


```

      WHEN "SUBQ"."FIRSTMEASUREMENTDATE" THEN "BM"."WEIGHT" END )>0.06)
8 - access("BM"."USERID"="SUBQ"."USERID")
15 - access("U"."USERID"="SUBQCTE"."USERID")
    filter("U"."USERID"="SUBQCTE"."USERID")
17 - access("U"."USERID"="D2"."USERID")
    filter("U"."USERID"="D2"."USERID")
18 - filter("DBMS_LOB"."INSTR"(INTERNAL_FUNCTION("D2"."MEALDESCRIPTION"), 'the')>0)
19 - access("U"."USERID"="D"."USERID")
    filter("U"."USERID"="D"."USERID")
20 - filter("D"."MEALDATE">=TO_DATE(' 2018-01-01 00:00:00', 'yyyy-mm-dd hh24:mi:ss') AND "D"."MEALDATE"<TO_DATE('
      2019-01-01 00:00:00', 'yyyy-mm-dd hh24:mi:ss'))

```

- [view original](#) (query plan)

1.2 QUERY 2

1.2.1 Partition by hash

```

CREATE TABLE HealthRecordsMod
(
  RecordID NUMBER PRIMARY KEY,
  UserID NUMBER,
  RecordDate DATE,
  BloodPressure VARCHAR2(10),
  CholesterolLevel NUMBER,
  HeartRate NUMBER,
  Notes CLOB,
  FOREIGN KEY (UserID) REFERENCES MEMBERS(UserID)
)
PARTITION BY HASH(UserID) PARTITIONS 4;

```

- [view modified query](#)

	Original Query (seconds)	Query with hash partition
Run 1	3.6679887771606445	3.3190224170684814
Run 2	3.6720266342163086	3.210211753845215
Run 3	3.657158136367798	3.2407665252685547
Average	3.67	3.256

1.2.2 Query Plan

PLAN_TABLE_OUTPUT										
Plan hash value: 2665936367										
	Id	Operation	Name	Rows	Bytes	TempSpc	Cost (%CPU)	Time	Pstart	Pstop
	0	SELECT STATEMENT		142K	14M		18453 (1)	00:00:01		
	1	SORT ORDER BY		142K	14M	15M	18453 (1)	00:00:01		
*	2	HASH JOIN RIGHT SEMI		142K	14M	11M	15023 (1)	00:00:01		
	3	PART JOIN FILTER CREATE	:BF0000	353K	7585K		6315 (1)	00:00:01		
	4	VIEW	VW_NSO_2	353K	7585K		6315 (1)	00:00:01		
	5	HASH GROUP BY		353K	7585K		6315 (1)	00:00:01		
	6	PARTITION HASH ALL		353K	7585K		6294 (1)	00:00:01	1	4
	7	TABLE ACCESS FULL	HEALTHRECORDSMOD	353K	7585K		6294 (1)	00:00:01	1	4
*	8	HASH JOIN		142K	11M		7486 (1)	00:00:01		
	9	PART JOIN FILTER CREATE	:BF0001	193	6948		1188 (3)	00:00:01		
	10	NESTED LOOPS		193	6948		1188 (3)	00:00:01		
	11	NESTED LOOPS		267	6948		1188 (3)	00:00:01		
	12	VIEW	VW_NSO_1	267	1335		918 (4)	00:00:01		
*	13	HASH GROUP BY		267	3471		918 (4)	00:00:01		
	14	TABLE ACCESS FULL	EXERCISEACTIVITIES	5403	70239		917 (4)	00:00:01		
*	15	INDEX UNIQUE SCAN	SYS_C008324	1			1 (0)	00:00:01		
*	16	TABLE ACCESS BY INDEX ROWID	MEMBERS	1	31		2 (0)	00:00:01		
	17	PARTITION HASH AND		353K	16M		6295 (1)	00:00:01	KEY(AP)	KEY(AP)
	18	TABLE ACCESS FULL	HEALTHRECORDSMOD	353K	16M		6295 (1)	00:00:01	KEY(AP)	KEY(AP)
Predicate Information (identified by operation id):										
2 - access("HR"."USERID"="USERID" AND "HR"."RECORDDATE"="MAX(RECORDDATE)")										
8 - access("U"."USERID"="HR"."USERID")										

```

13 - filter(COUNT(*)>0)
14 - filter(EXTRACT(YEAR FROM INTERNAL_FUNCTION("ACTIVITYDATE"))=2017)
15 - access("U"."USERID"="USERID")
16 - filter("U"."GENDER"='M' AND TRUNC(MONTHS_BETWEEN(SYSDATE@!,INTERNAL_FUNCTION("U"."BIRTHDATE"))/12)>=25 AND
      TRUNC(MONTHS_BETWEEN(SYSDATE@!,INTERNAL_FUNCTION("U"."BIRTHDATE"))/12)<=35)

```

- [view original](#) (query plan)

1.2.3 Partition by range for user id, for comparison with hash

```

CREATE TABLE HealthRecordsModNew
(
  RecordID NUMBER PRIMARY KEY,
  UserID NUMBER,
  RecordDate DATE,
  BloodPressure VARCHAR2(10),
  CholesterolLevel NUMBER,
  HeartRate NUMBER,
  Notes CLOB,
  FOREIGN KEY (UserID) REFERENCES MEMBERS(UserID)
)
PARTITION BY RANGE (UserID) (
  PARTITION p1 VALUES LESS THAN (40000),
  PARTITION p2 VALUES LESS THAN (80000),
  PARTITION p3 VALUES LESS THAN (120000),
  PARTITION p_max_value VALUES LESS THAN (MAXVALUE)
);

```

- [view modified query](#)

	Original Query (seconds)	Query with range partition
Run 1	3.6679887771606445	0.5901393890380859
Run 2	3.6720266342163086	0.6251513957977295
Run 3	3.657158136367798	0.6021437644958496
Average	3.67	0.605

1.2.4 Query Plan

PLAN_TABLE_OUTPUT										
Plan hash value: 262661078										
	Id	Operation	Name	Rows	Bytes	TempSpc	Cost (%CPU)	Time	Pstart	Pstop
	0	SELECT STATEMENT		142K	14M		18478 (1)	00:00:01		
	1	SORT ORDER BY		142K	14M	15M	18478 (1)	00:00:01		
*	2	HASH JOIN RIGHT SEMI		142K	14M	11M	15041 (1)	00:00:01		
	3	PART JOIN FILTER CREATE	:BF0000	362K	7792K		6316 (1)	00:00:01		
	4	VIEW	VW_NSO_2	362K	7792K		6316 (1)	00:00:01		
	5	HASH GROUP BY		362K	7792K		6316 (1)	00:00:01		
	6	PARTITION RANGE ALL		362K	7792K		6294 (1)	00:00:01	1	4
	7	TABLE ACCESS FULL	HEALTHRECORDSMODNEW	362K	7792K		6294 (1)	00:00:01	1	4
*	8	HASH JOIN		142K	11M		7486 (1)	00:00:01		
	9	PART JOIN FILTER CREATE	:BF0001	193	6948		1188 (3)	00:00:01		
	10	NESTED LOOPS		193	6948		1188 (3)	00:00:01		
	11	NESTED LOOPS		267	6948		1188 (3)	00:00:01		
	12	VIEW	VW_NSO_1	267	1335		918 (4)	00:00:01		
*	13	HASH GROUP BY		267	3471		918 (4)	00:00:01		
	14	TABLE ACCESS FULL	EXERCISEACTIVITIES	5403	70239		917 (4)	00:00:01		
*	15	INDEX UNIQUE SCAN	SYS_C008324	1			1 (0)	00:00:01		
*	16	TABLE ACCESS BY INDEX ROWID	MEMBERS	1	31		2 (0)	00:00:01		
	17	PARTITION RANGE AND		362K	16M		6296 (1)	00:00:01	KEY (AP)	KEY (AP)
	18	TABLE ACCESS FULL	HEALTHRECORDSMODNEW	362K	16M		6296 (1)	00:00:01	KEY (AP)	KEY (AP)
Predicate Information (identified by operation id):										
2 - access("HR"."USERID"="USERID" AND "HR"."RECORDDATE"=MAX(RECORDDATE))										
8 - access("U"."USERID"="HR"."USERID")										

```

13 - filter(COUNT(*)>0)
14 - filter(EXTRACT(YEAR FROM INTERNAL_FUNCTION("ACTIVITYDATE"))=2017)
15 - access("U"."USERID"="USERID")
16 - filter("U"."GENDER"='M' AND TRUNC(MONTHS_BETWEEN(SYSDATE@!,INTERNAL_FUNCTION("U"."BIRTHDATE"))/12)>=25 AND
      TRUNC(MONTHS_BETWEEN(SYSDATE@!,INTERNAL_FUNCTION("U"."BIRTHDATE"))/12)<=35)

```

- [view original](#) (query plan)

2 QUERY PLANS

2.1 QUERY 1

PLAN_TABLE_OUTPUT							
Plan hash value: 630115401							
Id	Operation	Name	Rows	Bytes	TempSpc	Cost (%CPU)	Time
0	SELECT STATEMENT		749	88382		9275 (3)	00:00:01
* 1	HASH JOIN SEMI		749	88382		9275 (3)	00:00:01
* 2	HASH JOIN		1371	140K		7795 (4)	00:00:01
* 3	HASH JOIN		7827	473K		6204 (2)	00:00:01
4	VIEW		7827	298K		5072 (3)	00:00:01
* 5	FILTER						
6	HASH GROUP BY		7827	313K		5072 (3)	00:00:01
* 7	HASH JOIN		618K	24M	5352K	5035 (2)	00:00:01
8	VIEW		156K	3515K		2716 (2)	00:00:01
9	HASH GROUP BY		156K	1987K	14M	2716 (2)	00:00:01
10	TABLE ACCESS FULL	BODYMEASUREMENTS	618K	7846K		1170 (1)	00:00:01
11	TABLE ACCESS FULL	BODYMEASUREMENTS	618K	10M		1172 (2)	00:00:01
12	TABLE ACCESS FULL	MEMBERS	154K	3469K		1131 (1)	00:00:01
* 13	TABLE ACCESS FULL	DIETLOG	27062	1136K		1591 (8)	00:00:01
* 14	TABLE ACCESS FULL	DIETLOG	108K	1378K		1479 (1)	00:00:01

Predicate Information (identified by operation id):

```

1 - access("U"."USERID"="D"."USERID")
2 - access("U"."USERID"="D2"."USERID")
3 - access("U"."USERID"="SUBQCTE"."USERID")
5 - filter((MAX(CASE "BM"."MEASUREMENTDATE" WHEN "SUBQ"."LASTMEASUREMENTDATE" THEN
      "BM"."WEIGHT" END )-MIN(CASE "BM"."MEASUREMENTDATE" WHEN "SUBQ"."FIRSTMEASUREMENTDATE" THEN
      "BM"."WEIGHT" END ))/MIN(CASE "BM"."MEASUREMENTDATE" WHEN "SUBQ"."FIRSTMEASUREMENTDATE" THEN
      "BM"."WEIGHT" END )>0.06)
7 - access("BM"."USERID"="SUBQ"."USERID")
13 - filter("DBMS_LOB"."INSTR"(INTERNAL_FUNCTION("D2"."MEALDESCRIPTION"),'the')>0)
14 - filter("D"."MEALDATE">=TO_DATE(' 2018-01-01 00:00:00', 'syyy-mm-dd hh24:mi:ss') AND
      "D"."MEALDATE"<TO_DATE(' 2019-01-01 00:00:00', 'syyy-mm-dd hh24:mi:ss'))

```

2.2 QUERY 2

PLAN_TABLE_OUTPUT							
Plan hash value: 1760211671							
Id	Operation	Name	Rows	Bytes	TempSpc	Cost (%CPU)	Time
0	SELECT STATEMENT		193	15826		13354 (1)	00:00:01
1	SORT ORDER BY		193	15826		13354 (1)	00:00:01
* 2	HASH JOIN SEMI		193	15826		13353 (1)	00:00:01
* 3	HASH JOIN		490	33320		6707 (1)	00:00:01
4	NESTED LOOPS		193	7913		1188 (3)	00:00:01
5	NESTED LOOPS		267	7913		1188 (3)	00:00:01
6	VIEW	VW_NSQ_1	267	1335		918 (4)	00:00:01

* 7	HASH GROUP BY		267	3471		918	(4)	00:00:01	
* 8	TABLE ACCESS FULL	EXERCISEACTIVITIES	5403	70239		917	(4)	00:00:01	
* 9	INDEX UNIQUE SCAN	SYS_C008324	1			1	(0)	00:00:01	
* 10	TABLE ACCESS BY INDEX ROWID	MEMBERS	1	36		2	(0)	00:00:01	
11	TABLE ACCESS FULL	HEALTHRECORDS	385K	9M		5516	(1)	00:00:01	
12	VIEW	VW_NSO_2	151K	2075K		6645	(1)	00:00:01	
13	HASH GROUP BY		151K	1927K	9088K	6645	(1)	00:00:01	
14	TABLE ACCESS FULL	HEALTHRECORDS	385K	4898K		5514	(1)	00:00:01	

Predicate Information (identified by operation id):

```

2 - access("HR"."USERID"="USERID" AND "HR"."RECORDDATE"="MAX(RECORDDATE)")
3 - access("U"."USERID"="HR"."USERID")
7 - filter(COUNT(*)>0)
8 - filter(EXTRACT(YEAR FROM INTERNAL_FUNCTION("ACTIVITYDATE"))=2017)
9 - access("U"."USERID"="USERID")
10 - filter("U"."GENDER"='M' AND TRUNC(MONTHS_BETWEEN(TO_DATE(' 2023-01-01 00:00:00', 'yyyy-mm-dd hh24:mi:ss'),INTERNAL_FUNCTION("BIRTHDATE"))/12)>=25 AND TRUNC(MONTHS_BETWEEN(TO_DATE(' 2023-01-01 00:00:00', 'yyyy-mm-dd hh24:mi:ss'),INTERNAL_FUNCTION("BIRTHDATE"))/12)<=35)

```

3 QUERIES

3.1 Q1 ORIGINAL

```

WITH SubqCTE AS (
  SELECT
    BM.UserID,
    MAX(CASE WHEN BM.MeasurementDate = Subq.LastMeasurementDate THEN BM.Weight END) AS
LastWeight,
    MIN(CASE WHEN BM.MeasurementDate = Subq.FirstMeasurementDate THEN BM.Weight END) AS
FirstWeight
  FROM
    BodyMeasurements BM
  JOIN (
    SELECT
      BM.UserID,
      MAX(BM.MeasurementDate) AS LastMeasurementDate,
      MIN(BM.MeasurementDate) AS FirstMeasurementDate
    FROM
      BodyMeasurements BM
    GROUP BY
      BM.UserID
  ) Subq
  ON BM.UserID = Subq.UserID
  GROUP BY
    BM.UserID, Subq.LastMeasurementDate, Subq.FirstMeasurementDate
)

SELECT
  U.UserID,
  U.FirstName,
  U.LastName,
  (SubqCTE.LastWeight - SubqCTE.FirstWeight) / SubqCTE.FirstWeight AS WeightChangeRatio,
  U.Gender,
  D2.MEALDESCRIPTION
FROM
  Members U
JOIN SubqCTE ON U.UserID = SubqCTE.UserID
JOIN DIETLOG D2 ON U.USERID = D2.USERID
WHERE
  (SubqCTE.LastWeight - SubqCTE.FirstWeight) / SubqCTE.FirstWeight > 0.06
  AND EXISTS (

```

```

SELECT 1
FROM DietLog D
WHERE U.UserID = D.UserID
AND D.MealDate >= TO_DATE('2018-01-01', 'YYYY-MM-DD')
AND D.MealDate < TO_DATE('2019-01-01', 'YYYY-MM-DD')
)
AND DBMS_LOB.INSTR(D2.MEALDESCRIPTION, 'the') > 0;

```

3.2 Q2 ORIGINAL

```

WITH RecentHealthRecords AS (
  SELECT
    hr.UserID,
    hr.HeartRate,
    hr.CholesterolLevel
  FROM
    HealthRecords hr
  WHERE
    (hr.UserID, hr.RecordDate) IN (
      SELECT UserID, MAX(RecordDate)
      FROM HealthRecords
      GROUP BY UserID
    )
)
SELECT
  u.UserID,
  u.FirstName,
  u.LastName,
  rhr.HeartRate,
  rhr.CholesterolLevel
FROM
  Members u
JOIN
  RecentHealthRecords rhr ON u.UserID = rhr.UserID
WHERE
  u.Gender = 'M'
  AND TRUNC(MONTHS_BETWEEN(TO_DATE('2023-01-01', 'YYYY-MM-DD'), u.BirthDate) / 12) BETWEEN
25 AND 35
  AND u.UserID IN (
    SELECT UserID
    FROM ExerciseActivities
    WHERE EXTRACT(YEAR FROM ActivityDate) = 2017
    GROUP BY UserID
    HAVING COUNT(*) > 0
  )
ORDER BY u.UserID;

```

4 MODIFIED QUERIES

```

sql_query_pt1 = """WITH SubqCTE AS (
  SELECT
    BM.UserID,
    MAX(CASE WHEN BM.MeasurementDate = Subq.LastMeasurementDate THEN BM.Weight END) AS
LastWeight,
    MIN(CASE WHEN BM.MeasurementDate = Subq.FirstMeasurementDate THEN BM.Weight END) AS
FirstWeight
  FROM
    BodyMeasurementsMod BM

```

```

        JOIN (
            SELECT
                BM.UserID,
                MAX(BM.MeasurementDate) AS LastMeasurementDate,
                MIN(BM.MeasurementDate) AS FirstMeasurementDate
            FROM
                BodyMeasurementsMod BM
            GROUP BY
                BM.UserID
        ) Subq
    ON BM.UserID = Subq.UserID
    GROUP BY
        BM.UserID, Subq.LastMeasurementDate, Subq.FirstMeasurementDate
)

SELECT
    U.UserID,
    U.FirstName,
    U.LastName,
    (SubqCTE.LastWeight - SubqCTE.FirstWeight) / SubqCTE.FirstWeight AS WeightChangeRatio,
    U.Gender,
    D2.MEALDESCRIPTION
FROM
    Members U
JOIN SubqCTE ON U.UserID = SubqCTE.UserID
JOIN DIETLOG D2 ON U.USERID = D2.USERID
WHERE
    (SubqCTE.LastWeight - SubqCTE.FirstWeight) / SubqCTE.FirstWeight > 0.06
    AND EXISTS (
        SELECT 1
        FROM DietLog D
        WHERE U.UserID = D.UserID
        AND D.MealDate >= TO_DATE('2018-01-01', 'YYYY-MM-DD')
        AND D.MealDate < TO_DATE('2019-01-01', 'YYYY-MM-DD')
    )
    AND DBMS_LOB.INSTR(D2.MEALDESCRIPTION, 'the') > 0""

sql_query_pt2 = ""WITH RecentHealthRecordsMod AS (
    SELECT
        hr.UserID,
        hr.HeartRate,
        hr.CholesterolLevel
    FROM
        HealthRecordsMod hr
    WHERE
        (hr.UserID, hr.RecordDate) IN (
            SELECT UserID, MAX(RecordDate)
            FROM HealthRecordsMod
            GROUP BY UserID
        )
)
SELECT
    u.UserID,
    u.FirstName,
    u.LastName,
    rhr.HeartRate,
    rhr.CholesterolLevel
FROM
    Members u
JOIN
    RecentHealthRecordsMod rhr ON u.UserID = rhr.UserID
WHERE
    u.Gender = 'M'

```

```

        AND TRUNC(MONTHS_BETWEEN(SYSDATE, u.BirthDate) / 12) BETWEEN 25 AND 35
        AND u.UserID IN (
            SELECT UserID
            FROM ExerciseActivities
            WHERE EXTRACT(YEAR FROM ActivityDate) = 2017
            GROUP BY UserID
            HAVING COUNT(*) > 0
        )
    ORDER BY u.UserID""""

sql_query_pt3 = """"WITH RecentHealthRecordsModNew AS (
    SELECT
        hr.UserID,
        hr.HeartRate,
        hr.CholesterolLevel
    FROM
        HealthRecordsModNew hr
    WHERE
        (hr.UserID, hr.RecordDate) IN (
            SELECT UserID, MAX(RecordDate)
            FROM HealthRecordsModNew
            GROUP BY UserID
        )
)
SELECT
    u.UserID,
    u.FirstName,
    u.LastName,
    rhr.HeartRate,
    rhr.CholesterolLevel
FROM
    Members u
JOIN
    RecentHealthRecordsModNew rhr ON u.UserID = rhr.UserID
WHERE
    u.Gender = 'M'
    AND TRUNC(MONTHS_BETWEEN(SYSDATE, u.BirthDate) / 12) BETWEEN 25 AND 35
    AND u.UserID IN (
        SELECT UserID
        FROM ExerciseActivities
        WHERE EXTRACT(YEAR FROM ActivityDate) = 2017
        GROUP BY UserID
        HAVING COUNT(*) > 0
    )
ORDER BY u.UserID""""

```