QUALOGY

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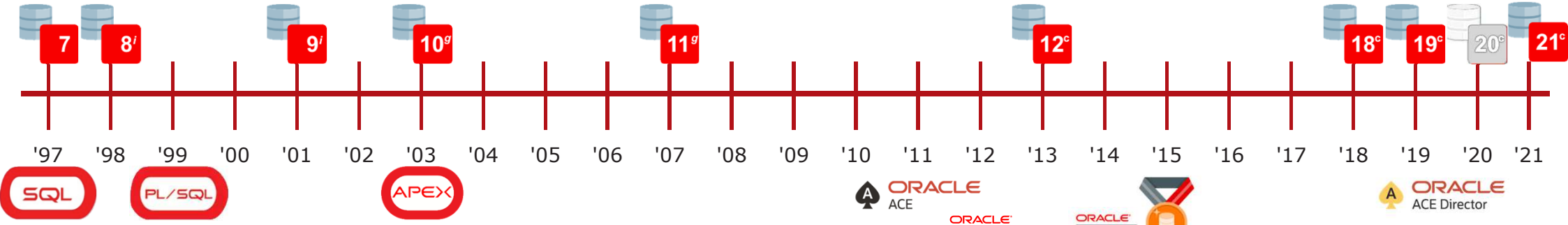
http://blog.bar-solutions.com

QUALOGY

About me…



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All things ORACLE http://allthingsoracle.com

OTECH MAGAZINE http://www.otechmag.com

www.red-gate.com/simple-talk/author/patrick-barel/

bar-solutions.com/otechmagazine.php

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http://plugins.bar-solutions.com

Contact me…

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Patrick Barel

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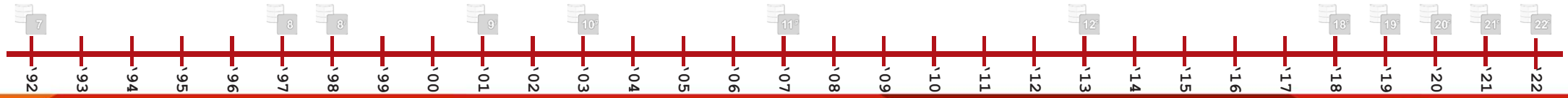
A collection’s a collection
No matter how small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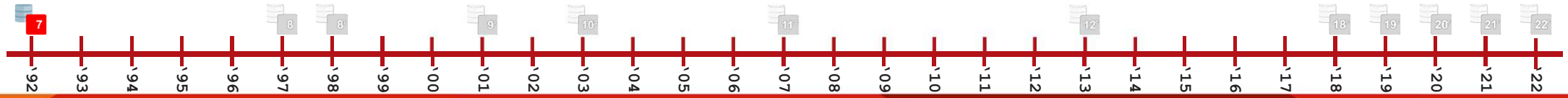
Oracle 7


PL/
SQL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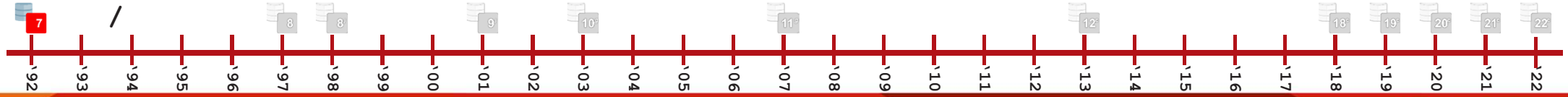
Oracle 7

```
declare
   type    names_pt is table of varchar2(30) index by binary_integer;
   l_names names_pt;
   l_indx  binary_integer;
begin
   -- fill up the collection
   l_names(1)                    := 'Hooly';
   l_names(42)                   := 'Heddy';
   l_names(10)                   := 'Hilder';
   l_names(l_names.count + 1)    := 'Holy';
   l_names(-1)                   := 'Haley';
   -- display the contents of the collection
   l_indx := l_names.first;
   while l_indx is not null loop
     dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
     l_indx := l_names.next(l_indx);
   end loop;
end;
/
```



Oracle 7

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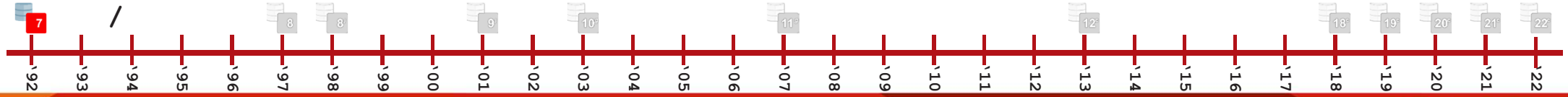
   end loop;
end;
/
```



Oracle 7

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    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```
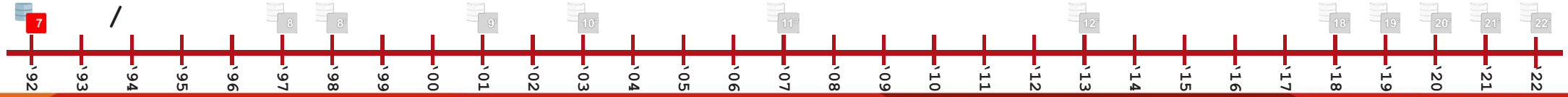

1	Hooly



Oracle 7

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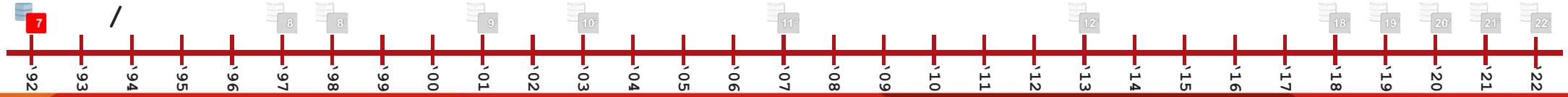
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```

1	Hooly

42	Heddy



Oracle 7

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    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```
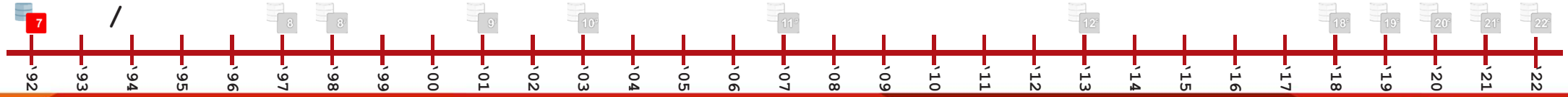

10	Hilder

1	Hooly
42	Heddy



Oracle 7

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  while l_indx is not null loop
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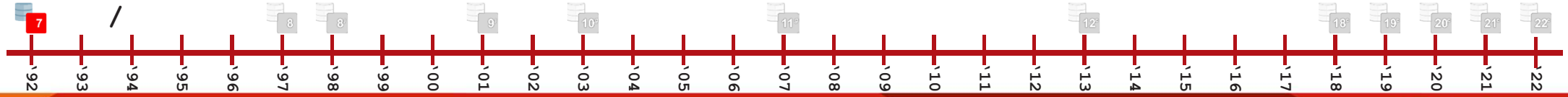
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```

4	Holy

1	Hooly
10	Hilder
42	Heddy



Oracle 7

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    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```
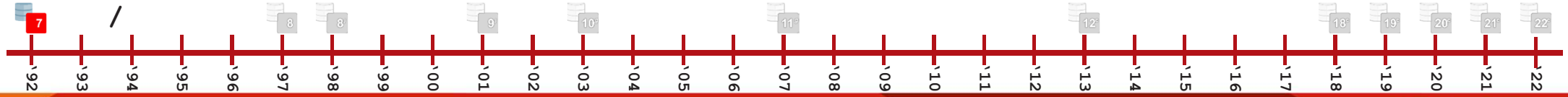

-1	Haley

1	Hooly
4	Holy
10	Hilder
42	Heddy



Oracle 7

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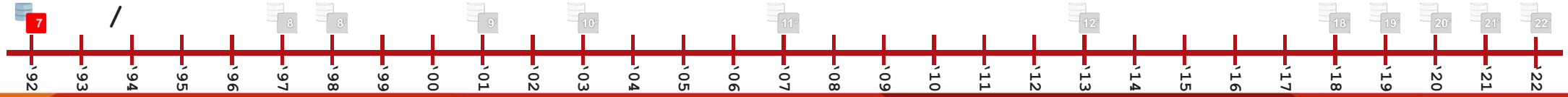
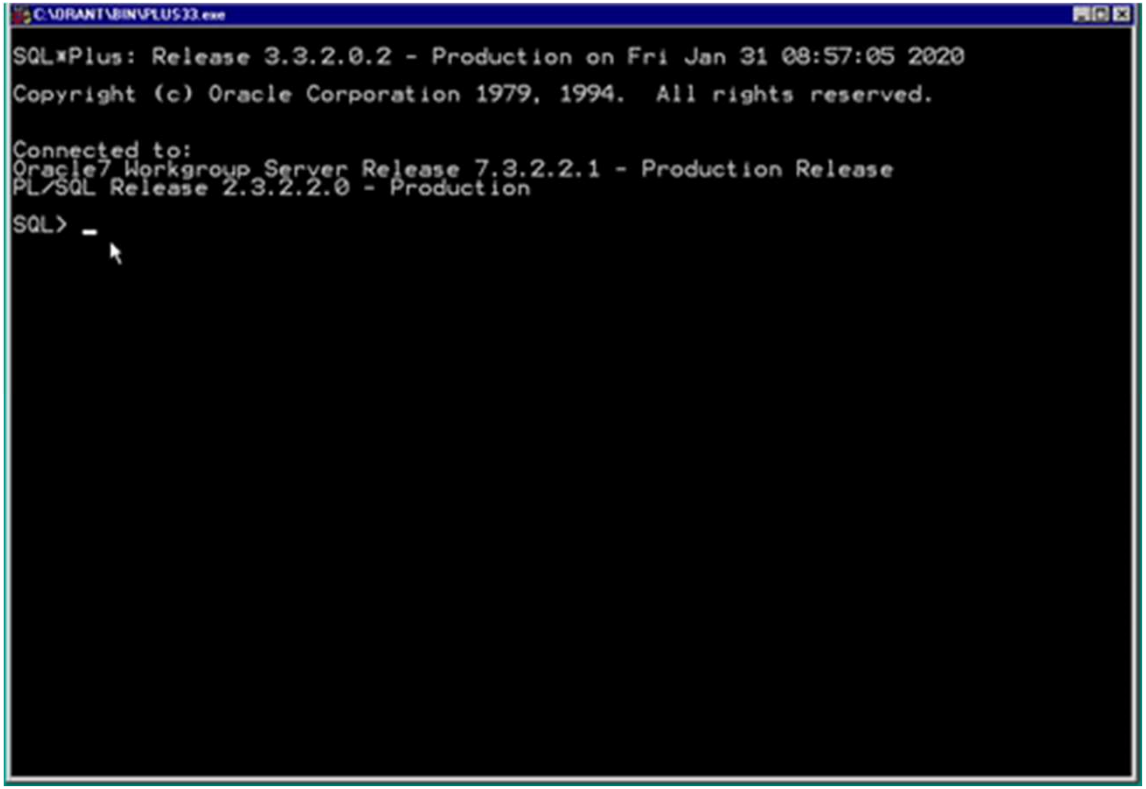
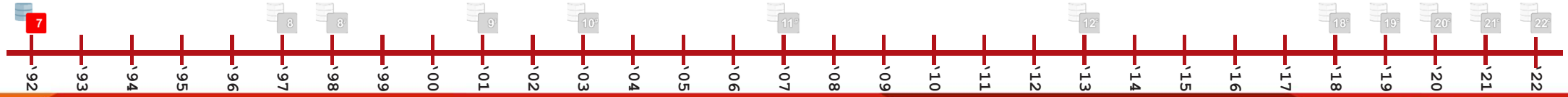
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```

-1	Haley
1	Hooly
4	Holy
10	Hilder
42	Heddy



Oracle 7


C:\ORANT\BIN\PLUS33.exe
SQL*Plus: Release 3.3.2.0.2 - Production on Fri Jan 31 08:57:05 2020
Copyright (c) Oracle Corporation 1979, 1994. All rights reserved.
Connected to:
Oracle7 Workgroup Server Release 7.3.2.2.1 - Production Release
PL/SQL Release 2.3.2.2.0 - Production
SQL>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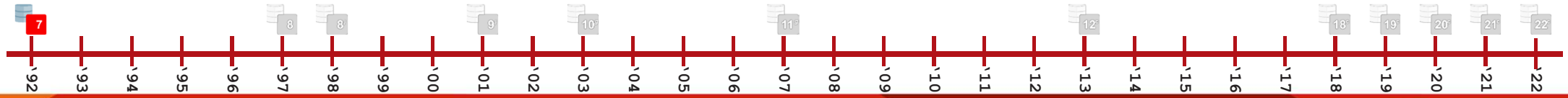
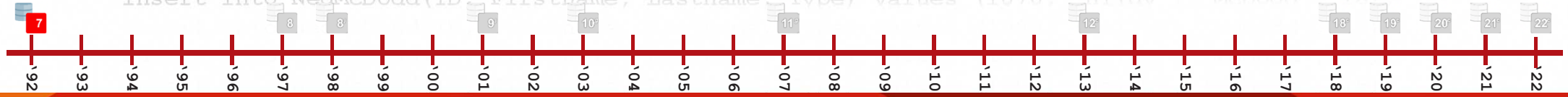
Oracle 7

```
prompt create the RelationTypes table
create table RelationTypes(
  Type number(2)
, Name varchar2(16)
)
/
prompt create the NedMcDodd table
create table NedMcDodd(
  ID        number(4)
, Firstname varchar2(32)
, Lastname  varchar2(32)
, Type      number(2)
)
/
```



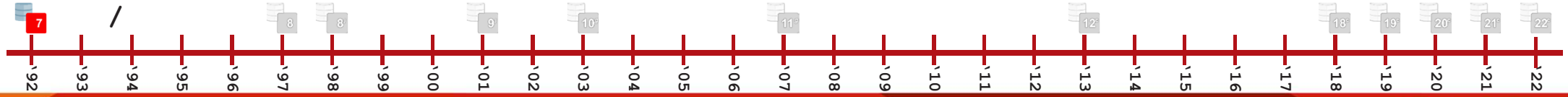
Oracle 7

```
prompt add the Relation Types to the table
begin
 insert into RelationTypes(Type, Name) values (10, 'Relative');
 insert into RelationTypes(Type, Name) values (12, 'Wife');
 insert into RelationTypes(Type, Name) values (15, 'Son');
 insert into RelationTypes(Type, Name) values (18, 'Daughter');
 insert into RelationTypes(Type, Name) values (20, 'Friend');
 insert into RelationTypes(Type, Name) values (30, 'Enemy');
 commit;
end;
/
prompt add the characters to the NedMcDodd table
begin
 -- Relative
 insert into NedMcDodd(ID, Firstname, Lastname, Type) values (1010, 'Sally', 'O''Malley', 12);
 insert into NedMcDodd(ID, Firstname, Lastname, Type) values (1020, 'JoJo', 'McDodd', 15);
 insert into NedMcDodd(ID, Firstname, Lastname, Type) values (1030, 'Hooly', 'McDodd', 18);
 insert into NedMcDodd(ID, Firstname, Lastname, Type) values (1040, 'Hedy', 'McDodd', 18);
 insert into NedMcDodd(ID, Firstname, Lastname, Type) values (1050, 'Helen', 'McDodd', 18);
 insert into NedMcDodd(ID, Firstname, Lastname, Type) values (1060, 'Heather', 'McDodd', 18);
 insert into NedMcDodd(ID, Firstname, Lastname, Type) values (1070, 'Hildy', 'McDodd', 18);
```



Oracle 7

```
declare
  cursor c_names is
    select n.firstname from NedMcDodd n where n.type = 18;
  type    names_pt is table of varchar2(30) index by binary_integer;
  l_names names_pt;
begin
  -- fill up the collection by selecting from the table
  open c_names;
  loop
    fetch c_names into l_names(l_names.count + 1);
    exit when c_names%notfound;
  end loop;
  close c_names;
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```



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    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
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/
```

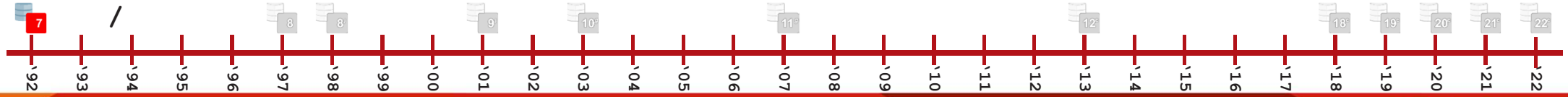

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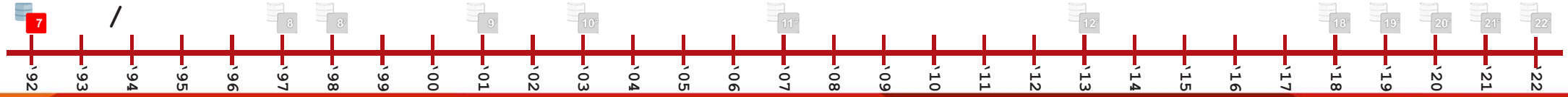
  end loop;
end;
/
```

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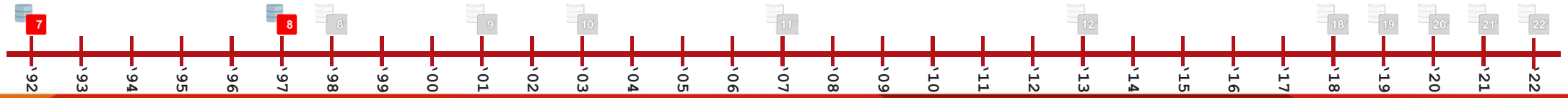
Oracle 8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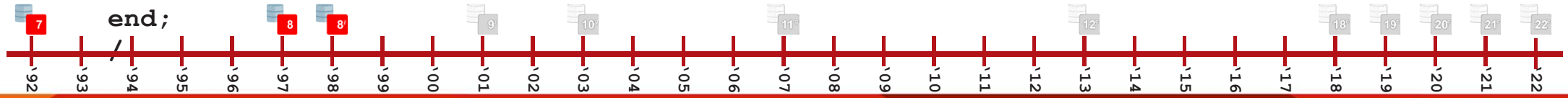
Oracle 8*i*

```
declare
   type    names_nt is table of varchar2(30);
   l_names names_nt;
begin
   -- initialize the collection
   l_names := names_nt();
   -- extend the collection
   l_names.extend(5); -- make room for 5 items right away
   -- fill up the collection
   l_names(1) := 'Haley';
   l_names(5) := 'Heddy';
   l_names(4) := 'Hilder';
   l_names(2) := 'Hooly';
   l_names(3) := 'Holy';
   -- display the contents of the collection
   for l_indx in l_names.first .. l_names.last loop
     dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
   end loop;
end;
/
```



Oracle 8*i*

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   end loop;
end;
/
```

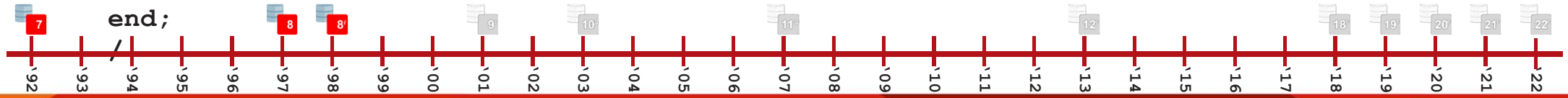

Oracle 8*i*

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  end loop;
end;
/
```

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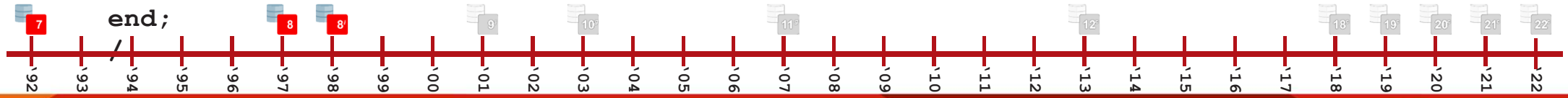
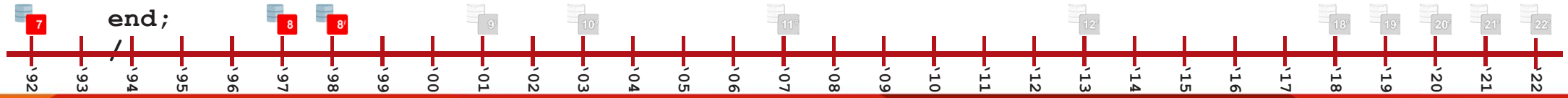
4	
5	



Oracle 8*i*

```
declare
  type    names_nt is table of varchar2(30);
  l_names names_nt;
begin
  -- initialize the collection
  l_names := names_nt();
  -- extend the collection
  l_names.extend(5); -- make room for 5 items right away
  -- fill up the collection
  l_names(1) := 'Haley';
  l_names(5) := 'Heddy';
  l_names(4) := 'Hilder';
  l_names(2) := 'Hooly';
  l_names(3) := 'Holy';
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

1	Haley
2	
3	
4	
5	



Oracle 8*i*

```
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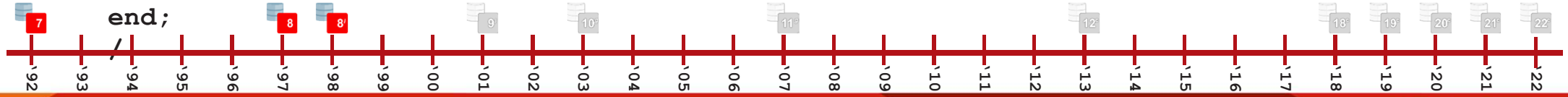
  l_names(2) := 'Hooly';
  l_names(3) := 'Holy';
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

1	Haley
2	
3	
4	
5	Heddy



Oracle 8*i*

```
declare
  type    names_nt is table of varchar2(30);
  l_names names_nt;
begin
  -- initialize the collection
  l_names := names_nt();
  -- extend the collection
  l_names.extend(5); -- make room for 5 items right away
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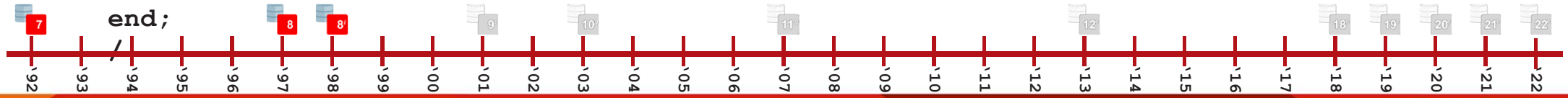
  l_names(5) := 'Heddy';
  l_names(4) := 'Hilder';
  l_names(2) := 'Hooly';
  l_names(3) := 'Holy';
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

1	Haley
2	
3	
4	Hilder
5	Heddy



Oracle 8*i*

```
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  l_names names_nt;
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  -- initialize the collection
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  l_names.extend(5); -- make room for 5 items right away
  -- fill up the collection
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  l_names(5) := 'Heddy';
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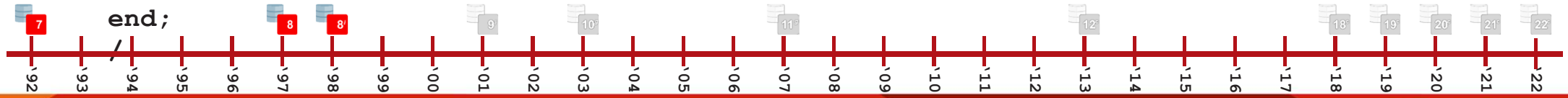
  l_names(2) := 'Hooly';
  l_names(3) := 'Holy';
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

1	Haley
2	Hooly
3	
4	Hilder
5	Heddy



Oracle 8*i*

```
declare
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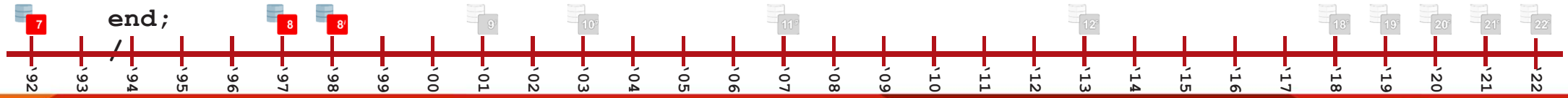
  l_names names_nt;
begin
  -- initialize the collection
  l_names := names_nt();
  -- extend the collection
  l_names.extend(5); -- make room for 5 items right away
  -- fill up the collection
  l_names(1) := 'Haley';
  l_names(5) := 'Heddy';
  l_names(4) := 'Hilder';
  l_names(2) := 'Hooly';
  l_names(3) := 'Holy';
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

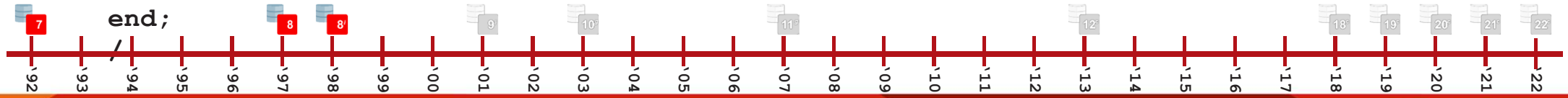
1	Haley
2	Hooly
3	Holy
4	Hilder
5	Heddy



Oracle 8*i*

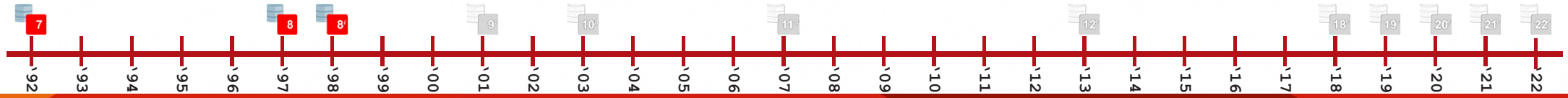
```
declare
  type    names_nt is table of varchar2(30);
  l_names names_nt;
begin
  -- initialize the collection
  l_names := names_nt();
  -- extend the collection
  l_names.extend(5); -- make room for 5 items right away
  -- fill up the collection
  l_names(1) := 'Haley';
  l_names(5) := 'Heddy';
  l_names(4) := 'Hilder';
  l_names(2) := 'Hooly';
  l_names(3) := 'Holy';
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

1	Haley
2	Hooly
3	Holy
4	Hilder
5	Heddy



Oracle 8*i*

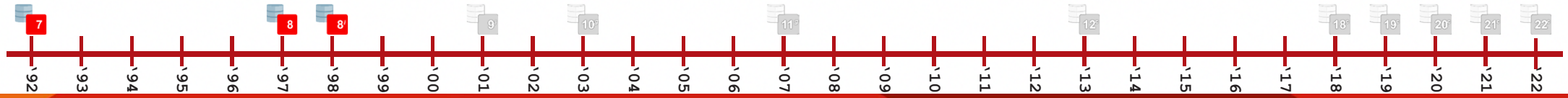
```
declare
  cursor c_names is
    select n.firstname from NedMcDodd n where n.type = 18;
  type    names_ibi is table of varchar2(30) index by binary_integer;
  l_names names_ibi;
begin
  -- fill up the collection by selecting from the table
  open c_names;
  fetch c_names bulk collect into l_names;
  close c_names;
  -- display the contents of the collection
  for l_indx in l_names.first .. l_names.last loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

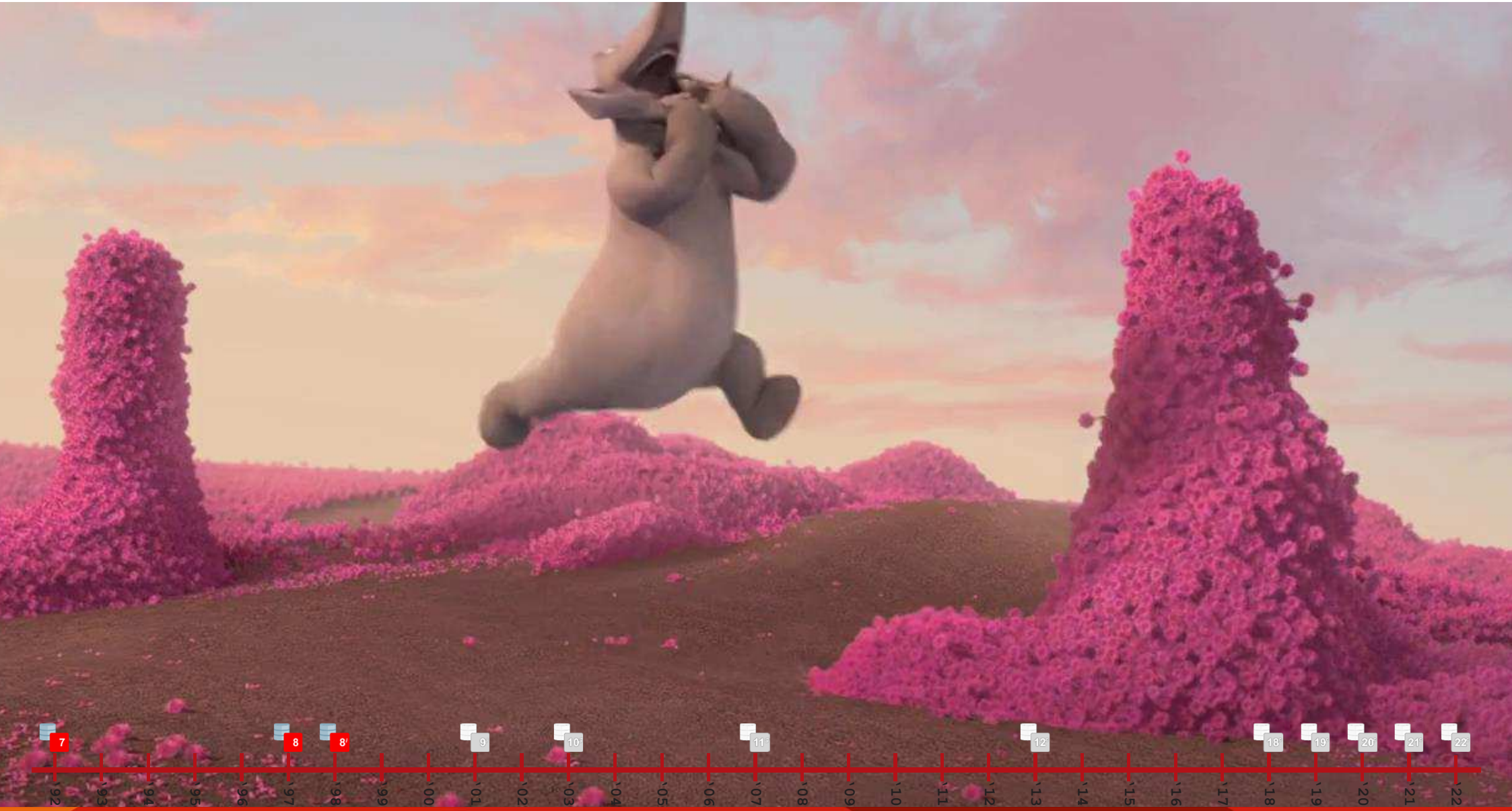


Oracle 8*i*

```
declare
  cursor c_names is
    select n.firstname from NedMcDodd n where n.type = 18;
  type    names_ibi is table of varchar2(30) index by binary_integer;
  l_names names_ibi;
begin
  -- fill up the collection by selecting from the table
  open c_names;
  fetch c_names bulk collect into l_names;
  close c_names;
  -- display the contents of the collection
  for l_indx in 1 .. l_names.count loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
  end loop;
end;
/
```

Densely filled, starting at 1




7
8
8'
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15
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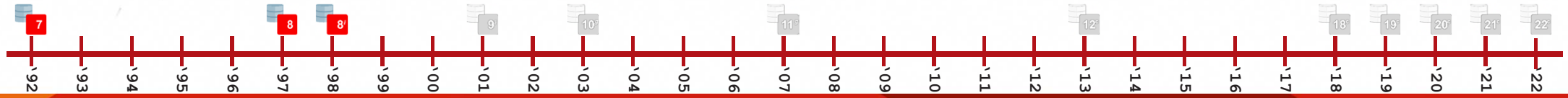
17
18
19
20
21
22

Oracle 8*i*

```
declare
  c_limit constant number := 4;
  cursor c_names is select n.firstname from NedMcDodd n where n.type = 18;
  type names_ibi is table of varchar2(30) index by binary_integer;
  l_names names_ibi;
begin
  open c_names;
  loop
    fetch c_names bulk collect into l_names limit c_limit;
    if l_names.count > 0 then -- display the contents of the collection
      for l_indx in l_names.first .. l_names.last loop
        dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
      end loop;
    end if;
    exit when l_names.count < c_limit;
  end loop;
  close c_names;
end;
```

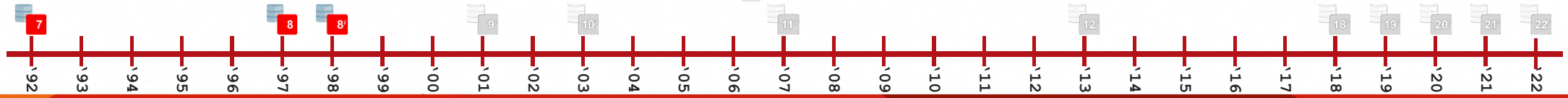


Oracle 8*i*

```
declare
  type id_ibi         is table of NedMcDodd.id%type         index by binary_integer;
  type firstname_ibi  is table of NedMcDodd.firstname%type  index by binary_integer;
  type lastname_ibi   is table of NedMcDodd.lastname%type   index by binary_integer;
  type type_ibi       is table of NedMcDodd.type%type       index by binary_integer;

  cursor c_NedMcDodd is
  select n.id, n.firstname, n.lastname, n.type
    from NedMcDodd n where n.type in (12, 15, 18);

  l_ids         id_ibi;
  l_firstnames  firstname_ibi;
  l_lastnames   lastname_ibi;
  l_types       type_ibi;
begin
  open c_NedMcDodd;
  fetch c_NedMcDodd bulk collect into l_ids
                                    , l_firstnames
```

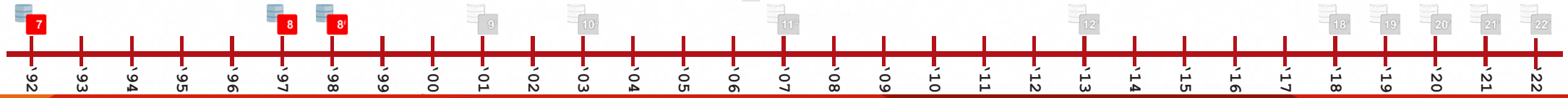


Oracle 8*i*

```
declare
  type id_ibi         is table of NedMcDodd.id%type         index by binary_integer;
  type firstname_ibi  is table of NedMcDodd.firstname%type  index by binary_integer;
  type lastname_ibi   is table of NedMcDodd.lastname%type   index by binary_integer;
  type type_ibi       is table of NedMcDodd.type%type       index by binary_integer;

  cursor c_NedMcDodd is
  select n.id, n.firstname, n.lastname, n.type
    from NedMcDodd n where n.type in (12, 15, 18);

  l_ids         id_ibi;
  l_firstnames  firstname_ibi;
  l_lastnames   lastname_ibi;
  l_types       type_ibi;
begin
  open c_NedMcDodd;
  fetch c_NedMcDodd bulk collect into l_ids
                                    , l_firstnames
```

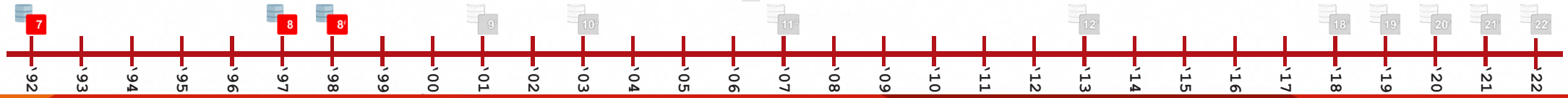


Oracle 8*i*

```
declare
  type id_ibi         is table of NedMcDodd.id%type         index by binary_integer;
  type firstname_ibi  is table of NedMcDodd.firstname%type  index by binary_integer;
  type lastname_ibi   is table of NedMcDodd.lastname%type   index by binary_integer;
  type type_ibi       is table of NedMcDodd.type%type       index by binary_integer;

  cursor c_NedMcDodd is
  select n.id, n.firstname, n.lastname, n.type
    from NedMcDodd n where n.type in (12, 15, 18);

  l_ids         id_ibi;
  l_firstnames  firstname_ibi;
  l_lastnames   lastname_ibi;
  l_types       type_ibi;
begin
  open c_NedMcDodd;
  fetch c_NedMcDodd bulk collect into l_ids
                                    , l_firstnames
```

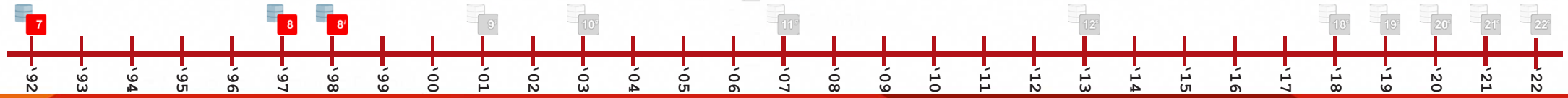


Oracle 8*i*

```
declare
  type id_ibi         is table of NedMcDodd.id%type         index by binary_integer;
  type firstname_ibi  is table of NedMcDodd.firstname%type  index by binary_integer;
  type lastname_ibi   is table of NedMcDodd.lastname%type   index by binary_integer;
  type type_ibi       is table of NedMcDodd.type%type       index by binary_integer;

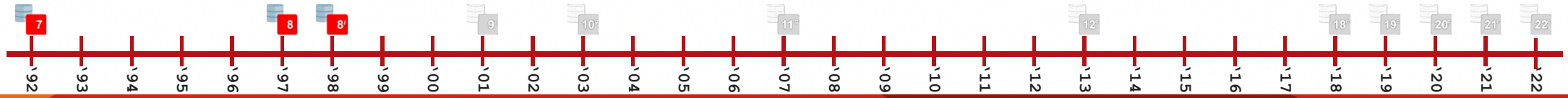
  cursor c_NedMcDodd is
  select n.id, n.firstname, n.lastname, n.type
    from NedMcDodd n where n.type in (12, 15, 18);

  l_ids         id_ibi;
  l_firstnames  firstname_ibi;
  l_lastnames   lastname_ibi;
  l_types       type_ibi;
begin
  open c_NedMcDodd;
  fetch c_NedMcDodd bulk collect into l_ids
                                    , l_firstnames
```



Oracle 8*i*

```
  l_ids         id_ibi;
  l_firstnames  firstname_ibi;
  l_lastnames   lastname_ibi;
  l_types       type_ibi;
begin
  open c_NedMcDodd;
  fetch c_NedMcDodd bulk collect into l_ids
                                    , l_firstnames
                                    , l_lastnames
                                    , l_types;
  close c_NedMcDodd;
  dbms_output.put_line('Number of relatives :'||l_ids.count);
  for indx in l_ids.first .. l_ids.last loop
    dbms_output.put_line('Relative('||l_ids(indx)||') : '||l_firstnames(indx));
  end loop;
end;
/
```

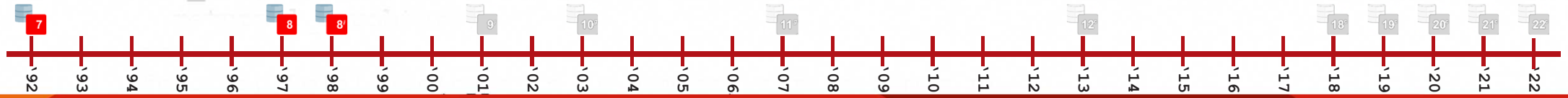


Oracle 8*i*

```
create or replace type Names_NT as table of varchar2(32)
/

create or replace package McDodd as
  function Daughters return Names_nt;
  function Relatives(type_in in number) return Names_nt;
end;
/

create or replace package body McDodd as
  function Daughters return Names_nt
  is
    l_Daughters Names_NT;
  begin
    l_Daughters := Names_NT();
    l_Daughters.extend(2);
    l_Daughters(1) := 'Hooly';
    l_Daughters(2) := 'Holy';
```



Oracle 8*i*

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/

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  function Daughters return Names_nt;
  function Relatives(type_in in number) return Names_nt;
end;
/

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  is
    l_Daughters Names_NT;
  begin
    l_Daughters := Names_NT();
    l_Daughters.extend(2);
    l_Daughters(1) := 'Hooly';
    l_Daughters(2) := 'Holy';
```

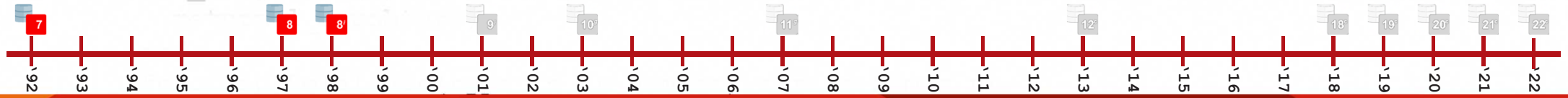

Oracle 8*i*

```
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/

create or replace package McDodd as
  function Daughters return Names_nt;
  function Relatives(type_in in number) return Names_nt;
end;
/

create or replace package body McDodd as
  function Daughters return Names_nt
  is
    l_Daughters Names_NT;
  begin
    l_Daughters := Names_NT();
    l_Daughters.extend(2);
    l_Daughters(1) := 'Hooly';
    l_Daughters(2) := 'Holy';
```
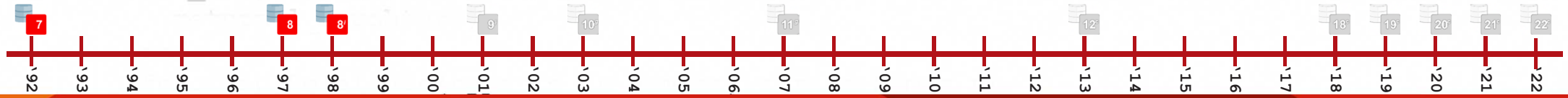
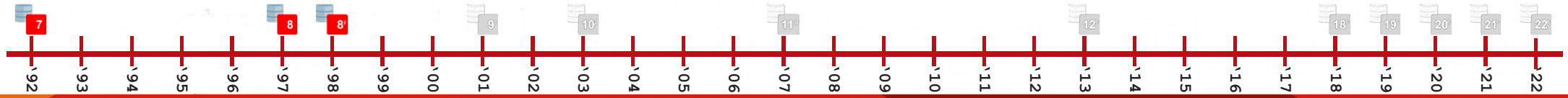



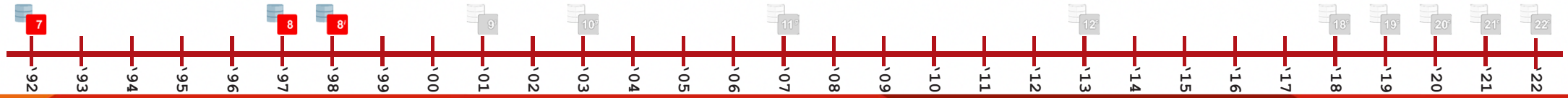
Oracle 8*i*

```
create or replace package body McDodd as
  function Daughters return Names_nt
  is
    l_Daughters Names_NT;
  begin
    l_Daughters := Names_NT();
    l_Daughters.extend(2);
    l_Daughters(1) := 'Hooly';
    l_Daughters(2) := 'Holy';
    return l_Daughters;
  end;
  function Relatives(type_in in number) return Names_nt
  is
    l_Names Names_NT;
  begin
    select n.firstname
      bulk collect into l_Names
      from NedMcDodd n
```



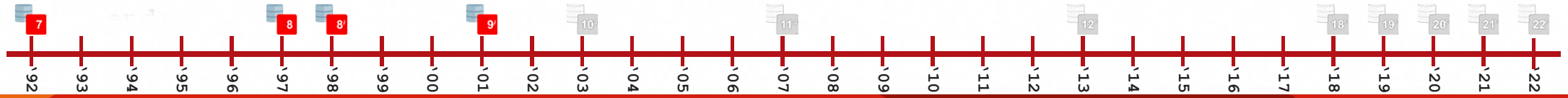
Oracle 8*i*

```
  function Relatives(type_in in number) return Names_nt
  is
    l_Names Names_NT;
  begin
    select n.firstname
      bulk collect into l_Names
      from NedMcDodd n
     where n.type = type_in;
    return l_Names;
  end;
end;
/
select column_value from table(cast (McDodd.Daughters() as Names_nt))
/
select column_value from table(cast (McDodd.Relatives(20) as Names_nt))
/
```



Oracle 9*i*

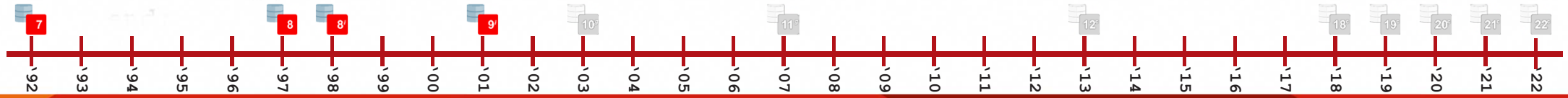
```
declare
   type names_aa is table of varchar2(30) index by varchar2(10);

   l_names names_aa;
   l_indx  varchar2(10);
begin
   -- fill up the collection
   l_names('Hooly')  := 'One';
   l_names('Heddy')  := 'Two';
   l_names('Hilder') := 'Three';
   l_names('Holy')   := 'Four';
   l_names('Haley')  := 'Five';
   -- display the contents of the collection
   l_indx := l_names.first;
   while l_indx is not null loop
     dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
     l_indx := l_names.next(l_indx);
   end loop;
```



Oracle 9*i*

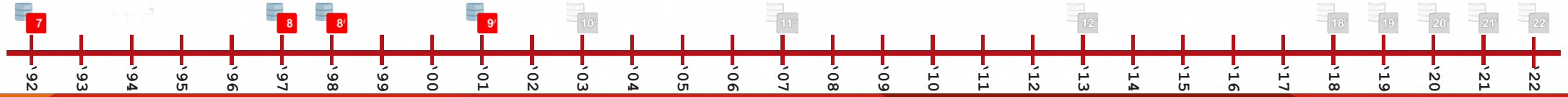
```
declare
   type names_aa is table of varchar2(30) index by varchar2(10);

   l_names names_aa;
   l_indx  varchar2(10);
begin
   -- fill up the collection
   l_names('Hooly')  := 'One';
   l_names('Heddy')  := 'Two';
   l_names('Hilder') := 'Three';
   l_names('Holy')   := 'Four';
   l_names('Haley')  := 'Five';
   -- display the contents of the collection
   l_indx := l_names.first;
   while l_indx is not null loop
     dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
     l_indx := l_names.next(l_indx);
   end loop;
```

Hooly	One



Oracle 9*i*

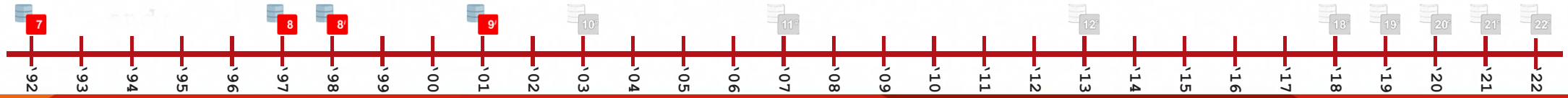
```
declare
  type names_aa is table of varchar2(30) index by varchar2(10);

  l_names names_aa;
  l_indx  varchar2(10);
begin
  -- fill up the collection
  l_names('Hooly')  := 'One';
  l_names('Heddy')  := 'Two';
  l_names('Hilder') := 'Three';
  l_names('Holy')   := 'Four';
  l_names('Haley')  := 'Five';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
```



Oracle 9*i*

```
declare
  type names_aa is table of varchar2(30) index by varchar2(10);

  l_names names_aa;
  l_indx  varchar2(10);
begin
  -- fill up the collection
  l_names('Hooly')  := 'One';
  l_names('Heddy')  := 'Two';
  l_names('Hilder') := 'Three';
  l_names('Holy')   := 'Four';
  l_names('Haley')  := 'Five';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
```

Heddy	Two
Hilder	Three
Hooly	One

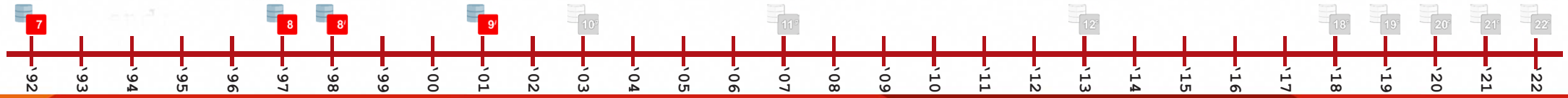


Oracle 9*i*

```
declare
  type names_aa is table of varchar2(30) index by varchar2(10);

  l_names names_aa;
  l_indx  varchar2(10);
begin
  -- fill up the collection
  l_names('Hooly')  := 'One';
  l_names('Heddy')  := 'Two';
  l_names('Hilder') := 'Three';
  l_names('Holy')   := 'Four';
  l_names('Haley')  := 'Five';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
```

Holy	Four

Heddy	Two
Hilder	Three
Hooly	One

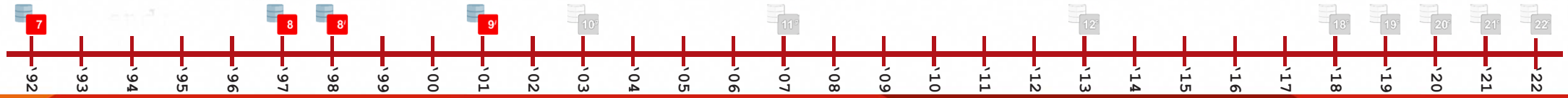


Oracle 9*i*

```
declare
  type names_aa is table of varchar2(30) index by varchar2(10);

  l_names names_aa;
  l_indx  varchar2(10);
begin
  -- fill up the collection
  l_names('Hooly')  := 'One';
  l_names('Heddy')  := 'Two';
  l_names('Hilder') := 'Three';
  l_names('Holy')   := 'Four';
  l_names('Haley')  := 'Five';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
```

Haley	Five

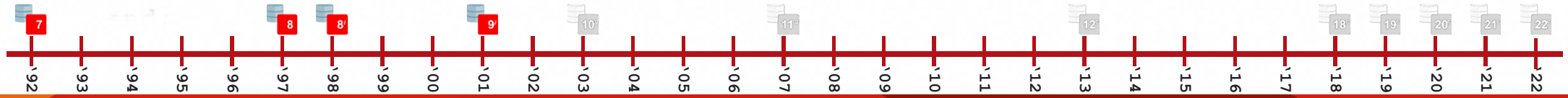
Heddy	Two
Hilder	Three
Holy	Four
Hooly	One



Oracle 9*i*

```
declare
  type names_aa is table of varchar2(30) index by varchar2(10);

  l_names names_aa;
  l_indx  varchar2(10);
begin
  -- fill up the collection
  l_names('Hooly')  := 'One';
  l_names('Heddy')  := 'Two';
  l_names('Hilder') := 'Three';
  l_names('Holy')   := 'Four';
  l_names('Haley')  := 'Five';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
```

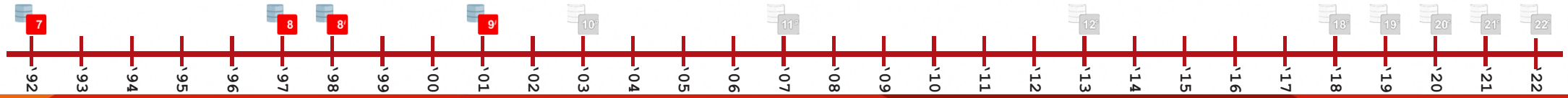
Haley	Five
Heddy	Two
Hilder	Three
Holy	Four
Hooly	One



Oracle 9*i*

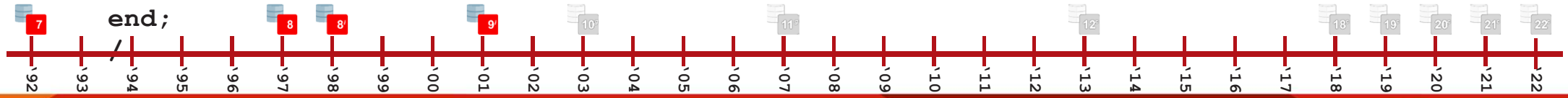
```
  l_names names_aa;
  l_indx  varchar2(10);
begin
  -- fill up the collection
  l_names('Hooly')  := 'One';
  l_names('Heddy')  := 'Two';
  l_names('Hilder') := 'Three';
  l_names('Holy')   := 'Four';
  l_names('Haley')  := 'Five';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```

Haley	Five
Heddy	Two
Hilder	Three
Holy	Four
Hooly	One



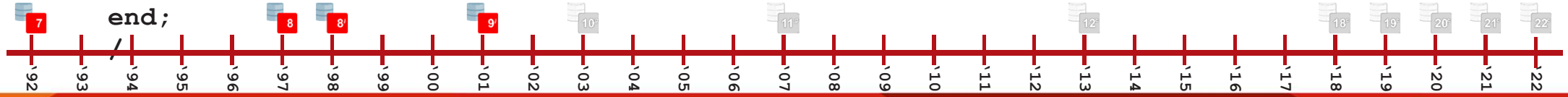
Oracle 9*i*

```
declare
   type NedMcDodd_aa is table of NedMcDodd%rowtype index by binary_integer;

   cursor c_NedMcDodd
   is
   select n.id, n.firstname, n.lastname, n.type
     from NedMcDodd n
    where n.type in (12, 15, 18);
   l_NedMcDodds NedMcDodd_aa;
begin
   open c_NedMcDodd;
   fetch c_NedMcDodd bulk collect into l_NedMcDodds;
   close c_NedMcDodd;
   dbms_output.put_line('Number of relatives :'||l_NedMcDodds.count);
   for indx in l_NedMcDodds.first .. l_NedMcDodds.last loop
     dbms_output.put_line('Relative('||l_NedMcDodds(indx).id||') : ' ||
                                       l_NedMcDodds(indx).firstname);
   end loop;
end;
/
```



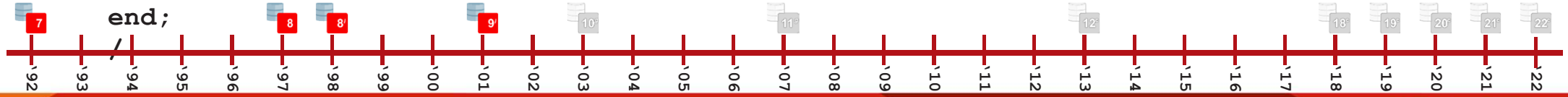
Oracle 9*i*

```
declare
   type NedMcDodd_aa is table of NedMcDodd%rowtype index by binary_integer;

   cursor c_NedMcDodd
   is
   select n.id, n.firstname, n.lastname, n.type
     from NedMcDodd n
    where n.type in (12, 15, 18);
   l_NedMcDodds NedMcDodd_aa;
begin
   open c_NedMcDodd;
   fetch c_NedMcDodd bulk collect into l_NedMcDodds;
   close c_NedMcDodd;
   dbms_output.put_line('Number of relatives :'||l_NedMcDodds.count);
   for indx in l_NedMcDodds.first .. l_NedMcDodds.last loop
     dbms_output.put_line('Relative('||l_NedMcDodds(indx).id||') : ' ||
                                       l_NedMcDodds(indx).firstname);
   end loop;
end;
/
```



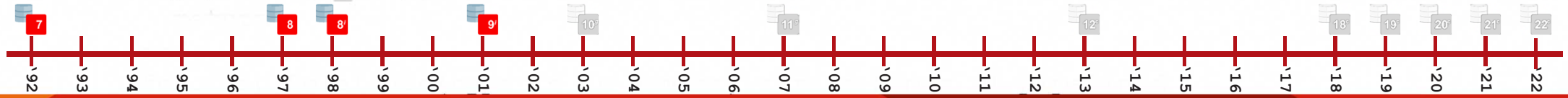
Oracle 9*i*

```
declare
  type NedMcDodd_aa is table of NedMcDodd%rowtype index by binary_integer;

  cursor c_NedMcDodd
  is
  select n.id, n.firstname, n.lastname, n.type
    from NedMcDodd n
   where n.type in (12, 15, 18);
  l_NedMcDodds NedMcDodd_aa;
begin
  open c_NedMcDodd;
  fetch c_NedMcDodd bulk collect into l_NedMcDodds;
  close c_NedMcDodd;
  dbms_output.put_line('Number of relatives :'||l_NedMcDodds.count);
  for indx in l_NedMcDodds.first .. l_NedMcDodds.last loop
    dbms_output.put_line('Relative('||l_NedMcDodds(indx).id||') : ' ||
                                      l_NedMcDodds(indx).firstname);
  end loop;
end;
/
```



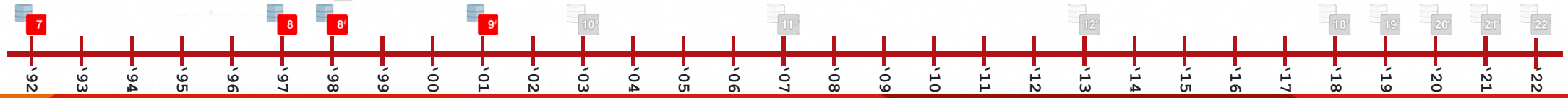
Oracle 9*i*

```
create or replace type Names_NT as table of varchar2(32)
/

create or replace package McDodd as
  function Daughters return Names_NT pipelined;
  function Relatives(type_in in number) return Names_NT pipelined;
end;
/

create or replace package body McDodd as
  function Daughters return Names_NT pipelined
  is
    l_row NedMcDodd.Firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
```



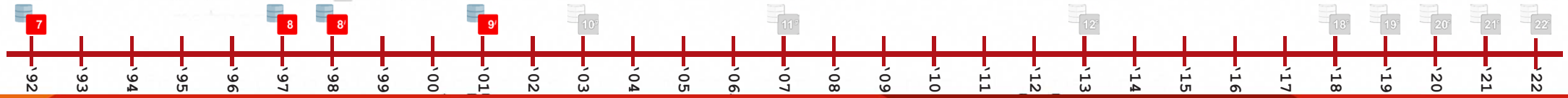
Oracle 9*i*

```
create or replace type Names_NT as table of varchar2(32)
/

create or replace package McDodd as
  function Daughters return Names_NT pipelined;
  function Relatives(type_in in number) return Names_NT pipelined;
end;
/

create or replace package body McDodd as
  function Daughters return Names_NT pipelined
  is
    l_row NedMcDodd.Firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
```



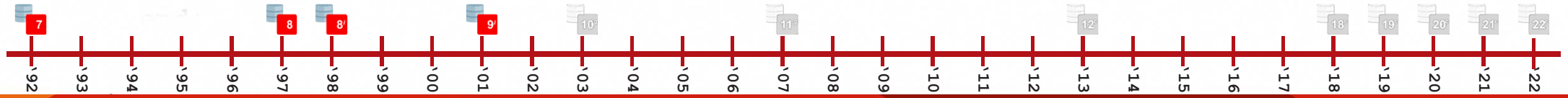
Oracle 9*i*

```
create or replace type Names_NT as table of varchar2(32)
/

create or replace package McDodd as
  function Daughters return Names_NT pipelined;
  function Relatives(type_in in number) return Names_NT pipelined;
end;
/

create or replace package body McDodd as
  function Daughters return Names_NT pipelined
  is
    l_row NedMcDodd.Firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
```



Oracle 9*i*

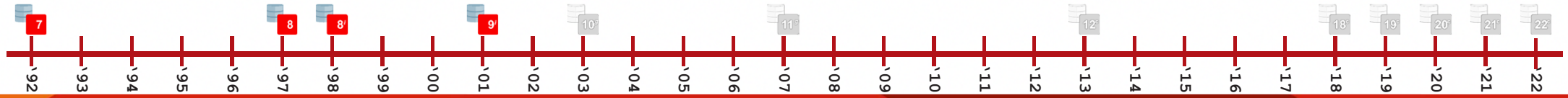
```
create or replace package body McDodd as
  function Daughters return Names_NT pipelined
  is
    l_row NedMcDodd.Firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
    return;
  end;
  function Relatives(type_in in number) return Names_NT pipelined
  is
  begin
    for l_row in (select n.firstname from NedMcDodd n where n.type = type_in) loop
      pipe row(l_row.firstname);
    end loop;
    return;
```



Oracle 9*i*

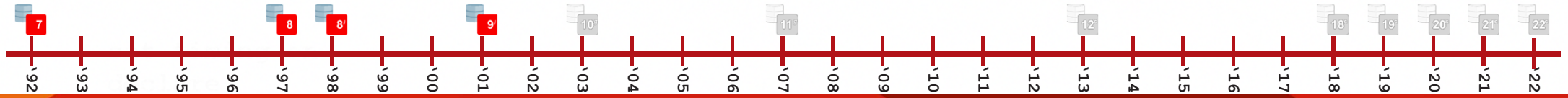
```
  function Relatives(type_in in number) return Names_NT pipelined
  is
  begin
    for l_row in (select n.firstname from NedMcDodd n where n.type = type_in) loop
      pipe row(l_row.firstname);
    end loop;
    return;
  end;
end;
/
```

```
select * from table(McDodd.Daughters)
/
select * from table(McDodd.Relatives(20))
/
```



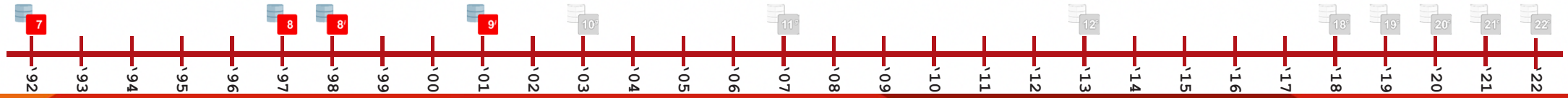
Oracle 9*i*

```
clear screen
set serveroutput on size unlimited

drop table FatMcDodd
/

prompt create a big fat table
create table FatMcDodd as select * from NedMcDodd where 1=2
/
begin
  for indx in 1 .. 10000 loop
    insert into FatMcDodd select * from NedMcDodd;
  end loop;
  commit;
end;
/
select count(*) from FatMcDodd
/
```



Oracle 9*i*

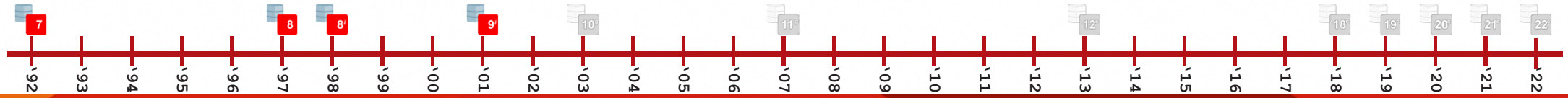
```
  end loop;
  commit;
end;
/
select count(*) from FatMcDodd
/

set timing on
declare
  l_id FatMcDodd.id%type;
begin
  for rec in (select * from FatMcDodd) loop
    l_id := rec.id;
  end loop;
end;
/
set timing off
```



```
PL/SQL procedure successfully completed
Executed in 4.453 seconds
```

Oracle 9*i*

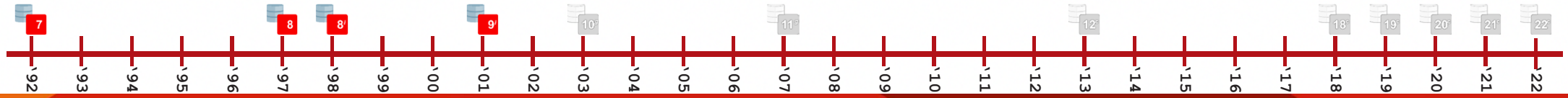
```
declare
  l_id FatMcDodd.id%type;
begin
  for rec in (select * from FatMcDodd) loop
    l_id := rec.id;
  end loop;
end;
/
set timing off
```



```
PL/SQL procedure successfully completed
Executed in 1.235 seconds
```

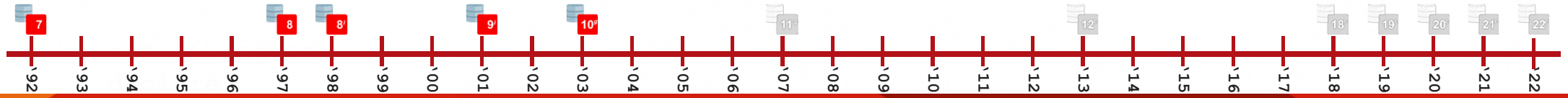
Oracle 9*i*

```
declare
  cursor c_FatMcDodd
  is
  select * from FatMcDodd;
  type t_FatMcDodd is table of FatMcDodd%rowtype index by pls_integer;
  lFatMcDodd t_FatMcDodd;
  l_id FatMcDodd.id%type;
begin
  open c_FatMcDodd;
  loop
    fetch c_FatMcDodd bulk collect into lFatMcDodd limit 10000;
    exit when lFatMcDodd.count = 0;
    for indx in lFatMcDodd.first .. lFatMcDodd.last loop
      l_id := lFatMcDodd(indx).id;
    end loop;
  end loop;
end;
/
```



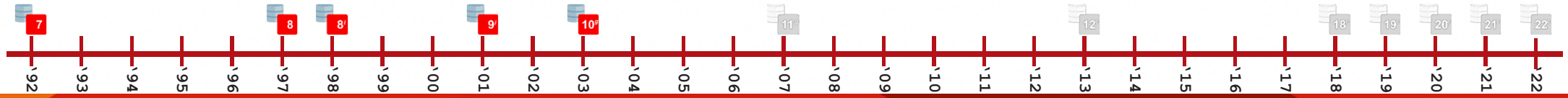
Oracle 10g

```
clear screen
set serveroutput on size unlimited

drop table FatMcDodd
/

prompt create a big fat table
create table FatMcDodd as select * from NedMcDodd where 1=2
/
begin
  for indx in 1 .. 10000 loop
    insert into FatMcDodd select * from NedMcDodd;
  end loop;
  commit;
end;
/
select count(*) from FatMcDodd
/
```



Oracle 10g

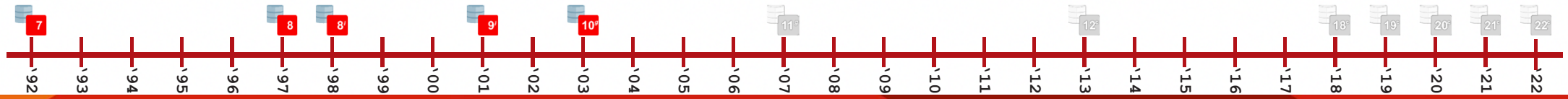
```
  end loop;
  commit;
end;
/
select count(*) from FatMcDodd
/

set timing on
declare
  l_id FatMcDodd.id%type;
begin
  for rec in (select * from FatMcDodd) loop
    l_id := rec.id;
  end loop;
end;
/
set timing off
```



```
PL/SQL procedure successfully completed
Executed in 0.701 seconds
```

Oracle 10g

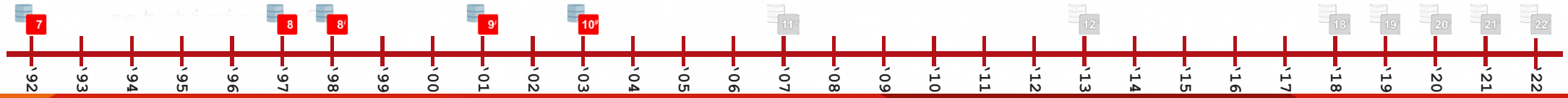
```
declare
  l_id FatMcDodd.id%type;
begin
  for rec in (select * from FatMcDodd) loop
    l_id := rec.id;
  end loop;
end;
/
set timing off
```

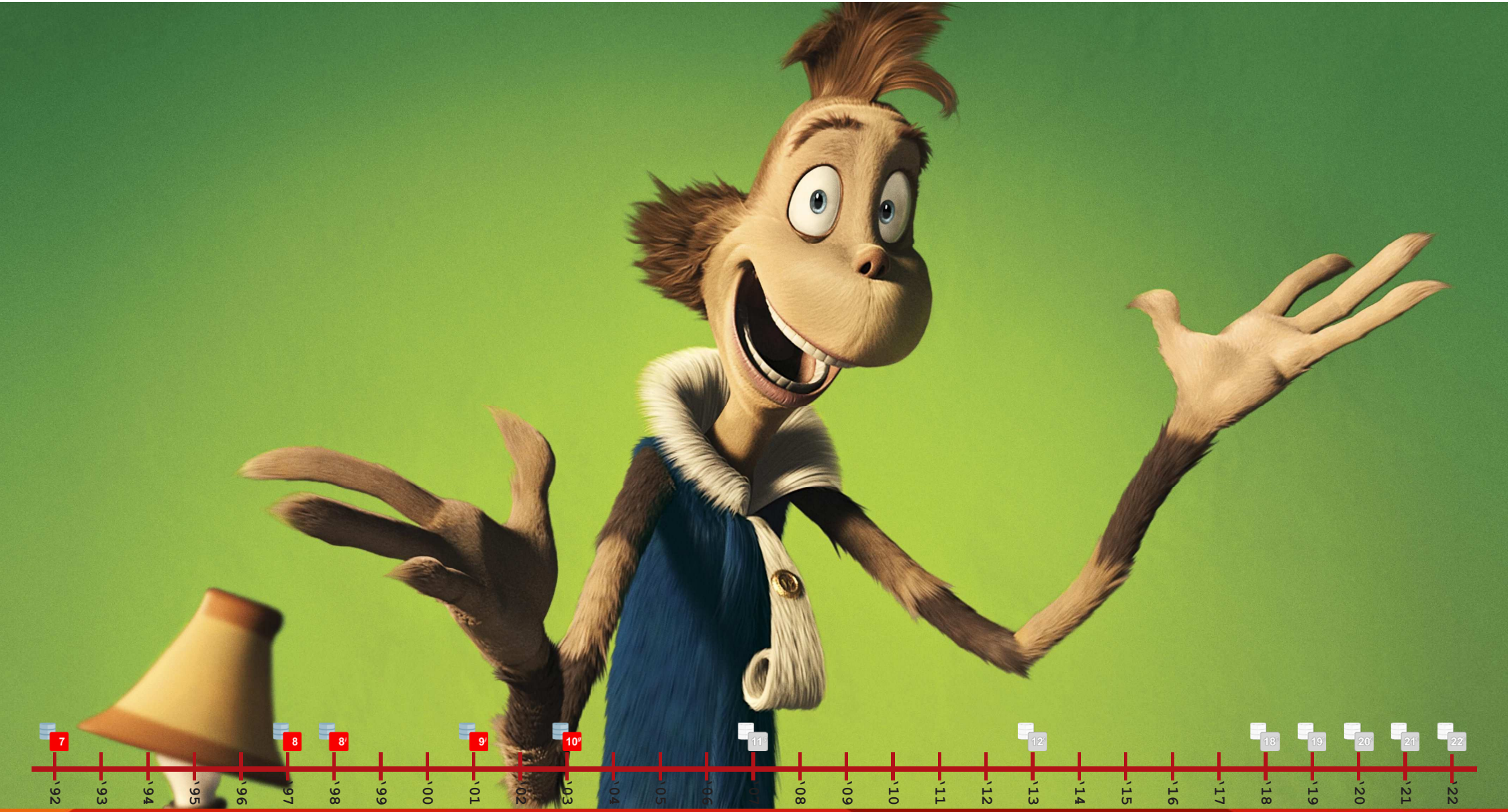


```
PL/SQL procedure successfully completed
Executed in 0.581 seconds
```

Oracle 10g

```
declare
  cursor c_FatMcDodd
  is
  select * from FatMcDodd;
  type t_FatMcDodd is table of FatMcDodd%rowtype index by pls_integer;
  lFatMcDodd t_FatMcDodd;
  l_id FatMcDodd.id%type;
begin
  open c_FatMcDodd;
  loop
    fetch c_FatMcDodd bulk collect into lFatMcDodd limit 10000;
    exit when lFatMcDodd.count = 0;
    for indx in lFatMcDodd.first .. lFatMcDodd.last loop
      l_id := lFatMcDodd(indx).id;
    end loop;
  end loop;
end;
/
```

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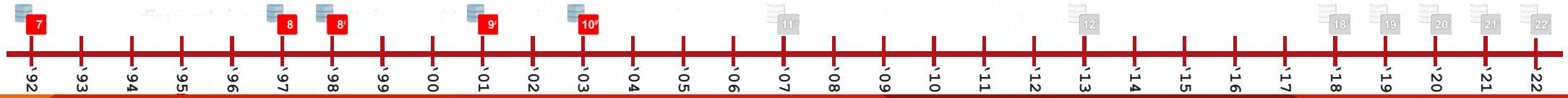
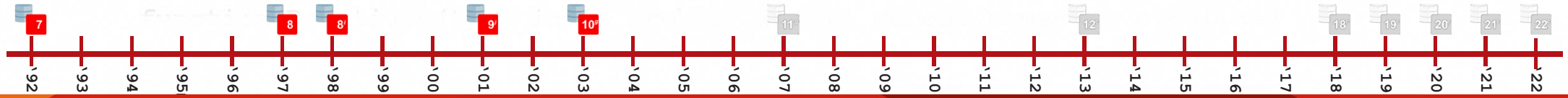
Oracle 10g

```
create or replace package McDodd as
  type Names_NT is table of NedMcDodd.firstname%type;
  function Daughters return McDodd.Names_NT pipelined;
  function Relatives(type_in in number) return McDodd.Names_NT pipelined;
end;
/

create or replace package body McDodd as
  function Daughters return McDodd.Names_NT pipelined
  is
    l_row NedMcDodd.firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
    return;
  end;
```



Oracle 10g

```
create or replace package McDodd as
  type Names_NT is table of NedMcDodd.firstname%type;
  function Daughters return McDodd.Names_NT pipelined;
  function Relatives(type_in in number) return McDodd.Names_NT pipelined;
end;
/

create or replace package body McDodd as
  function Daughters return McDodd.Names_NT pipelined
  is
    l_row NedMcDodd.firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
    return;
  end;
```



Oracle 10g

```
create or replace package McDodd as
  type Names_NT is table of NedMcDodd.firstname%type;
  function Daughters return McDodd.Names_NT pipelined;
  function Relatives(type_in in number) return McDodd.Names_NT pipelined;
end;
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create or replace package body McDodd as
  function Daughters return McDodd.Names_NT pipelined
  is
    l_row NedMcDodd.firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
    return;
  end;
```
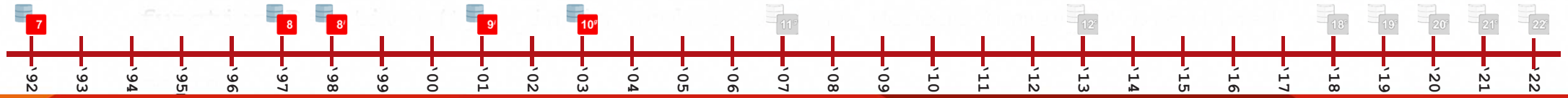
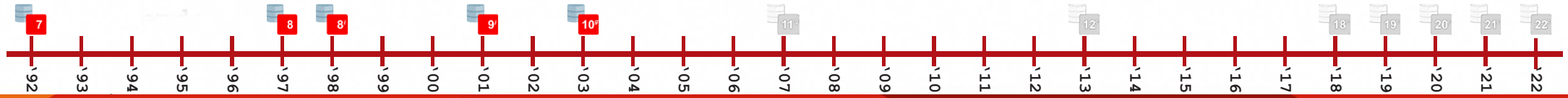



Oracle 10g

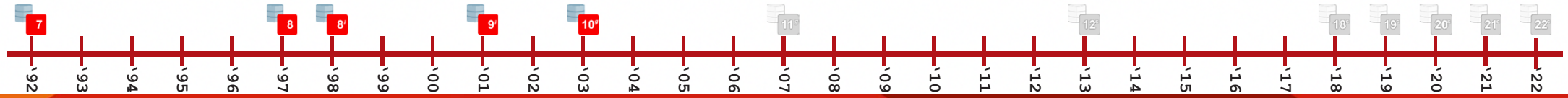
```
create or replace package body McDodd as
  function Daughters return McDodd.Names_NT pipelined
  is
    l_row NedMcDodd.firstname%type;
  begin
    l_row := 'Hooly';
    pipe row(l_row);
    l_row := 'Holy';
    pipe row(l_row);
    return;
  end;
  function Relatives(type_in in number) return McDodd.Names_NT pipelined
  is
  begin
    for l_row in (select n.firstname from NedMcDodd n where n.type = type_in) loop
      pipe row(l_row.firstname);
    end loop;
    return;
```



Oracle 10g

```
  function Relatives(type_in in number) return McDodd.Names_NT pipelined
  is
  begin
    for l_row in (select n.firstname from NedMcDodd n where n.type = type_in) loop
      pipe row(l_row.firstname);
    end loop;
    return;
  end;
end;
/
```

```
select * from table(McDodd.Daughters)
/
select * from table(McDodd.Relatives(20))
/
```

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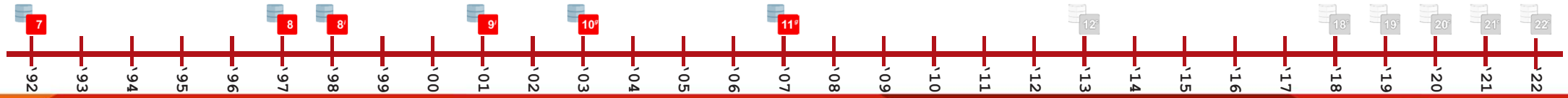
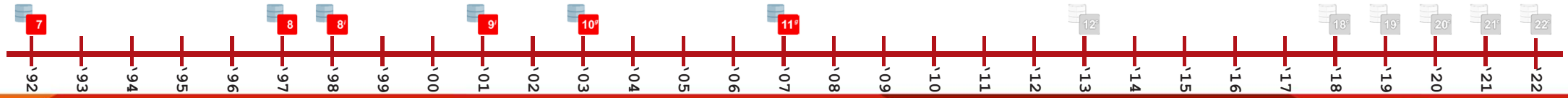
Oracle 11g

```
create or replace package McDodd as
  type Daughters_NT is table of NedMcDodd.firstname%type;
end;
/

declare
  Daughters McDodd.Daughters_NT;
begin
  Daughters := McDodd.Daughters_NT();
  Daughters.extend(2);
  Daughters(1) := 'Hooly';
  Daughters(2) := 'Holy';
  for i in (select n.firstname from NedMcDodd n where n.type = 18
               and n.firstname not in (select * from table(Daughters))) loop
    dbms_output.put_line(i.firstname);
  end loop;
end;
/
```



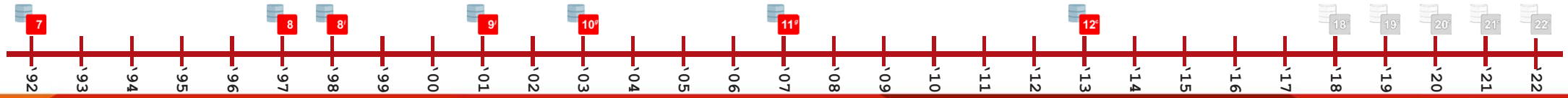
Oracle 11g

```
create or replace
  type Daughters_NT as table of varchar2(32)
/


declare
  Daughters Daughters_NT;
begin
  Daughters := Daughters_NT();
  Daughters.extend(2);
  Daughters(1) := 'Hooly';
  Daughters(2) := 'Holy';
  for i in (select n.firstname from NedMcDodd n where n.type = 18
                and n.firstname not in (select * from table(Daughters))) loop
    dbms_output.put_line(i.firstname);
  end loop;
end;
/
```



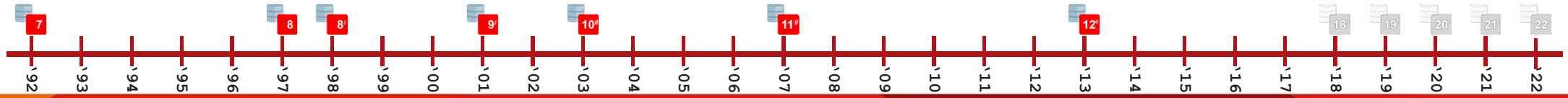
Oracle 12c

```
create or replace package McDodd as
  type Daughters_NT is table of NedMcDodd.firstname%type;
end;
/

declare
  Daughters McDodd.Daughters_NT;
begin
  Daughters := McDodd.Daughters_NT();
  Daughters.extend(2);
  Daughters(1) := 'Hooly';
  Daughters(2) := 'Holy';
  for i in (select n.firstname from NedMcDodd n where n.type = 18
               and n.firstname not in (select * from table(Daughters))) loop
    dbms_output.put_line(i.firstname);
  end loop;
end;
/
```



Oracle 12c

```
create or replace package McDodd as
  type Daughters_AA is table of NedMcDodd.firstname%type index by pls_integer;
end;
/

declare
  Daughters McDodd.Daughters_AA;
Begin


  Daughters(1) := 'Hooly';
  Daughters(2) := 'Holy';
  for i in (select n.firstname from NedMcDodd n where n.type = 18
               and n.firstname not in (select * from table(Daughters))) loop
    dbms_output.put_line(i.firstname);
  end loop;
end;
/
```

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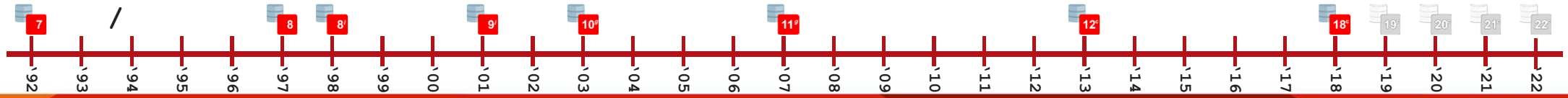
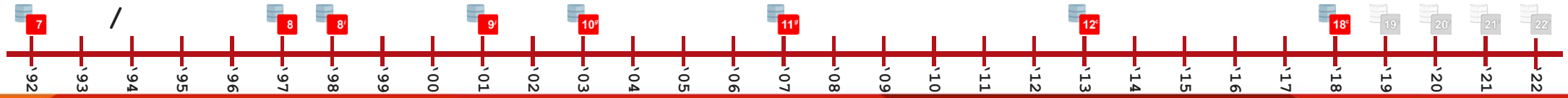
Oracle 18c

```
declare
  type    names_aa is table of varchar2(30) index by binary_integer;
  l_names names_aa;
  l_indx  binary_integer;
begin
  -- fill up the collection
  l_names(1)                    := 'Hooly';
  l_names(42)                   := 'Heddy';
  l_names(10)                   := 'Hilder';
  l_names(l_names.count + 1)    := 'Holy';
  l_names(-1)                   := 'Haley';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```



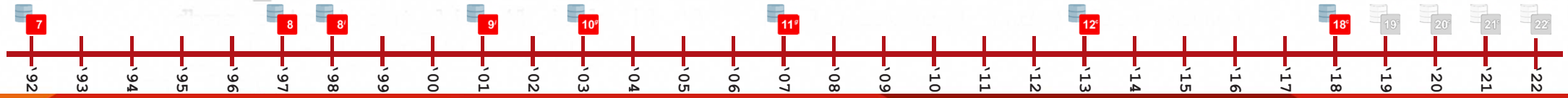
Oracle 18c

```
declare
  type    names_aa is table of varchar2(30) index by binary_integer;
  l_names names_aa;
  l_indx  binary_integer;
begin
  -- fill up the collection
  l_names := names_aa(1  => 'Hooly'
                     ,42 => 'Heddy'
                     ,10 => 'Hilder'
                     ,(l_names.count + 1)  => 'Holy'
                     ,-1 => 'Haley');
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```



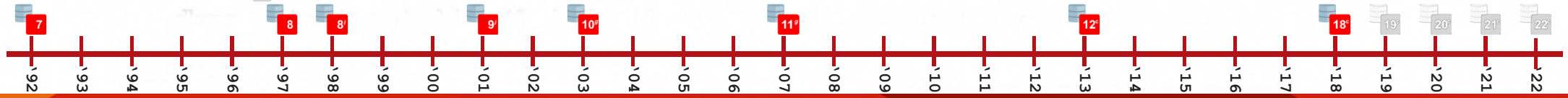
Oracle 18c

```
declare
  type McDodd_rec is record
  ( firstname varchar2(32)
  , type      number(2)
  );
  type McDodd_AA is table of McDodd_rec index by pls_integer;
  l_McDodd McDodd_AA;
  l_indx   pls_integer;
begin
  -- fill up the collection
  l_McDodd := McDodd_AA(1  => McDodd_rec(firstname => 'Hooly',  type => 18)
                       ,42 => McDodd_rec(firstname => 'Heddy',  type => 18)
                       ,10 => McDodd_rec(firstname => 'Hilder', type => 18)
                       ,4  => McDodd_rec(firstname => 'Holy',   type => 18)
                       ,-1 => McDodd_rec(firstname => 'Haley',  type => 18));
  -- display the contents of the collection
  l_indx := l_McDodd.first;
  while l_indx is not null loop
```

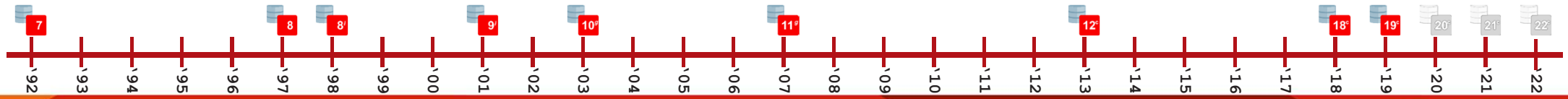


Oracle 18c

```
declare
  type McDodd_rec is record
  ( firstname varchar2(32)
  , type      number(2)
  );
  type McDodd_AA is table of McDodd_rec index by pls_integer;
  l_McDodd McDodd_AA;
  l_indx   pls_integer;
begin
  -- fill up the collection
  l_McDodd := McDodd_AA(1  => McDodd_rec(firstname => 'Hooly',  type => 18)
                       ,42 => McDodd_rec(firstname => 'Heddy',  type => 18)
                       ,10 => McDodd_rec(firstname => 'Hilder', type => 18)
                       ,4  => McDodd_rec(firstname => 'Holy',   type => 18)
                       ,-1 => McDodd_rec(firstname => 'Haley',  type => 18));
  -- display the contents of the collection
  l_indx := l_McDodd.first;
  while l_indx is not null loop
```



Oracle 19c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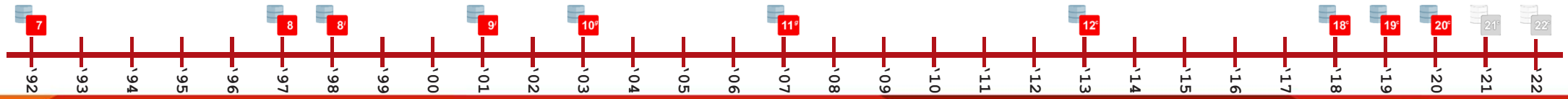
Oracle 20c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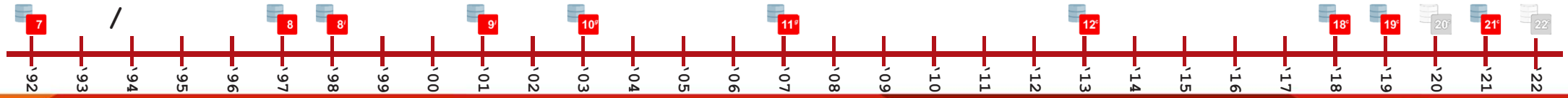
Oracle 21c

```
declare
  type    names_aa is table of varchar2(30) index by binary_integer;
  l_names names_aa;
  l_indx  binary_integer;
begin
  -- fill up the collection
  l_names(1)                   := 'Hooly';
  l_names(42)                  := 'Heddy';
  l_names(10)                  := 'Hilder';
  l_names(l_names.count + 1)   := 'Holy';
  l_names(-1)                  := 'Haley';
  -- display the contents of the collection
  l_indx := l_names.first;
  while l_indx is not null loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));
    l_indx := l_names.next(l_indx);
  end loop;
end;
/
```



Oracle 21c

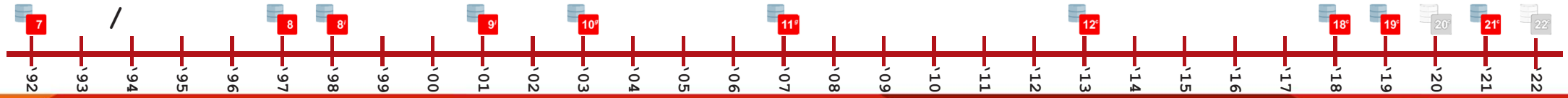
```
declare
  type    names_aa is table of varchar2(30) index by binary_integer;
  l_names names_aa;
  l_indx  binary_integer;
begin
  -- fill up the collection
  l_names(1)                    := 'Hooly';
  l_names(42)                   := 'Heddy';
  l_names(10)                   := 'Hilder';
  l_names(l_names.count + 1)    := 'Holy';
  l_names(-1)                   := 'Haley';
  -- display the contents of the collection

  for l_indx           in indices of l_names loop
    dbms_output.put_line(l_indx || ') ' || l_names(l_indx));

  end loop;
end;
/
```

```
-1) Haley
1) Hooly
4) Holy
10) Hilder
42) Heddy

PL/SQL procedure successfully completed
```



Oracle 21c

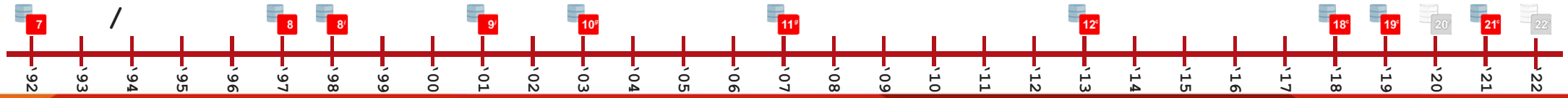
```
declare
  type    names_aa is table of varchar2(30) index by binary_integer;
  l_names names_aa;
  l_indx  binary_integer;
begin
  -- fill up the collection
  l_names(1)                    := 'Hooly';
  l_names(42)                   := 'Heddy';
  l_names(10)                   := 'Hilder';
  l_names(l_names.count + 1)    := 'Holy';
  l_names(-1)                   := 'Haley';
  -- display the contents of the collection

  for l_indx           in values  of l_names loop
    dbms_output.put_line(l_indx                          );

  end loop;
end;
/
```

```
Haley
Hooly
Holy
Hilder
Heddy

PL/SQL procedure successfully completed
```



Oracle 21c

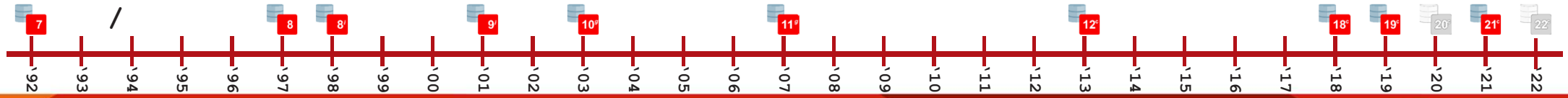
```
declare
  type    names_aa is table of varchar2(30) index by binary_integer;
  l_names names_aa;
  l_indx  binary_integer;
begin
  -- fill up the collection
  l_names(1)                    := 'Hooly';
  l_names(42)                   := 'Heddy';
  l_names(10)                   := 'Hilder';
  l_names(l_names.count + 1)    := 'Holy';
  l_names(-1)                   := 'Haley';
  -- display the contents of the collection

  for l_indx, l_value in pairs   of l_names loop
    dbms_output.put_line(l_indx || ') ' || l_value         );

  end loop;
end;
/
```

```
-1) Haley
1) Hooly
4) Holy
10) Hilder
42) Heddy

PL/SQL procedure successfully completed
```




This presentation was inspired by the movie
Dr. Seuss'
HORTON
HEARS A WHO!™
An animation done by:
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Q&A