

**Índices y Mejoras en el Desempeño de Consultas**  
**Contratación Pública en Antioquia 2024**

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**Tópicos Avanzados de Bases de Datos**  
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**Agosto 2025**

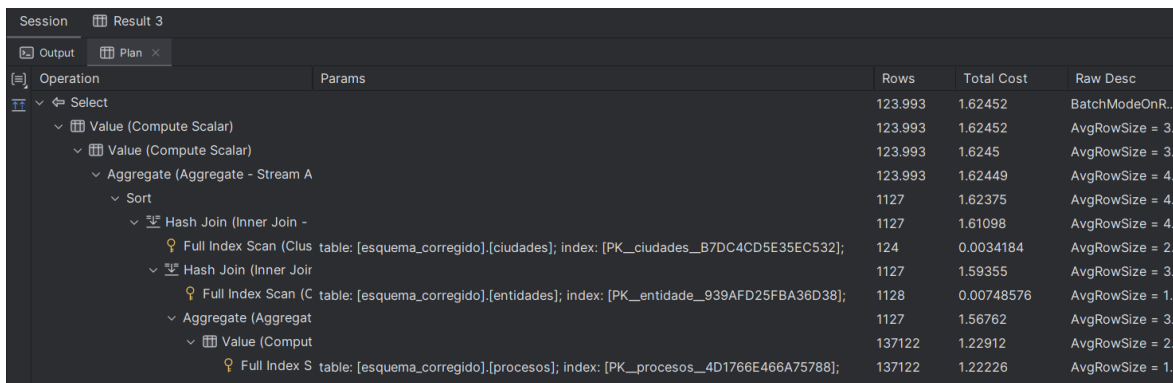
En este documento adjunto los resultados de las consultas tanto sin índices como con índices

### Resultados sin índices de la consulta:

```
SELECT
    c.nombre_ciudad AS ciudad,
    MIN(p.duracion) AS duracion_minima_contrato,
    ROUND(AVG(CAST(p.duracion AS FLOAT)), 2) AS
duracion_promedio_contrato,
    MAX(p.duracion) AS duracion_maxima_contrato
FROM esquema_corregido.procesos p
JOIN esquema_corregido.entidades e
    ON p.id_entidad = e.id_entidad
JOIN esquema_corregido.ciudades c
    ON e.id_ciudad = c.id_ciudad
GROUP BY c.nombre_ciudad
ORDER BY c.nombre_ciudad;
```

-- Índice para acelerar JOIN procesos -> entidades y agregados de duracion  
CREATE INDEX idx\_procesos\_id\_entidad  
ON esquema\_corregido.procesos (id\_entidad, duracion);

-- Índice para acelerar JOIN entidades -> ciudades  
CREATE INDEX idx\_entidades\_id\_ciudad  
ON esquema\_corregido.entidades (id\_ciudad);



Operation	Params	Rows	Total Cost	Raw Desc
Select		123.993	1.62452	BatchModeOnR...
Value (Compute Scalar)		123.993	1.62452	AvgRowSize = 3...
Value (Compute Scalar)		123.993	1.6245	AvgRowSize = 3...
Aggregate (Aggregate - Stream A)		123.993	1.62449	AvgRowSize = 4...
Sort		1127	1.62375	AvgRowSize = 4...
Hash Join (Inner Join -		1127	1.61098	AvgRowSize = 4...
Full Index Scan (Clus table: [esquema_corregido].[ciudades]; index: [PK_ciudades__B7DC4CD5E35EC532];		124	0.0034184	AvgRowSize = 2...
Hash Join (Inner Join		1127	1.59355	AvgRowSize = 3...
Full Index Scan (C table: [esquema_corregido].[entidades]; index: [PK_entidade_939AFD25FBA36D38];		1128	0.00748576	AvgRowSize = 1...
Aggregate (Aggregat		1127	1.56762	AvgRowSize = 3...
Value (Comput		137122	1.22912	AvgRowSize = 2...
Full Index S table: [esquema_corregido].[procesos]; index: [PK_procesos__4D1766E466A75788];		137122	1.22226	AvgRowSize = 1...

## Resultado con Índices:

Operation	Params	Rows	Total Cost	Raw Desc
Select		124	1.47125	BatchModeOnRowSt...
Sort		124	1.47125	AvgRowSize = 35;Es...
Value (Compute Scalar)		124	1.46673	AvgRowSize = 35;Es...
Value (Compute Scalar)		124	1.46672	AvgRowSize = 35;Es...
Aggregate (Aggregate - Hash)		124	1.46672	AvgRowSize = 35;Es...
Join (Inner Join - Adaptive)		137122	1.01024	AdaptiveThresholdR...
Join (Inner Join - Adaptive)		1128	0.0228048	AdaptiveThresholdR...
Full Index Scan	table: [esquema_corregido].[ciudades]; index: [ciudad_departamento_uk];	124	0.0034184	AvgRowSize = 23;Es...
Full Index Scan	table: [esquema_corregido].[entidades]; index: [idx_entidades_id_ciudad];	1128	0.00526354	AvgRowSize = 15;Es...
Index Scan (Index)	table: [esquema_corregido].[entidades]; index: [idx_entidades_id_ciudad];	9.09677	0.0269588	AvgRowSize = 11;Es...
Value (Compute Scalar)		137122	0.579491	AvgRowSize = 23;Es...
Full Index Scan	table: [esquema_corregido].[procesos]; index: [idx_procesos_id_entidad];	137122	0.572635	AvgRowSize = 15;Es...
Index Scan (Index)	table: [esquema_corregido].[procesos]; index: [idx_procesos_id_entidad];	121.562	1.47126	AvgRowSize = 11;Es...

## Resultado sin índices de la consulta:

```

WITH conteos_modalidad AS (
    SELECT mes,
           nombre_modalidad_contratacion,
           COUNT(*) AS cnt,
           ROW_NUMBER() OVER (PARTITION BY mes ORDER BY
COUNT(*) DESC) AS rn
    FROM esquema_corregido.procesos_mes
    GROUP BY mes, nombre_modalidad_contratacion
),
modalidad_top AS (
    SELECT mes, nombre_modalidad_contratacion
    FROM conteos_modalidad
    WHERE rn = 1
),
conteos_tipo AS (
    SELECT mes,
           nombre_tipo_contrato,
           COUNT(*) AS cnt,
           ROW_NUMBER() OVER (PARTITION BY mes ORDER BY
COUNT(*) DESC) AS rn
    FROM esquema_corregido.procesos_mes
    GROUP BY mes, nombre_tipo_contrato

```

```

),
tipo_top AS (
    SELECT mes, nombre_tipo_contrato
    FROM conteos_tipo
    WHERE rn = 1
),
precios_mes AS (
    SELECT mes,
        MIN(precio_base) AS precio_min,
        MAX(precio_base) AS precio_max,
        ROUND(AVG(CAST(precio_base AS FLOAT)), 2) AS precio_prom
    FROM esquema_corregido.procesos_mes
    GROUP BY mes
)
SELECT pm.mes,
    m.nombre_modalidad_contratacion AS modalidad_mas_recurrente,
    t.nombre_tipo_contrato AS tipo_mas_recurrente,
    pm.precio_min,
    pm.precio_max,
    pm.precio_prom,
    COUNT(*) OVER (PARTITION BY pm.mes) AS cantidad_procesos
FROM precios_mes pm
JOIN modalidad_top m ON pm.mes = m.mes
JOIN tipo_top t ON pm.mes = t.mes
ORDER BY pm.mes;

```

Session Result 40			
Output Plan			
Operation	Params	Rows	Total Cost
Select		85644	3.82788
Value (Compute Scalar)		85644	3.82788
Unknown (Window Aggregate)		85644	3.82788
Value (Compute Scalar)		85644	3.69342
Merge Join (Inner Join - Merge)		85644	3.58619
Filter		6588	1.5101
Unknown (Window Aggregate)		6588	1.50851
Sort		6588	1.50819
Value (Compute Scalar)		6588	1.4003
Aggregate (Aggregate)		6588	1.4003
Operations Tree			

## Resultado con Índices:

The screenshot shows a SQL query in a dark-themed IDE. The query is as follows:

```
60 m.nombre_modalidad_contratacion AS modalidad_mas_recurrente,  
61 t.nombre_tipo_contrato AS tipo_mas_recurrente,  
62 pm.precio_min,  
63 pm.precio_max,  
64 pm.precio_prom,  
65 COUNT(*) OVER (PARTITION BY pm.mes) AS cantidad_procesos  
66 FROM precios_mes pm  
67 JOIN modalidad_top m ON pm.mes = m.mes  
68 JOIN tipo_top t ON pm.mes = t.mes  
69 ORDER BY pm.mes;  
70  
71 SELECT  
72 mes,
```

Below the query, the execution plan is displayed. The plan shows a sequence of operations: Select, Value (Compute Scalar), Unknown (Window Aggregate), Value (Compute Scalar), Merge Join (Inner Join - Merge J), Filter, Unknown (Window Aggregate), Sort, Value (Compute Sca), and Aggregate (Aggregate). The plan also shows the number of rows, total cost, and raw description for each operation.

Operation	Rows	Total Cost	Raw Desc
Select	85644	2.95266	BatchModeOnR...
Value (Compute Scalar)	85644	2.95266	AvgRowSize = 2...
Unknown (Window Aggregate)	85644	2.95266	AvgRowSize = 2...
Value (Compute Scalar)	85644	2.8182	AvgRowSize = 2...
Merge Join (Inner Join - Merge J)	85644	2.71098	AvgRowSize = 2...
Filter	6588	0.775623	AvgRowSize = 1...
Unknown (Window Aggregate)	6588	0.774042	AvgRowSize = 1...
Sort	6588	0.773713	AvgRowSize = 1...
Value (Compute Sca)	6588	0.661858	AvgRowSize = 1...
Aggregate (Aggregate)	6588	0.661858	AvgRowSize = 1...

## Resultado sin Indices de la consulta:

SELECT

mes,

MIN(precio\_base) AS precio\_minimo,

MAX(precio\_base) AS precio\_maximo,

ROUND(AVG(CAST(precio\_base AS FLOAT)), 2) AS precio\_promedio

FROM esquema\_corregido.procesos\_mes

GROUP BY mes

ORDER BY mes;

The screenshot shows the same SQL query as above, but without the indexes. The execution plan is displayed, showing a sequence of operations: Select, Value (Compute Scalar), Value (Compute Scalar), Aggregate (Aggregate), and Value (Compute S). The plan also shows the number of rows, total cost, and raw description for each operation.

Operation	Rows	Total Cost	Raw Desc
Select	366	0.736417	BatchModeOnRowS...
Value (Compute Scalar)	366	0.736417	AvgRowSize = 38;E...
Value (Compute Scalar)	366	0.736381	AvgRowSize = 38;E...
Aggregate (Aggregate)	366	0.736381	AvgRowSize = 38;E...
Value (Compute S)	137047	0.653559	AvgRowSize = 30;E...
Full Index Scan table: [esquema_corregido].[procesos_mes]; index: [idx_procesos_mes_clustered];	73820	0.646706	AvgRowSize = 22;E...

## Resultado con Índices:

```
SELECT
    mes,
    MIN(precio_base) AS precio_minimo,
    MAX(precio_base) AS precio_maximo,
    ROUND(AVG(CAST(precio_base AS FLOAT)), 2) AS precio_promedio
FROM esquema_corregido.procesos_mes
GROUP BY mes
ORDER BY mes;

-- índice para búsquedas y agrupaciones por mes
CREATE NONCLUSTERED INDEX idx_procesos_mes_mes
ON esquema_corregido.procesos_mes (mes);
```

Session Result 41

Output Plan

Operation	Params	Rows	Total Cost	Raw Desc
Select		366	0.666047	BatchModeOnRowS...
Value (Compute Scalar)		366	0.666047	AvgRowSize = 38;E...
Value (Compute Scalar)		366	0.66601	AvgRowSize = 38;E...
Aggregate (Aggregate - :)		366	0.66601	AvgRowSize = 38;E...
Value (Compute Si		137047	0.583188	AvgRowSize = 30;E...
Full Index Scan	table: [esquema_corregido].[procesos_mes]; index: [idx_procesos_mes_precios];	73820	0.576336	AvgRowSize = 22;E...

Operations Tree