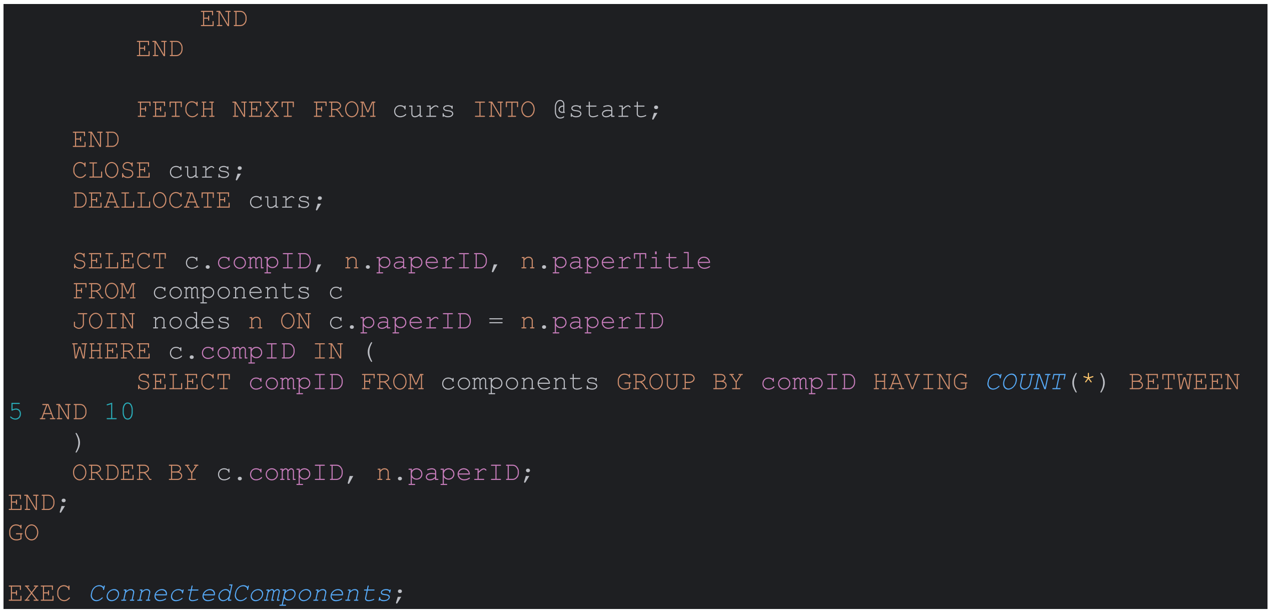
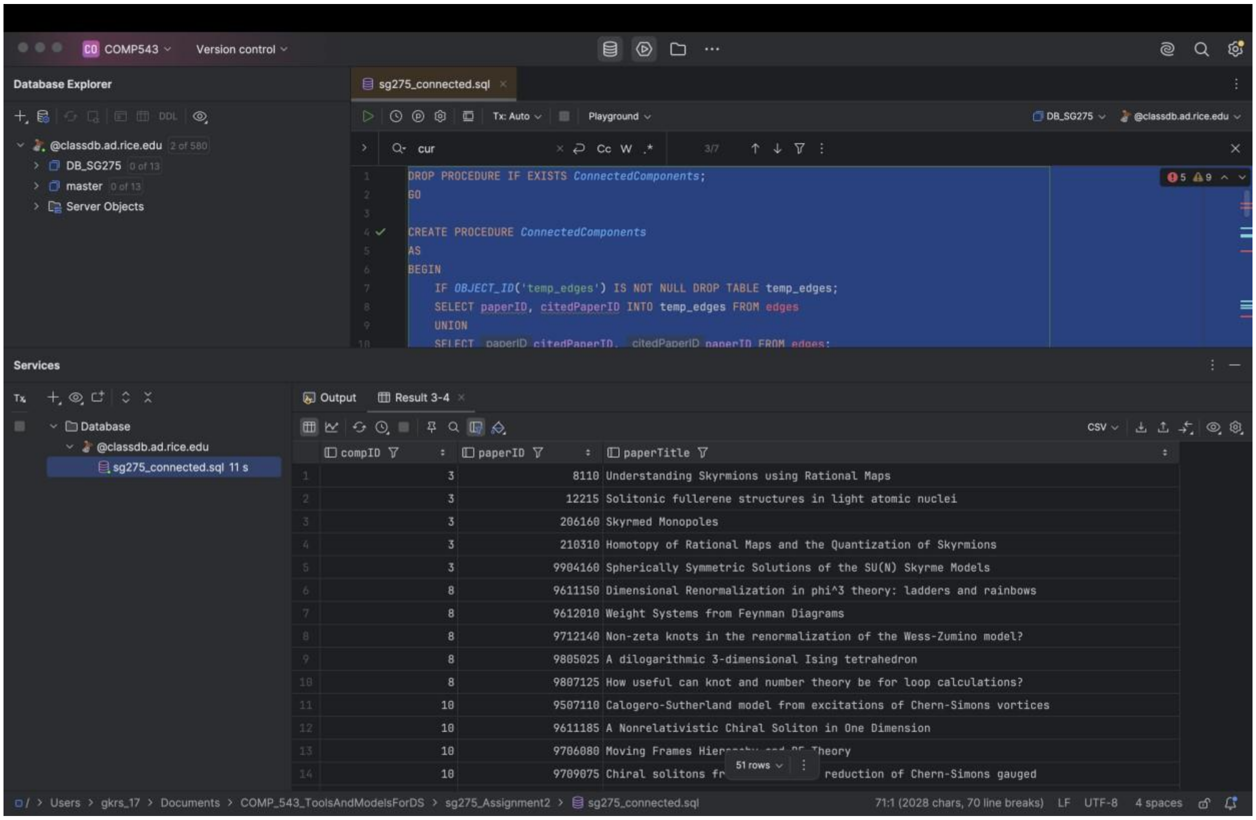
Task 1 Connected Components

```
DROP PROCEDURE IF EXISTS ConnectedComponents;
GO

CREATE PROCEDURE ConnectedComponents
AS
BEGIN
    IF OBJECT_ID('temp_edges') IS NOT NULL DROP TABLE temp_edges;
    SELECT paperID, citedPaperID INTO temp_edges FROM edges
    UNION
    SELECT citedPaperID, paperID FROM edges;

    IF OBJECT_ID('components') IS NOT NULL DROP TABLE components;
    CREATE TABLE components (
        paperID INT,
        compID INT
    );

    DECLARE @compID INT = 0;

    DECLARE curs CURSOR FOR SELECT paperID FROM nodes;
    DECLARE @start INT;

    OPEN curs;
    FETCH NEXT FROM curs INTO @start;
    WHILE @@FETCH_STATUS = 0
    BEGIN
        IF NOT EXISTS (SELECT 1 FROM components WHERE paperID = @start)
        BEGIN
            SET @compID = @compID + 1;

            IF OBJECT_ID('queue') IS NOT NULL DROP TABLE queue;
            CREATE TABLE queue (paperID INT PRIMARY KEY);

            INSERT INTO queue VALUES (@start);

            WHILE EXISTS (SELECT 1 FROM queue)
            BEGIN
                INSERT INTO components (paperID, compID)
                SELECT q.paperID, @compID
                FROM queue q
                WHERE NOT EXISTS (SELECT 1 FROM components c WHERE c.paperID = q.paperID);

                DELETE q
                FROM queue q
                JOIN components c ON q.paperID = c.paperID;

                INSERT INTO queue
                SELECT DISTINCT e.citedPaperID
                FROM temp_edges e
                JOIN components c ON e.paperID = c.paperID AND c.compID = @compID
                WHERE NOT EXISTS (SELECT 1 FROM components cc WHERE cc.paperID = e.citedPaperID);
```



```
                END
            END

            FETCH NEXT FROM curs INTO @start;
        END
        CLOSE curs;
        DEALLOCATE curs;

        SELECT c.compID, n.paperID, n.paperTitle
        FROM components c
        JOIN nodes n ON c.paperID = n.paperID
        WHERE c.compID IN (
            SELECT compID FROM components GROUP BY compID HAVING COUNT(*) BETWEEN
5 AND 10
        )
        ORDER BY c.compID, n.paperID;
END;
GO

EXEC ConnectedComponents;
```



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GO

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AS
BEGIN
    IF OBJECT_ID('temp_edges') IS NOT NULL DROP TABLE temp_edges;
    SELECT paperID, citedPaperID INTO temp_edges FROM edges
    UNION
    SELECT  paperID citedPaperID,  citedPaperID paperID FROM edges;
```

compID	paperID	paperTitle
3	8110	Understanding Skyrmions using Rational Maps
3	12215	Solitonic fullerene structures in light atomic nuclei
3	206160	Skyrmed Monopoles
3	210310	Homotopy of Rational Maps and the Quantization of Skyrmions
3	9904160	Spherically Symmetric Solutions of the SU(N) Skyrme Models
8	9611150	Dimensional Renormalization in phi^3 theory: ladders and rainbows
8	9612010	Weight Systems from Feynman Diagrams
8	9712140	Non-zeta knots in the renormalization of the Wess-Zumino model?
8	9805025	A dilogarithmic 3-dimensional Ising tetrahedron
8	9807125	How useful can knot and number theory be for loop calculations?
10	9507110	Calogero-Sutherland model from excitations of Chern-Simons vortices
10	9611185	A Nonrelativistic Chiral Soliton in One Dimension
10	9706080	Moving Frames Hier[illegible] Theory
10	9709075	Chiral solitons fr[illegible] reduction of Chern-Simons gauged

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Task 2 PageRank

```
DROP PROCEDURE IF EXISTS ComputePR;
GO

CREATE PROCEDURE ComputePR
AS
BEGIN
    DECLARE @d FLOAT = 0.85;
    DECLARE @delta FLOAT = 1.0;
    DECLARE @n INT;

    SELECT @n = COUNT(*) FROM nodes;

    IF OBJECT_ID('pagerank') IS NOT NULL DROP TABLE pagerank;
    CREATE TABLE pagerank (paperID INT PRIMARY KEY, rank FLOAT);

    INSERT INTO pagerank
    SELECT paperID, 1.0/@n FROM nodes;

    IF OBJECT_ID('outdeg') IS NOT NULL DROP TABLE outdeg;
    SELECT paperID, COUNT(*) AS outdeg INTO outdeg FROM edges GROUP BY
paperID;

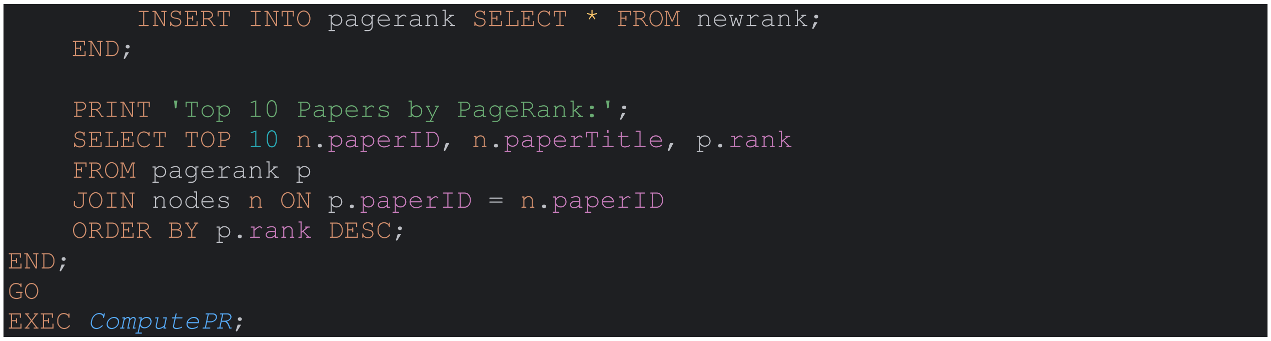
    WHILE @delta > 0.01
    BEGIN
        IF OBJECT_ID('newrank') IS NOT NULL DROP TABLE newrank;
        CREATE TABLE newrank (paperID INT PRIMARY KEY, rank FLOAT);

        INSERT INTO newrank
        SELECT n.paperID,
               (1.0 - @d)/@n +
               @d * (
                   ISNULL((
                       SELECT SUM(pr.rank / od.outdeg)
                       FROM edges e
                       JOIN pagerank pr ON e.paperID = pr.paperID
                       JOIN outdeg od ON e.paperID = od.paperID
                       WHERE e.citedPaperID = n.paperID
                   ), 0)
               )
        FROM nodes n;

        DECLARE @sinkRank FLOAT = (
            SELECT SUM(pr.rank)
            FROM pagerank pr
            WHERE pr.paperID NOT IN (SELECT paperID FROM outdeg)
        );
        UPDATE newrank
        SET rank = rank + @d * @sinkRank / @n;

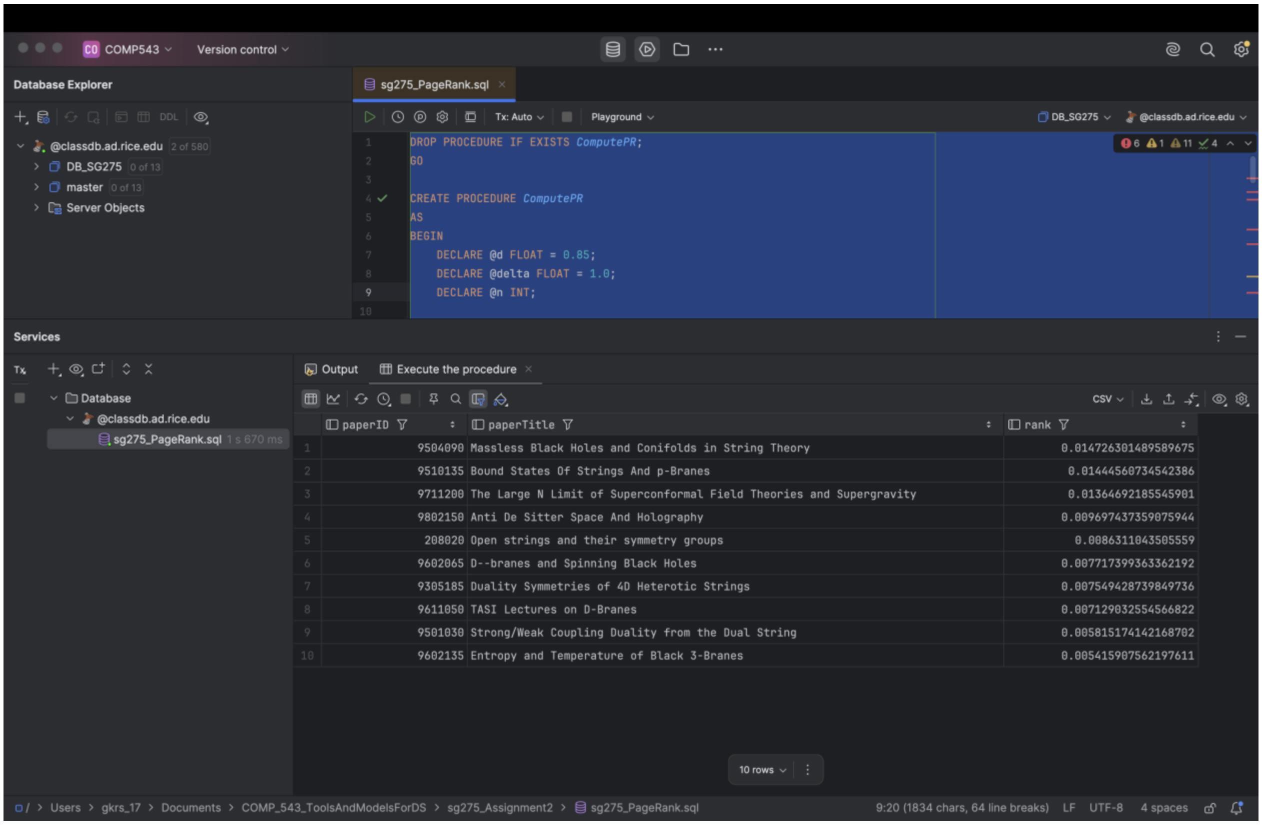
        SELECT @delta = SUM(ABS(n.rank - p.rank))
        FROM newrank n
        JOIN pagerank p ON n.paperID = p.paperID;

        DELETE FROM pagerank;
```



```
        INSERT INTO pagerank SELECT * FROM newrank;
    END;

    PRINT 'Top 10 Papers by PageRank:';
    SELECT TOP 10 n.paperID, n.paperTitle, p.rank
    FROM pagerank p
    JOIN nodes n ON p.paperID = n.paperID
    ORDER BY p.rank DESC;
END;
GO
EXEC ComputePR;
```



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CREATE PROCEDURE ComputePR
AS
BEGIN
    DECLARE @d FLOAT = 0.85;
    DECLARE @delta FLOAT = 1.0;
    DECLARE @n INT;
```

	paperID	paperTitle	rank
1	9504090	Massless Black Holes and Conifolds in String Theory	0.014726301489589675
2	9510135	Bound States Of Strings And p-Branes	0.01444560734542386
3	9711200	The Large N Limit of Superconformal Field Theories and Supergravity	0.01364692185545901
4	9802150	Anti De Sitter Space And Holography	0.009697437359075944
5	208020	Open strings and their symmetry groups	0.0086311043505559
6	9602065	D--branes and Spinning Black Holes	0.007717399363362192
7	9305185	Duality Symmetries of 4D Heterotic Strings	0.007549428739849736
8	9611050	TASI Lectures on D-Branes	0.007129032554566822
9	9501030	Strong/Weak Coupling Duality from the Dual String	0.005815174142168702
10	9602135	Entropy and Temperature of Black 3-Branes	0.005415907562197611