```
*** First set of tests will be for a table in which only the first 10% of
blocks have 50% deleted data

*** Coalesce First


SQL> DROP TABLE bowie_stuff;

Table dropped.

SQL> CREATE TABLE bowie_stuff (id NUMBER, name VARCHAR2(20));

Table created.

SQL> INSERT INTO bowie_stuff SELECT rownum, 'DAVID BOWIE' FROM dual CONNECT
BY LEVEL <= 1000000;

1000000 rows created.

SQL> COMMIT;

Commit complete.

SQL> CREATE INDEX bowie_stuff_i ON bowie_stuff(id);

Index created.

SQL> DELETE bowie_stuff WHERE mod(id,2) = 1 and id <= 100000;

50000 rows deleted.

SQL> COMMIT;

Commit complete.

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2226          5       50000    17848160
90



*** 50,000 deleted leaf rows to get rid off


SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        128729824
```

```
SQL> ALTER INDEX bowie_stuff_i COALESCE;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                         131570396
(Diff 2,840,572)

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2116          5           0    16968160
90



*** Leaf blocks reduced by 110 blocks and at cost of 2,840,572 of redo.



*** Next up, SHRINK SPACE COMPACT



SQL> DROP TABLE bowie_stuff;

Table dropped.

SQL> CREATE TABLE bowie_stuff (id NUMBER, name VARCHAR2(20));

Table created.

SQL> INSERT INTO bowie_stuff SELECT rownum, 'DAVID BOWIE' FROM dual CONNECT
BY LEVEL <= 1000000;

1000000 rows created.

SQL> COMMIT;

Commit complete.

SQL> CREATE INDEX bowie_stuff_i ON bowie_stuff(id);

Index created.

SQL> DELETE bowie_stuff WHERE mod(id,2) = 1 and id <= 100000;

50000 rows deleted.
```

```
SQL> COMMIT;

Commit complete.

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2226          5       50000    17848160
90

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        252982196

SQL> ALTER INDEX bowie_stuff_i SHRINK SPACE COMPACT;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        257736892
(Diff 4,754,696)

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2116          5           0    16968160
90


*** Index in the same state as after the Coalesce with leaf blocks down by
110 but at nearly double the costs at 4,754,696 byes of redo ...

*** Of course, for just a tad more work, we can reduce the number of blocks
as well


SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';
```

```
NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                         257737624

SQL> ALTER INDEX bowie_stuff_i SHRINK SPACE;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                         257767572
(Diff 29,948)


SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2168       2116          5           0    16968160
90



*** Yes, blocks have now decreased as well for just 29,948 bytes of
additional redo


*** And now for the REBUILD ...


SQL> DROP TABLE bowie_stuff;

Table dropped.

SQL> CREATE TABLE bowie_stuff (id NUMBER, name VARCHAR2(20));

Table created.

SQL> INSERT INTO bowie_stuff SELECT rownum, 'DAVID BOWIE' FROM dual CONNECT
BY LEVEL <= 1000000;

1000000 rows created.

SQL> COMMIT;

Commit complete.

SQL> CREATE INDEX bowie_stuff_i ON bowie_stuff(id);

Index created.

SQL> DELETE bowie_stuff WHERE mod(id,2) = 1 and id <= 100000;

50000 rows deleted.
```

```
SQL> COMMIT;

Commit complete.

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2226          5       50000    17848160
90

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        318315872

SQL> ALTER INDEX bowie_stuff_i REBUILD;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        336229644
(Diff 17,913,772)


SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2176       2116          5           0    16968160
90


*** The index rebuild has also reduced leaf blocks by 110 and also reduced
the number of blocks, but look at the cost, a massive 17,913,772 in
comparison !!
```

*** Clearly the Coalesce achieved the goal of reducing the fragmentation at the lowest cost, but couldn't reduce the blocks allocated to the index segment.

*** So always use Coalesce, right ?

*** Well, let's run a slightly different series of tests. This time, we'll delete 75% of rows from 100% of the index.

```
SQL> DROP TABLE bowie_stuff;

Table dropped.

SQL> CREATE TABLE bowie_stuff (id NUMBER, name VARCHAR2(20));

Table created.

SQL> INSERT INTO bowie_stuff SELECT rownum, 'DAVID BOWIE' FROM dual CONNECT
BY LEVEL <= 1000000;

1000000 rows created.

SQL> COMMIT;

Commit complete.

SQL> CREATE INDEX bowie_stuff_i ON bowie_stuff(id);

Index created.

SQL> DELETE bowie_stuff WHERE mod(id,4) IN (0,1,2);

750000 rows deleted.

SQL> COMMIT;

Commit complete.

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2226          5           0    17848160
23
```

```
*** OK, PCT_USED is a very low 23%

*** BTW, those who rebuild indexes based on a ratio of deleted rows had
better not look at the DEL_LF_ROWS figure ...



SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                         724924196

SQL> ALTER INDEX bowie_stuff_i COALESCE;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                         768486772
(Diff 43,562,576)


SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used
 FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304        559          5           0     4512160
89



*** Very good, leaf blocks down right down to just 559 from 2226 at a cost
of 43,562,576.



*** SHRINK SPACE COMPACT, your turn


SQL> DROP TABLE bowie_stuff;

Table dropped.

SQL> CREATE TABLE bowie_stuff (id NUMBER, name VARCHAR2(20));

Table created.
```

```
SQL> INSERT INTO bowie_stuff SELECT rownum, 'DAVID BOWIE' FROM dual CONNECT
BY LEVEL <= 1000000;

1000000 rows created.

SQL> COMMIT;

Commit complete.

SQL> CREATE INDEX bowie_stuff_i ON bowie_stuff(id);

Index created.

SQL> DELETE bowie_stuff WHERE mod(id,4) IN (0,1,2);

750000 rows deleted.

SQL> COMMIT;

Commit complete.

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2226          5           0    17848160
23


SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        1157062988

SQL> ALTER INDEX bowie_stuff_i SHRINK SPACE COMPACT;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        1206975488
(Diff 49,912,500)


SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.
```

```
SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304        559          5           0     4512160
89


*** Same results as the Coalesce only somewhat more expensive at 49,912,500
of redo

*** But again, for just a tad more, we can deallocate storage from the
index


SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        1206976176

SQL> ALTER INDEX bowie_stuff_i SHRINK SPACE;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        1207113236
(Diff 137,060)

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3        584        559          5           0     4512160
89


*** Now blocks has dropped way down to 584 for just a little bit more redo



*** OK, REBUILD, you're up
```

```
SQL> DROP TABLE bowie_stuff;

Table dropped.

SQL> CREATE TABLE bowie_stuff (id NUMBER, name VARCHAR2(20));

Table created.


SQL> INSERT INTO bowie_stuff SELECT rownum, 'DAVID BOWIE' FROM dual CONNECT
BY LEVEL <= 1000000;

1000000 rows created.

SQL> COMMIT;

Commit complete.

SQL> CREATE INDEX bowie_stuff_i ON bowie_stuff(id);

Index created.

SQL> DELETE bowie_stuff WHERE mod(id,4) IN (0,1,2);

750000 rows deleted.

SQL> COMMIT;

Commit complete.

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         3       2304       2226          5           0    17848160
23

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
redo size                                                        1595418060

SQL> ALTER INDEX bowie_stuff_i REBUILD;

Index altered.

SQL> SELECT n.name, s.value FROM v$mystat s, v$statname n WHERE
s.statistic# = n.statistic# AND n.name = 'redo size';

NAME                                                                  VALUE
---------------------------------------------------------------- ----------
```

```
redo size                                                    1600076740
(Diff 4,658,680)

SQL> ANALYZE INDEX bowie_stuff_i VALIDATE STRUCTURE;

Index analyzed.

SQL> SELECT height, blocks, lf_blks, br_blks, del_lf_rows, btree_space,
pct_used FROM index_stats;

    HEIGHT     BLOCKS    LF_BLKS    BR_BLKS DEL_LF_ROWS BTREE_SPACE
PCT_USED
---------- ---------- ---------- ---------- ----------- ----------- -------
---
         2        640        557          1           0     4464032
90


*** WOW !! Not only have we reduced leaf blocks to 557, and reduced blocks
to 640
*** but we have also reduced the height of the index and the cost is a
relatively tiny 4,658,680 of redo, just 10% of the Coalesce costs ...


*** Coalesce, Shrink Space and Rebuild all have their place ...
```