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**ИНСТИТУТ ИНТЕЛЛЕКТУАЛЬНЫХ КИБЕРНЕТИЧЕСКИХ СИСТЕМ**

**Кафедра №42 (криптологии и кибербезопасности)**

**ОТЧЕТ ПО ЛАБОРАТОРНОЙ РАБОТЕ №1-4**

«Data Warehousing»

по дисциплине: «Безопасность систем баз данных»

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# **Описание содержания таблицы**

Диаграмма базы данных:



Новые таблицы в базе данных:

* *timestamps* – хранит значения времени с точностью до дня;
* *market\_values* – хранит значения трансферной стоимости футболистов (с учетом временного периода).

# **Описание характерных участков данных**

Данные для поиска:

1. Сведения о футболистах, трансферная стоимость которых превышает 80 миллионов евро.
2. Сведения о футболистах, трансферная стоимость которых изменяется по V-образному закону в течение трех трансферных окон (лето 2022 – зима 2023).

Запросы к базе данных:

* SELECT \*  
   FROM market\_values  
   MATCH\_RECOGNIZE (  
   PARTITION BY player\_id  
   ORDER BY player\_id  
   MEASURES  
   MATCH\_NUMBER() AS match\_number  
   ALL ROWS PER MATCH  
   PATTERN (^ gt80)  
   DEFINE  
   gt80 AS player\_market\_value > 80  
   ) MR  
   INNER JOIN players  
   ON MR.player\_id = players.player\_id  
   ORDER BY match\_number;
* SELECT \*  
   FROM market\_values  
   MATCH\_RECOGNIZE (  
   PARTITION BY player\_id  
   ORDER BY order\_id  
   MEASURES  
   STRT.timestamp\_id AS start\_tstamp,  
   LAST(DOWN.timestamp\_id) AS bottom\_tstamp,  
   LAST(UP.timestamp\_id) AS end\_tstamp,  
   MATCH\_NUMBER() AS match\_number  
   ALL ROWS PER MATCH  
   AFTER MATCH SKIP TO LAST DOWN  
   PATTERN (STRT UP+ FLAT\* DOWN+)  
   DEFINE  
   DOWN AS DOWN.player\_market\_value < PREV(DOWN.player\_market\_value),  
   FLAT AS FLAT.player\_market\_value = PREV(FLAT.player\_market\_value),  
   UP AS UP.player\_market\_value > PREV(UP.player\_market\_value)  
   ) MR  
   INNER JOIN players  
   ON MR.player\_id = players.player\_id  
   ORDER BY  
   MR.player\_id,  
   MR.start\_tstamp;

Структура запроса MATCH\_RECOGNIZE:

* PARTITION BY player\_id – разделение данных по игрокам;
* ORDER BY player\_id – разделение данных в порядке возрастания номера футболиста;
* MEASURES – определение мер:
  + match\_number – число, которое отражает соответствие между строками и совпадениями;
  + start\_tstamp – временная метка начала графика,
  + bottom\_tstamp – временная метка нижней части графика,
  + end\_tstamp – временная метка конца графика;
* ALL ROWS PER MATCH – вывод всех строк в совпадении;
* AFTER MATCH SKIP TO LAST DOWN – возобновление поиска в строке, которая является последней в переменной DOWN;
* PATTERN (^ gt80) – использование переменной gt80 в шаблоне поиска (превышение трансферной стоимостью футболиста значения в 80 миллионов евро);
* PATTERN (STRT UP+ FLAT\* DOWN+) – использование переменных STRT, UP, FLAT и DOWN в шаблоне поиска (V-образная зависимость трансферной стоимости футболиста от времени);
* DEFINE – определение условий сопоставления строк с переменными шаблона (сравнение значений трансферной стоимости футболистов в разные трансферные окна).

# **Список таблиц фактов и измерений**

Основы Data Warehousing:

1. Таблицы фактов – это таблицы, записи которых являются неизменяемыми «фактами», такими как журналы службы и сведения об измерениях. Записи постепенно добавляются в таблицу в потоковой манере и остаются там до тех пор, пока не будут удалены из-за затрат или потери их ценности. В противном случае записи не обновляются.
2. Таблицы измерений – это таблицы, записи которых являются описательными атрибутами – текстовыми полями или дискретными числами. Такие атрибуты предназначены для выполнения двух важнейших задач: ограничения запросов и маркировки результирующего набора запросов.

Таблицы фактов и измерений в базе данных:

* *timestamps* – является таблицей измерений, поскольку содержит временные атрибуты, которые предназначены для маркировки результирующего набора запросов;
* *market\_values* – является таблицей фактов, поскольку содержит неизменяемые значения трансферной стоимости футболистов (с учетом временного периода), которые постепенно добавляются в потоковой манере.

# **Описание разработанных измерений атрибутов и иерархий**

Путем использования таблицы timestamps создается измерение атрибутов временного типа, а также соответствующая временная иерархия:

* измерение атрибута time\_attr\_dim определяет уровни иерархии time\_hier, составляющих даты открытия и закрытия трансферного окна, и отношения временных атрибутов между уровнями;
* иерархия time\_hier определяет иерархические отношения между уровнями измерения атрибута, составляющих даты открытия и закрытия трансферного окна.

Запросы к базе данных:

* CREATE OR REPLACE ATTRIBUTE DIMENSION time\_attr\_dim  
  USING timestamps  
  ATTRIBUTES (timestamp\_id, day, month, year)  
  LEVEL timestamp\_id  
   KEY timestamp\_id  
   MEMBER NAME TO\_CHAR(timestamp\_id)  
   MEMBER CAPTION TO\_CHAR(timestamp\_id)  
   DETERMINES (day, month, year)  
  LEVEL day  
   KEY day  
   MEMBER NAME TO\_CHAR(day)  
   MEMBER CAPTION TO\_CHAR(day)  
  LEVEL month  
   KEY month  
   MEMBER NAME TO\_CHAR(month)  
   MEMBER CAPTION TO\_CHAR(month)  
  LEVEL year  
   KEY year  
   MEMBER NAME TO\_CHAR(year)  
   MEMBER CAPTION TO\_CHAR(year);
* CREATE OR REPLACE HIERARCHY time\_hier  
  USING time\_attr\_dim  
   (timestamp\_id CHILD OF  
   day CHILD OF  
   month CHILD OF  
   year);
* SELECT  
   day,  
   month,  
   year,  
   member\_name,  
   member\_unique\_name,  
   member\_caption,  
   member\_description  
  FROM time\_hier  
  ORDER BY hier\_order;

# **Описание смысла метрик**

Путем использования таблицы market\_values создается аналитическое представление:

* аналитическое представление определяет меры, которые описывают суммы значений трансферной стоимости футболистов на каждом уровне временной иерархии.

Запрос к базе данных:

* CREATE OR REPLACE ANALYTIC VIEW market\_values\_av  
   CLASSIFICATION caption VALUE 'Market Values AV'  
   CLASSIFICATION description VALUE 'Market Values Analytic View'  
   CLASSIFICATION created\_by VALUE 'Dmitriy Rodionov'  
  USING market\_values  
  DIMENSION BY  
   (time\_attr\_dim  
   KEY timestamp\_id REFERENCES timestamp\_id  
   HIERARCHIES (  
   time\_hier DEFAULT)  
   )  
  MEASURES  
   (market\_values FACT player\_market\_value  
   CLASSIFICATION caption VALUE 'Market Values'  
   CLASSIFICATION description VALUE 'Player Market Values'  
   CLASSIFICATION format\_string VALUE '999',  
   market\_values\_prior\_period AS  
   (LAG(market\_values) OVER (HIERARCHY time\_hier OFFSET 1))  
   CLASSIFICATION caption VALUE 'Market Values Prior Period'  
   CLASSIFICATION description VALUE 'Market Values Prior Period'  
   CLASSIFICATION format\_string VALUE '999',  
   market\_values\_chg\_prior\_period AS  
   (LAG\_DIFF(market\_values) OVER (HIERARCHY time\_hier OFFSET 1))  
   CLASSIFICATION caption VALUE 'Market Values Change Prior Period'  
   CLASSIFICATION description VALUE 'Market Values Change Prior Period'  
   CLASSIFICATION format\_string VALUE '999'  
  );
* SELECT  
   day,  
   month,  
   year,  
   level\_name,  
   depth,  
   is\_leaf,  
   market\_values,  
   market\_values\_prior\_period,  
   market\_values\_chg\_prior\_period  
  FROM market\_values\_av  
  ORDER BY hier\_order;

# **Заключение**

В данной лабораторной работе изучены аналитические возможности Oracle Database 18c в концепции Data Warehousing. В частности, изучена работа оператора MATCH\_RECOGNIZE, разработано регулярное выражение и обеспечен его поиск в таблице средствами СУБД Oracle Database. В схеме данных выделены таблицы атрибутов и фактов, для которых создано ATTRIBUTE DIMENSION. По созданной ATTRIBUTE DIMENSION разработана иерархия, на базе которой создано аналитическое представление, содержащее несколько различных метрик.

Описанные возможности применяются в ERP-системах при разработке инструментов анализа данных и финансового анализа.

# **Приложения**

SQL-инструкции, использованные в рамках работы:

SQL> CREATE TABLE national\_teams(

2 national\_team\_id NUMBER(3, 0) NOT NULL,

3 national\_team\_name NVARCHAR2(60) NOT NULL,

4 national\_team\_points NUMBER(6, 2) NOT NULL,

5 national\_team\_association NVARCHAR2(10) NOT NULL,

6 PRIMARY KEY (national\_team\_id)

7 );

SQL> CREATE TABLE leagues(

2 league\_id NUMBER(3, 0) NOT NULL,

3 national\_team\_id NUMBER(3, 0) NOT NULL,

4 league\_name NVARCHAR2(50) NOT NULL,

5 PRIMARY KEY (league\_id),

6 FOREIGN KEY (national\_team\_id) REFERENCES national\_teams(national\_team\_id)

7 );

SQL> CREATE TABLE clubs(

2 club\_id NUMBER(5, 0) NOT NULL,

3 league\_id NUMBER(3, 0) NOT NULL,

4 club\_name NVARCHAR2(50) NOT NULL,

5 club\_stadium NVARCHAR2(50) NOT NULL,

6 PRIMARY KEY (club\_id),

7 FOREIGN KEY (league\_id) REFERENCES leagues(league\_id)

8 );

SQL> CREATE TABLE players(

2 player\_id NUMBER(6, 0) NOT NULL,

3 club\_id NUMBER(5, 0) NOT NULL,

4 national\_team\_id NUMBER(3, 0) NOT NULL,

5 player\_name NVARCHAR2(50) NOT NULL,

6 player\_ovr NUMBER(2, 0) NOT NULL,

7 player\_age NUMBER(2, 0) NOT NULL,

8 player\_trait NVARCHAR2(50) NOT NULL,

9 player\_speciality NVARCHAR2(40) NOT NULL,

10 PRIMARY KEY (player\_id),

11 FOREIGN KEY (club\_id) REFERENCES clubs(club\_id),

12 FOREIGN KEY (national\_team\_id) REFERENCES national\_teams(national\_team\_id)

13 );

SQL> CREATE TABLE timestamps(

2 timestamp\_id NUMBER(4, 0) NOT NULL,

3 day NUMBER(2, 0) NOT NULL,

4 month NUMBER(2, 0) NOT NULL,

5 year NUMBER(4, 0) NOT NULL,

6 PRIMARY KEY (timestamp\_id)

7 );

SQL> CREATE TABLE market\_values(

2 market\_value\_id NUMBER(6, 0) NOT NULL,

3 player\_id NUMBER(6, 0) NOT NULL,

4 timestamp\_id NUMBER(4, 0) NOT NULL,

5 player\_market\_value NUMBER(3, 0) NOT NULL,

6 PRIMARY KEY (market\_value\_id),

7 FOREIGN KEY (player\_id) REFERENCES players(player\_id),

8 FOREIGN KEY (timestamp\_id) REFERENCES timestamps(timestamp\_id)

9 );

SQL> CONNECT system/tecatech@"DESKTOP-UG7SO1F:1521/xepdb1";

SQL> GRANT UNLIMITED TABLESPACE TO tecatech\_lab1\_4;

SQL> CONNECT tecatech\_lab1\_4/alpha@"DESKTOP-UG7SO1F:1521/xepdb1";

SQL> INSERT ALL

2 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (1, 'Belgium', 1828.45, 'UEFA')

3 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (2, 'Brazil', 1823.42, 'CONMEBOL')

4 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (3, 'France', 1786.15, 'UEFA')

5 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (4, 'Argentina', 1766.99, 'CONMEBOL')

6 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (5, 'England', 1755.52, 'UEFA')

7 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (6, 'Portugal', 1660.25, 'UEFA')

8 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (7, 'Mexico', 1647.91, 'CONCACAF')

9 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (8, 'Senegal', 1587.78, 'CAF')

10 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (9, 'IR Iran', 1572.89, 'AFC')

11 INTO national\_teams(national\_team\_id, national\_team\_name, national\_team\_points, national\_team\_association) VALUES (10, 'New Zealand', 1161.66, 'OFC')

12 SELECT \* FROM dual;

SQL> INSERT ALL

2 INTO leagues(league\_id, national\_team\_id, league\_name) VALUES (1, 5, 'Premier League')

3 INTO leagues(league\_id, national\_team\_id, league\_name) VALUES (2, 3, 'Ligue 1 Conforama')

4 INTO leagues(league\_id, national\_team\_id, league\_name) VALUES (3, 6, 'Liga NOS')

5 INTO leagues(league\_id, national\_team\_id, league\_name) VALUES (4, 1, 'Pro League')

6 INTO leagues(league\_id, national\_team\_id, league\_name) VALUES (5, 2, 'Serie A')

7 SELECT \* FROM dual;

SQL> INSERT ALL

2 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (1, 1, 'Arsenal', 'Emirates Stadium')

3 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (2, 1, 'Everton', 'Goodison Park')

4 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (3, 1, 'Manchester United', 'Old Trafford')

5 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (4, 1, 'Manchester City', 'Etihad Stadium')

6 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (5, 2, 'Paris Saint-Germain', 'Parc des Princes')

7 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (6, 2, 'Olympique de Marseille', 'Stade Vélodrome')

8 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (7, 3, 'SL Benfica', 'Estadio da Luz')

9 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (8, 3, 'FC Porto', 'Estadio do Dragao')

10 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (9, 4, 'Club Brugge KV', 'Jan Breydel Stadium')

11 INTO clubs(club\_id, league\_id, club\_name, club\_stadium) VALUES (10, 5, 'Atletico Mineiro', 'Estadio Governador')

12 SELECT \* FROM dual;

SQL> INSERT ALL

2 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (1, 5, 4, 'Lionel Messi', 93, 34, 'One Club Player', 'Free Kick Specialist')

3 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (2, 3, 6, 'Cristiano Ronaldo', 91, 36, 'Long Shot Taker', 'Aerial Threat')

4 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (3, 5, 2, 'Neymar Jr', 91, 30, 'Technical Dribbler', 'Acrobat')

5 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (4, 5, 3, 'Kylian Mbappe', 91, 23, 'Speed Dribbler', 'Speedster')

6 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (5, 4, 1, 'Kevin De Bruyne', 91, 30, 'Playmaker', 'Engine')

7 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (6, 4, 2, 'Ederson', 89, 27, 'Comes for Crosses', 'Long Passer')

8 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (7, 5, 2, 'Marquinhos', 88, 27, 'Leadership', 'Tackler')

9 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (8, 4, 6, 'Ruben Dias', 88, 24, 'Power Header', 'Solid Player')

10 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (9, 4, 5, 'Raheem Sterling', 87, 26, 'Clinical Finisher', 'Team Player')

11 INTO players(player\_id, club\_id, national\_team\_id, player\_name, player\_ovr, player\_age, player\_trait, player\_speciality) VALUES (10, 8, 9, 'Mehdi Taremi', 79, 29, 'Strength', 'Flair')

12 SELECT \* FROM dual;

SQL> INSERT ALL

2 INTO timestamps(timestamp\_id, day, month, year) VALUES (1, 10, 6, 2022)

3 INTO timestamps(timestamp\_id, day, month, year) VALUES (2, 31, 8, 2022)

4 INTO timestamps(timestamp\_id, day, month, year) VALUES (3, 1, 1, 2023)

5 INTO timestamps(timestamp\_id, day, month, year) VALUES (4, 31, 1, 2023)

6 INTO timestamps(timestamp\_id, day, month, year) VALUES (5, 10, 6, 2023)

7 SELECT \* FROM dual;

SQL> INSERT ALL

2 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (1, 3, 1, 180)

3 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (2, 4, 1, 200)

4 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (3, 7, 1, 70)

5 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (4, 8, 1, 75)

6 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (5, 9, 1, 160)

7 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (6, 3, 2, 75)

8 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (7, 4, 2, 150)

9 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (8, 7, 2, 80)

10 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (9, 8, 2, 90)

11 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (10, 9, 2, 55)

12 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (11, 3, 3, 100)

13 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (12, 4, 3, 160)

14 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (13, 7, 3, 75)

15 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (14, 8, 3, 85)

16 INTO market\_values(market\_value\_id, player\_id, timestamp\_id, player\_market\_value) VALUES (15, 9, 3, 70)

17 SELECT \* FROM dual;

SQL> SELECT \*

2 FROM market\_values

3 MATCH\_RECOGNIZE (

4 PARTITION BY player\_id

5 ORDER BY timestamp\_id

6 MEASURES

7 MATCH\_NUMBER() AS match\_number

8 ALL ROWS PER MATCH

9 PATTERN (^ gt80)

10 DEFINE

11 gt80 AS player\_market\_value > 80

12 ) MR

13 INNER JOIN players  
 14 ON MR.player\_id = players.player\_id

15 ORDER BY match\_number;

SQL> SELECT \*

2 FROM market\_values

3 MATCH\_RECOGNIZE (

4 PARTITION BY player\_id

5 ORDER BY timestamp\_id

6 MEASURES

7 STRT.timestamp\_id AS start\_tstamp,

8 LAST(DOWN.timestamp\_id) AS bottom\_tstamp,

9 LAST(UP.timestamp\_id) AS end\_tstamp,

10 MATCH\_NUMBER() AS match\_number

11 ALL ROWS PER MATCH

12 AFTER MATCH SKIP TO LAST DOWN

13 PATTERN (STRT UP+ FLAT\* DOWN+)

14 DEFINE

15 DOWN AS DOWN.player\_market\_value < PREV(DOWN.player\_market\_value),

16 FLAT AS FLAT.player\_market\_value = PREV(FLAT.player\_market\_value),

17 UP AS UP.player\_market\_value > PREV(UP.player\_market\_value)

18 ) MR

19 INNER JOIN players  
 20 ON MR.player\_id = players.player\_id

21 ORDER BY  
 22 MR.player\_id,  
 23 MR.start\_tstamp;

SQL> CONNECT system/tecatech@"DESKTOP-UG7SO1F:1521/xepdb1";

SQL> GRANT  
 2 CREATE ATTRIBUTE DIMENSION,

3 CREATE HIERARCHY,  
 4 CREATE ANALYTIC VIEW  
 5 TO tecatech\_lab1\_4;

SQL> CONNECT tecatech\_lab1\_4/alpha@"DESKTOP-UG7SO1F:1521/xepdb1";

SQL> CREATE OR REPLACE ATTRIBUTE DIMENSION time\_attr\_dim

2 USING timestamps

3 ATTRIBUTES

4 (timestamp\_id,

5 day,

6 month,

7 year)

8 LEVEL timestamp\_id

9 KEY timestamp\_id

10 MEMBER NAME TO\_CHAR(timestamp\_id)

11 MEMBER CAPTION TO\_CHAR(timestamp\_id)

12 ORDER BY timestamp\_id

13 DETERMINES

14 (day,

15 month,

16 year)

17 LEVEL day

18 KEY day

19 MEMBER NAME TO\_CHAR(day)

20 MEMBER CAPTION TO\_CHAR(day)

21 ORDER BY day

22 LEVEL month

23 KEY month

24 MEMBER NAME TO\_CHAR(month)

25 MEMBER CAPTION TO\_CHAR(month)

26 ORDER BY month

27 LEVEL year

28 KEY year

29 MEMBER NAME TO\_CHAR(year)

30 MEMBER CAPTION TO\_CHAR(year)

31 ORDER BY year;

SQL> CREATE OR REPLACE HIERARCHY time\_hier

2 USING time\_attr\_dim

3 (timestamp\_id CHILD OF

4 day CHILD OF

5 month CHILD OF

6 year);

SQL> SELECT  
 2 day,

3 month,

4 year,

5 member\_name,

6 member\_unique\_name,

7 member\_caption,

8 member\_description

9 FROM time\_hier

10 ORDER BY hier\_order;

SQL> CREATE OR REPLACE ANALYTIC VIEW market\_values\_av

2 CLASSIFICATION caption VALUE 'Market Values AV'

3 CLASSIFICATION description VALUE 'Market Values Analytic View'

4 CLASSIFICATION created\_by VALUE 'Dmitriy Rodionov'

5 USING market\_values

6 DIMENSION BY

7 (time\_attr\_dim

8 KEY timestamp\_id REFERENCES timestamp\_id

9 HIERARCHIES (

10 time\_hier DEFAULT)

11 )

12 MEASURES

13 (market\_values FACT player\_market\_value

14 CLASSIFICATION caption VALUE 'Market Values'

15 CLASSIFICATION description VALUE 'Player Market Values'

16 CLASSIFICATION format\_string VALUE '999',

17 market\_values\_prior\_period AS

18 (LAG(market\_values) OVER (HIERARCHY time\_hier OFFSET 1))

19 CLASSIFICATION caption VALUE 'Market Values Prior Period'

20 CLASSIFICATION description VALUE 'Market Values Prior Period'

21 CLASSIFICATION format\_string VALUE '999',

22 market\_values\_chg\_prior\_period AS

23 (LAG\_DIFF(market\_values) OVER (HIERARCHY time\_hier OFFSET 1))

24 CLASSIFICATION caption VALUE 'Market Values Change Prior Period'

25 CLASSIFICATION description VALUE 'Market Values Change Prior Period'

26 CLASSIFICATION format\_string VALUE '999'

27 );

SQL> SELECT  
 2 day,

3 month,

4 year,

5 level\_name,

6 depth,

7 is\_leaf,

8 market\_values,

9 market\_values\_prior\_period,

10 market\_values\_chg\_prior\_period

11 FROM market\_values\_av

12 ORDER BY hier\_order;