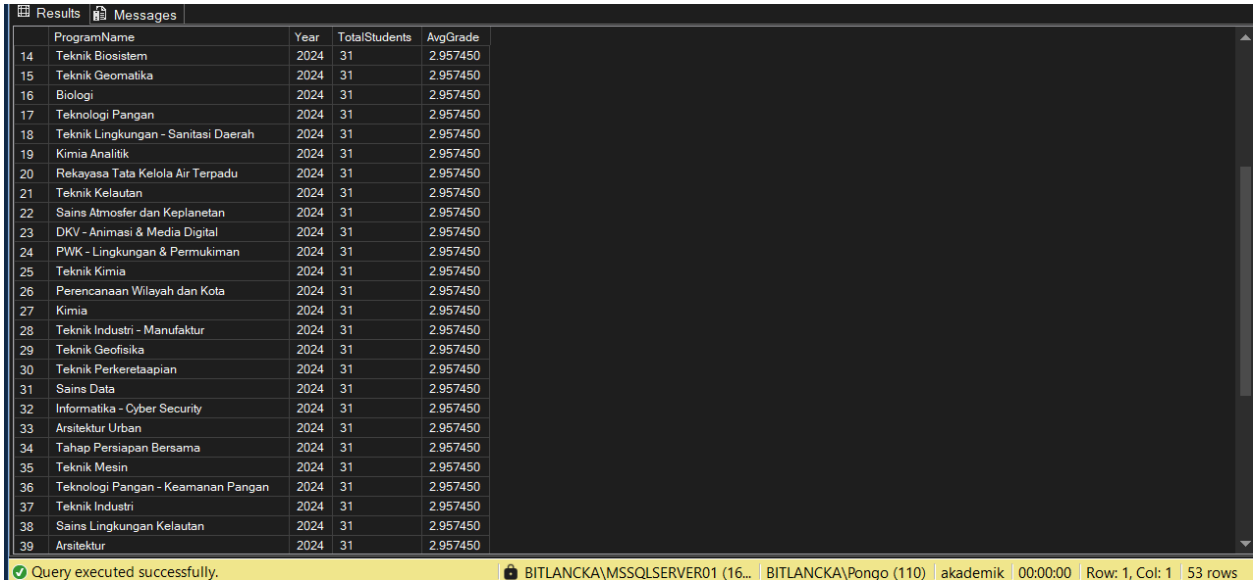
Output:



	ProgramName	Year	TotalStudents	AvgGrade
1	Teknik Sistem Energi - Energi Terbarukan	2024	31	2.957450
2	Teknik Industri - Logistik	2024	31	2.957450
3	Teknik Sipil	2024	31	2.957450
4	Teknik Sistem Energi	2024	31	2.957450
5	Sains Aktuaria	2024	31	2.957450
6	Farmasi	2024	31	2.957450
7	Meteorologi Terapan	2024	31	2.957450
8	Teknologi Industri Pertanian	2024	31	2.957450
9	Teknik Fisika	2024	31	2.957450
10	Teknik Informatika	2024	31	2.957450
11	Teknik Sipil - Konstruksi	2024	31	2.957450
12	PWK - Transportasi	2024	31	2.957450
13	Sains Data & Kecerdasan Buatan	2024	31	2.957450
14	Teknik Biosistem	2024	31	2.957450
15	Teknik Geomatika	2024	31	2.957450
16	Biologi	2024	31	2.957450
17	Teknologi Pangan	2024	31	2.957450
18	Teknik Lingkungan - Sanitasi Daerah	2024	31	2.957450
19	Kimia Analitik	2024	31	2.957450
20	Rekayasa Tata Kelola Air Terpadu	2024	31	2.957450
21	Teknik Kelautan	2024	31	2.957450
22	Sains Atmosfer dan Keplanetan	2024	31	2.957450
23	DKV - Animasi & Media Digital	2024	31	2.957450
24	PWK - Lingkungan & Permukiman	2024	31	2.957450
25	Teknik Kimia	2024	31	2.957450
26	Perencanaan Wilayah dan Kota	2024	31	2.957450

	ProgramName	Year	TotalStudents	AvgGrade
29	Teknik Geofisika	2024	31	2.957450
30	Teknik Perkeretaapian	2024	31	2.957450
31	Sains Data	2024	31	2.957450
32	Informatika - Cyber Security	2024	31	2.957450
33	Arsitektur Urban	2024	31	2.957450
34	Tahap Persiapan Bersama	2024	31	2.957450
35	Teknik Mesin	2024	31	2.957450
36	Teknologi Pangan - Keamanan Pangan	2024	31	2.957450
37	Teknik Industri	2024	31	2.957450
38	Sains Lingkungan Kelautan	2024	31	2.957450
39	Arsitektur	2024	31	2.957450
40	Fisika	2024	31	2.957450
41	DKV - Branding & Identitas Visual	2024	31	2.957450
42	Informatika - Software Development	2024	31	2.957450
43	Fisika Instrumentasi	2024	31	2.957450
44	Arsitektur Lanskap	2024	31	2.957450
45	Teknik Lingkungan	2024	31	2.957450
46	Matematika Terapan & Statistika	2024	31	2.957450
47	Desain Komunikasi Visual	2024	31	2.957450
48	Matematika	2024	31	2.957450
49	Teknik Sipil - Transportasi	2024	31	2.957450
50	Teknik Elektro	2024	31	2.957450
51	Teknik Mesin - Energi	2024	31	2.957450
52	Biologi Mikrobiologi	2024	31	2.957450
53	Fisika Material	2024	31	2.957450

Query executed successfully. BITLANCK

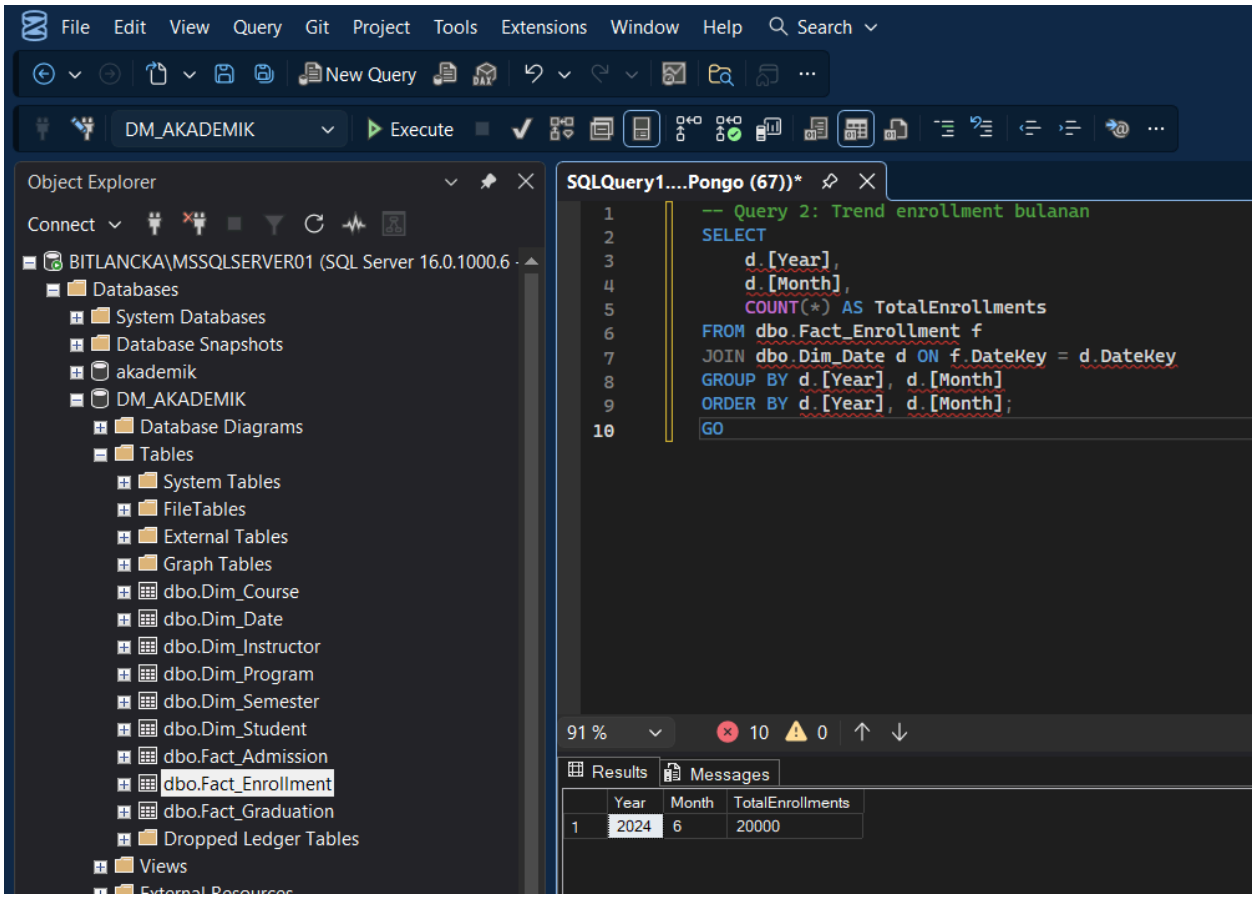


Results | Messages

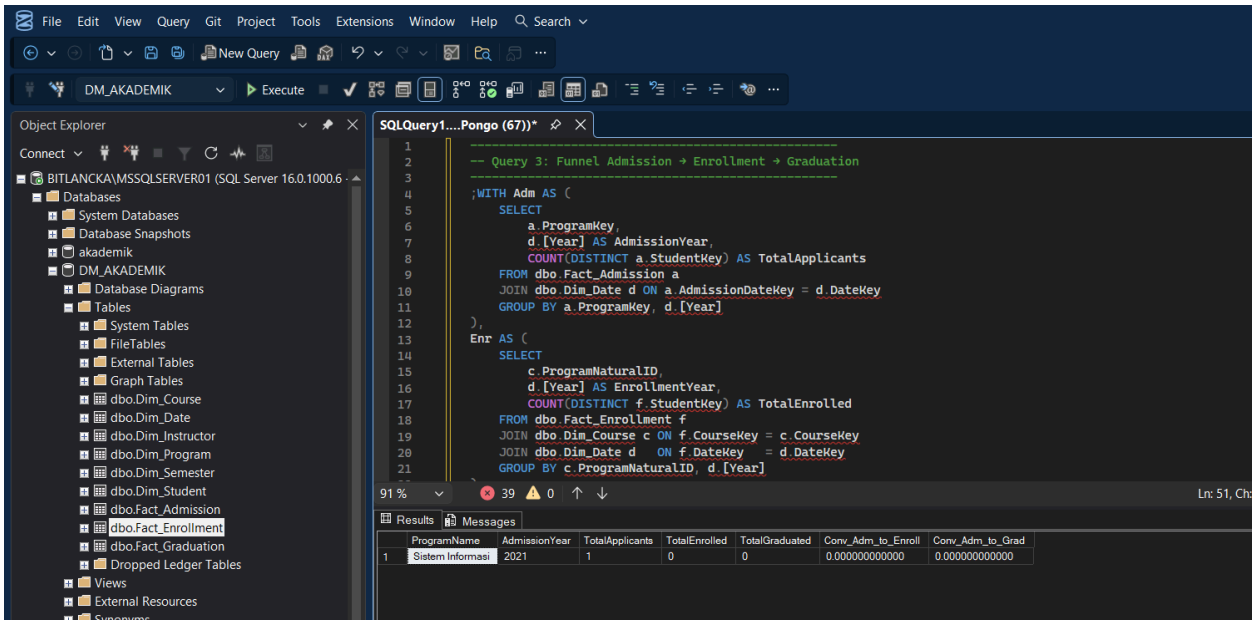
	ProgramName	Year	TotalStudents	AvgGrade
14	Teknik Biosistem	2024	31	2.957450
15	Teknik Geomatika	2024	31	2.957450
16	Biologi	2024	31	2.957450
17	Teknologi Pangan	2024	31	2.957450
18	Teknik Lingkungan - Sanitasi Daerah	2024	31	2.957450
19	Kimia Analitik	2024	31	2.957450
20	Rekayasa Tata Kelola Air Terpadu	2024	31	2.957450
21	Teknik Kelautan	2024	31	2.957450
22	Sains Atmosfer dan Keplanetan	2024	31	2.957450
23	DKV - Animasi & Media Digital	2024	31	2.957450
24	PWK - Lingkungan & Permukiman	2024	31	2.957450
25	Teknik Kimia	2024	31	2.957450
26	Perencanaan Wilayah dan Kota	2024	31	2.957450
27	Kimia	2024	31	2.957450
28	Teknik Industri - Manufaktur	2024	31	2.957450
29	Teknik Geofisika	2024	31	2.957450
30	Teknik Perkeretaapian	2024	31	2.957450
31	Sains Data	2024	31	2.957450
32	Informatika - Cyber Security	2024	31	2.957450
33	Arsitektur Urban	2024	31	2.957450
34	Tahap Persiapan Bersama	2024	31	2.957450
35	Teknik Mesin	2024	31	2.957450
36	Teknologi Pangan - Keamanan Pangan	2024	31	2.957450
37	Teknik Industri	2024	31	2.957450
38	Sains Lingkungan Kelautan	2024	31	2.957450
39	Arsitektur	2024	31	2.957450

Query executed successfully. | BITLANCKA\MSSQLSERVER01 (16... | BITLANCKA\Pongo (110) | akademik | 00:00:00 | Row: 1, Col: 1 | 53 rows

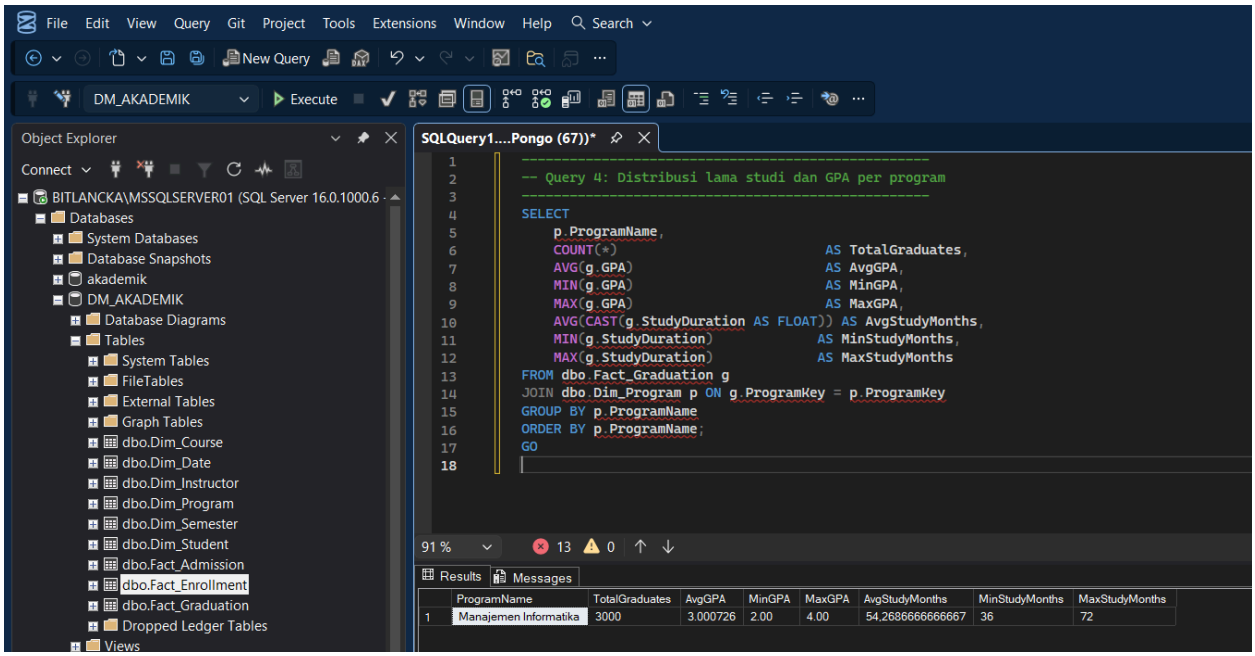
Query pertama digunakan untuk menghitung rata-rata nilai (NumericGrade) mahasiswa pada setiap program studi untuk setiap tahun akademik. Dengan menggabungkan tabel fact enrollment, dimensi tanggal, dan dimensi program, query ini membantu melihat *kualitas akademik rata-rata* tiap program dari tahun ke tahun. Hasilnya dapat digunakan untuk analisis performa program, tren peningkatan atau penurunan IP mahasiswa, serta menjadi indikator mutu pendidikan



Query ini digunakan untuk melihat jumlah pendaftaran/enrollment per bulan pada setiap tahun. Data ini bermanfaat untuk menganalisis *pola musiman* pendaftaran mahasiswa, misalnya apakah ada lonjakan pada awal semester atau penurunan pada bulan tertentu. Dengan tren bulanan ini, institusi dapat melakukan perencanaan kapasitas kelas, evaluasi jadwal akademik, atau kebutuhan sumber daya.

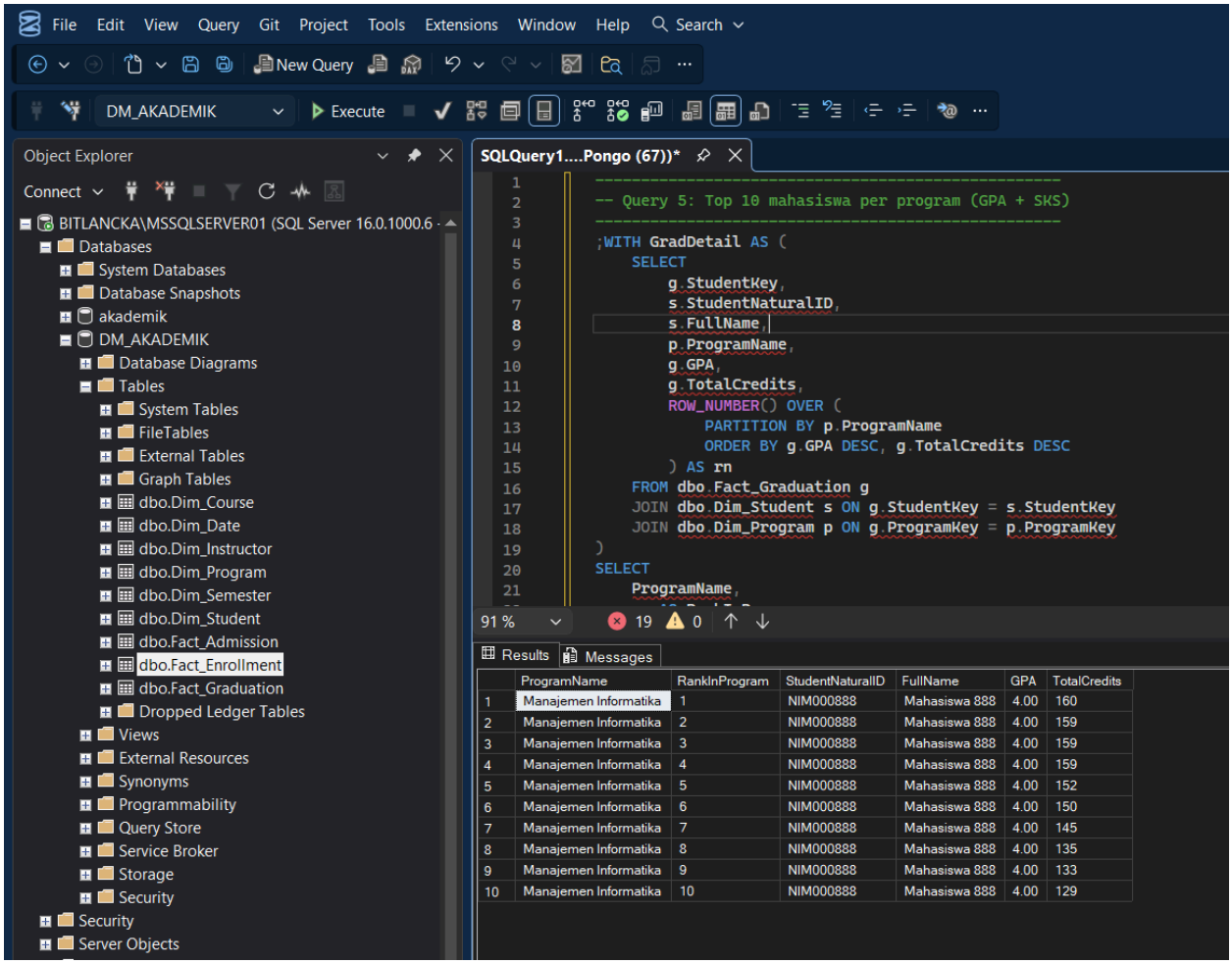


Query ketiga membangun *funnel analisis*, yaitu alur dari pendaftaran (admission) ke keterdaftaran dalam mata kuliah (enrollment) hingga kelulusan (graduation). Analisis funnel seperti ini sangat penting untuk melihat *rasio konversi* pada setiap tahapan pendidikan. Misalnya, berapa banyak dari pendaftar yang benar-benar masuk kuliah, dan berapa banyak dari mereka yang berhasil lulus. Data ini membantu mengukur efektivitas program studi serta menemukan potensi masalah seperti dropout.

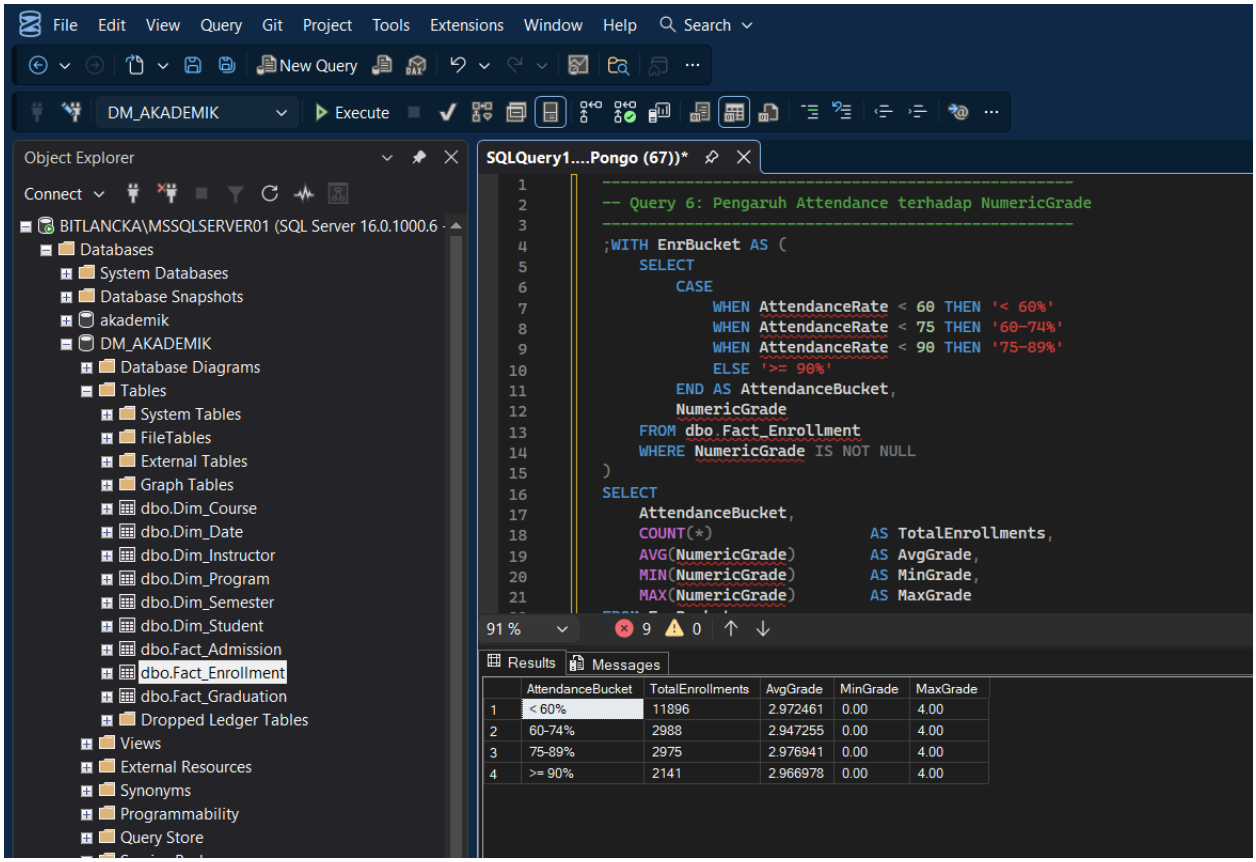


Query ini menghitung distribusi lama studi dan GPA (IPK) bagi mahasiswa yang telah lulus pada setiap program. Hasilnya mencakup jumlah lulusan, rata-rata IPK, IPK minimum-maksimum, serta lama studi rata-rata hingga lulus. Output ini penting untuk

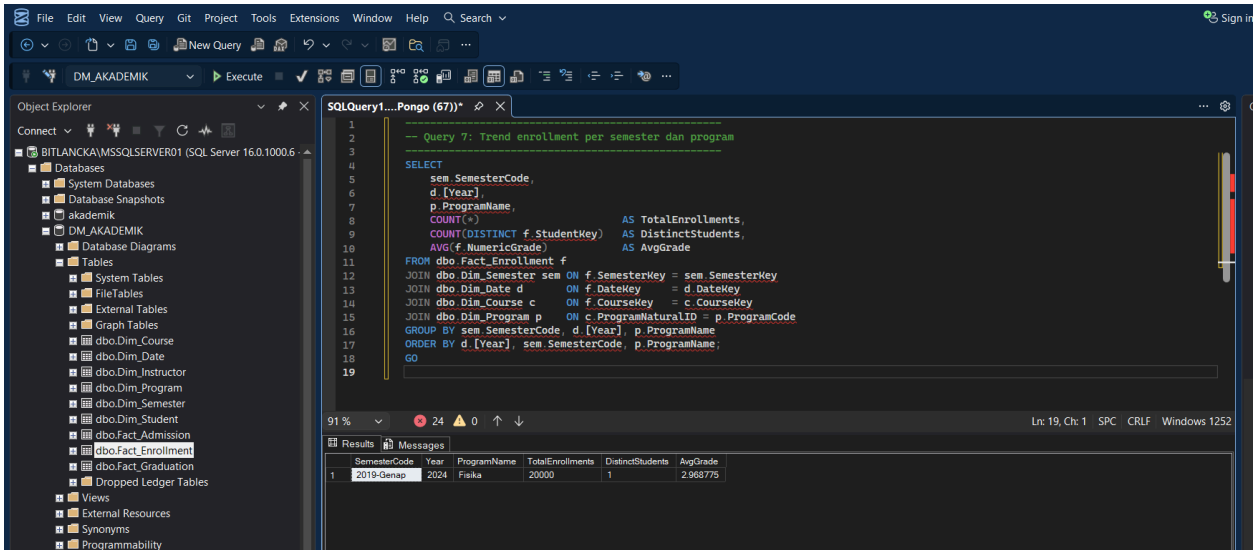
menganalisis *mutu lulusan*, konsistensi performa akademik, serta efektivitas kurikulum suatu program studi.



Query ini menyusun daftar 10 mahasiswa terbaik pada setiap program berdasarkan GPA dan jumlah SKS. Dengan menggunakan ranking per program, institusi dapat dengan mudah mengidentifikasi mahasiswa berprestasi, memberikan penghargaan, atau memanfaatkan data ini untuk laporan akreditasi. Query ini juga menunjukkan kualitas lulusan unggulan di masing-masing program.



Query keenam mengelompokkan mahasiswa berdasarkan persentase kehadiran (AttendanceRate) ke dalam bucket (misalnya <60%, 60–74%, 75–89%, ≥90%). Kemudian dihitung rata-rata nilai, nilai minimum, dan maksimum pada tiap kelompok. Analisis ini bertujuan melihat apakah *tingkat kehadiran berpengaruh terhadap nilai*, dan biasanya menunjukkan korelasi positif antara kehadiran tinggi dan nilai lebih baik.
Query keenam mengelompokkan mahasiswa berdasarkan persentase kehadiran (AttendanceRate) ke dalam bucket (misalnya <60%, 60–74%, 75–89%, ≥90%). Kemudian dihitung rata-rata nilai, nilai minimum, dan maksimum pada tiap kelompok. Analisis ini bertujuan melihat apakah *tingkat kehadiran berpengaruh terhadap nilai*, dan biasanya menunjukkan korelasi positif antara kehadiran tinggi dan nilai lebih baik.



Query terakhir memberikan gambaran jumlah enrollment, jumlah mahasiswa unik, dan rata-rata nilai pada setiap semester untuk tiap program studi. Data ini membantu memantau perkembangan jumlah peserta kelas per semester, mengidentifikasi perubahan jumlah mahasiswa, dan menganalisis performa akademik berdasarkan semester. Informasi ini bermanfaat untuk perencanaan akademik dan monitoring kapasitas program.