Assignment 2 analysis.pdf-----Produced by Tianrun Zhang

If the size of tuples is not large or the 1/Pf is too large, then there is no need to implement the SIMC indexing which may need to use more number of page reads when query and implementing.

And we can find that tuple SIMC need to compare most times but because it has more page utilization so it may use less page to read and write.

We can also find that if we use less query attributes in a query then bit-sliced Signatures will be more powerful than page signatures. However the numbers of space bit-sliced Signatures used is determined by expected number of tuples.
So which means if the actual tuples is much smaller than expected ,then bit-sliced Signatures will use much more page write/read in sig page read part than others.

And also, if our query has many clear attributes than bit-sliced SIMC will not have much improvement..
Below are testing results.
For a database :create test 100000 8 10000

```
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$ ./create test1 100000 8 10000
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$ ./stats test1
Global Info:
Dynamic:
  #items:  tuples: 0  tsigs: 0  psigs: 0  bsigs: 0
  #pages:  tuples: 1  tsigs: 1  psigs: 1  bsigs: 1
Static:
  tups   #attrs: 8  size: 70 bytes  max/page: 58
  sigs   bits/attr: 13
  tsigs  size: 160 bits (20 bytes)  max/page: 204
  psigs  size: 8896 bits (1112 bytes)  max/page: 3
  bsigs  size: 1728 bits (216 bytes)  max/page: 18
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$
```

After insert 100000 tuples.

We can see the states of this databases.

```
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$ ./stats test
Global Info:
Dynamic:
  #items:  tuples: 100000  tsigs: 100000  psigs: 1725  bsigs: 8896
  #pages:  tuples: 1725  tsigs: 491  psigs: 575  bsigs: 495
Static:
  tups   #attrs: 8  size: 70 bytes  max/page: 58
  sigs   bits/attr: 13
  tsigs  size: 160 bits (20 bytes)  max/page: 204
  psigs  size: 8896 bits (1112 bytes)  max/page: 3
  bsigs  size: 1728 bits (216 bytes)  max/page: 18
```

When search for open query:

No use SIMC:

```
Query Stats:
# signatures read:   0
# sig pages read:    0
# tuples examined:   100000
# data pages read:   1725
# false match pages: 0
```

Use tuple SIMC:

```
Query Stats:
# signatures read:   100000
# sig pages read:    491
# tuples examined:   100000
# data pages read:   1725
# false match pages: 0
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$
```

Use page SIMC:

```
# signatures read:   1725
# sig pages read:    575
# tuples examined:   100000
# data pages read:   1725
# false match pages: 0
```

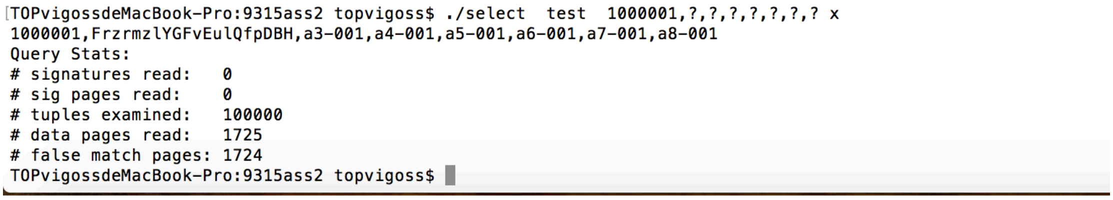
Use bit-sliced SIMC:

```
# signatures read:   0
# sig pages read:    0
# tuples examined:   100000
# data pages read:   1725
# false match pages: 0
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$
```

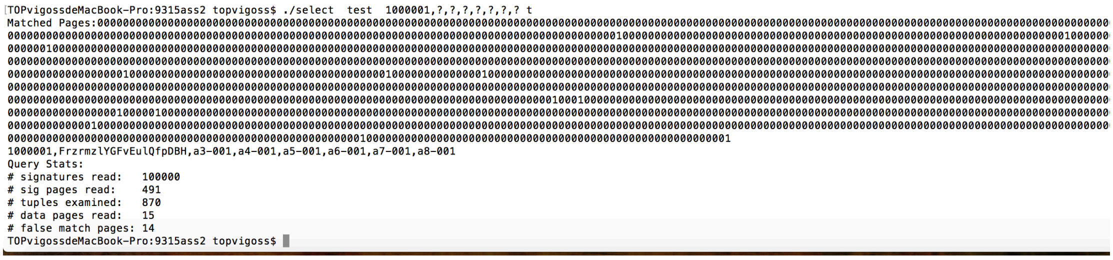
This is because query(?,?,?,?) can not get a clear codeword so no signatures are used.

When search for a query with one solution:

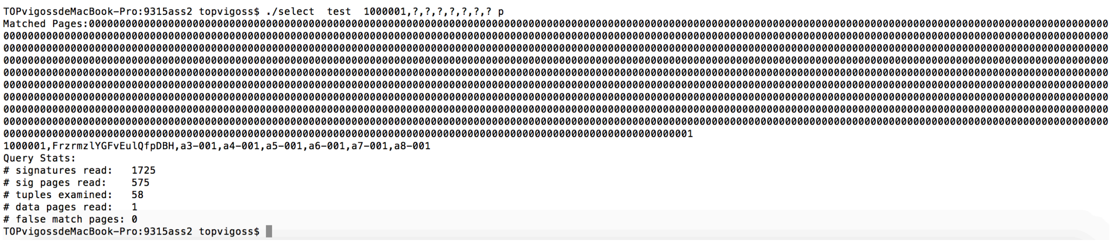
No use SIMC:



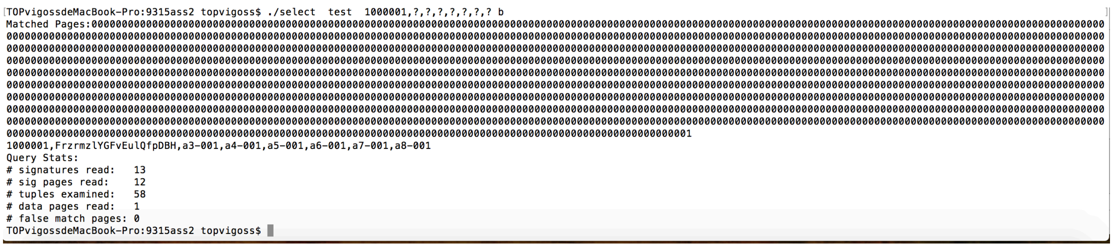
When use tuple SIMC:



When use page SIMC:



When use bit-sliced SIMC:



We can easily see that bit-sliced SIMC give a very good results with only 12+1=13 pages read.

When search for a query with many solutions:

No SIMC used:

```
Query Stats:
# signatures read:   0
# sig pages read:    0
# tuples examined:   100000
# data pages read:   1725
# false match pages: 1323
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$
```

When tuple SIMC is used:

```
Query Stats:
# signatures read:   100000
# sig pages read:    491
# tuples examined:   23896
# data pages read:   412
# false match pages: 10
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$
```

When page SIMC is used:

```
Query Stats:
# signatures read:   1725
# sig pages read:    575
# tuples examined:   23316
# data pages read:   402
# false match pages: 0
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$
```

When bit-sliced SIMC is used:

```
Query Stats:
# signatures read:   13
# sig pages read:    13
# tuples examined:   23316
# data pages read:   402
# false match pages: 0
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$
```

When search a query with multiple values:

No SIMC used:

```
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$ ./select  test  ?,?,a3-001,a4-001,a5-001,?,?,? x
1000001,FrzrmzlYGFvEulQfpDBH,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1004981,wQJHzsqcImpVhpCZhBEB,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1009961,pSGFARwajoYUVKJYvtsb,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1014941,KPDLiedRqGSKoUTYscgC,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1019921,UUdSnNePlcytRfArMqBB,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1024901,cAUrqMwmpxbrfFsQdNqT,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1029881,twEHkkQtlgrXRFJkVFfw,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
1034861,nBbgtfEVGdARXCQICBmF,a3-001,a4-001,a5-001,a6-001,a7-001,a8-333
1039841,jWXcnZBdTXYYwhoHDMyN,a3-001,a4-001,a5-001,a6-001,a7-333,a8-001
1044821,HprOjStwiafZuNduaJOg,a3-001,a4-001,a5-001,a6-001,a7-084,a8-333
1049801,OhdlsWkPvdQHIqQPNPVg,a3-001,a4-001,a5-001,a6-001,a7-416,a8-001
1054781,mTsQWrhqHNuAJUKuTzco,a3-001,a4-001,a5-001,a6-001,a7-167,a8-333
1059761,MAmFdsjMIUhAWheSwoDi,a3-001,a4-001,a5-001,a6-001,a7-499,a8-001
1064741,TPdLJGMSFeVCUjYqjSib,a3-001,a4-001,a5-001,a6-001,a7-250,a8-333
1069721,comVQTkQZceVCSRagcAa,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1074701,FwjXndraMTzWwUnyDPDw,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1079681,cclTBWcjxbicalDvFkaQ,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1084661,vrndnQRmqVvBkOLXkWTK,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1089641,qLIaxDfoqWckBAVjboez,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1094621,TxzGglknnPStGtJHUOeq,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1099601,CRpiSkbCqyaRkJdruLJL,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
Query Stats:
# signatures read:   0
# sig pages read:    0
# tuples examined:   100000
# data pages read:   1725
# false match pages: 1704
```

Tuple SIMC used:

```
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$ ./select  test  ?,?,a3-001,a4-001,a5-001,?,?,? t
Matched Pages:00000000001000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000
00000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000001000
00000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000
00000000000000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000
000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000
00000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000
00000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000
00000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000
00000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000001
1000001,FrzrmzlYGFvEulQfpDBH,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1004981,wQJHzsqcImpVhpCZhBEB,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1009961,pSGFARwajoYUVKJYvtsb,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1014941,KPDLiedRqGSKoUTYscgC,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1019921,UUdSnNePlcytRfArMqBB,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1024901,cAUrqMwmpxbrfFsQdNqT,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1029881,twEHkkQtlgrXRFJkVFfw,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
1034861,nBbgtfEVGdARXCQICBmF,a3-001,a4-001,a5-001,a6-001,a7-001,a8-333
1039841,jWXcnZBdTXYYwhoHDMyN,a3-001,a4-001,a5-001,a6-001,a7-333,a8-001
1044821,HprOjStwiafZuNduaJOg,a3-001,a4-001,a5-001,a6-001,a7-084,a8-333
1049801,OhdlsWkPvdQHIqQPNPVg,a3-001,a4-001,a5-001,a6-001,a7-416,a8-001
1054781,mTsQWrhqHNuAJUKuTzco,a3-001,a4-001,a5-001,a6-001,a7-167,a8-333
1059761,MAmFdsjMIUhAWheSwoDi,a3-001,a4-001,a5-001,a6-001,a7-499,a8-001
1064741,TPdLJGMSFeVCUjYqjSib,a3-001,a4-001,a5-001,a6-001,a7-250,a8-333
1069721,comVQTkQZceVCSRagcAa,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1074701,FwjXndraMTzWwUnyDPDw,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1079681,cclTBWcjxbicalDvFkaQ,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1084661,vrndnQRmqVvBkOLXkWTK,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1089641,qLIaxDfoqWckBAVjboez,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1094621,TxzGglknnPStGtJHUOeq,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1099601,CRpiSkbCqyaRkJdruLJL,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
Query Stats:
# signatures read:   100000
# sig pages read:    491
# tuples examined:   1218
# data pages read:   21
# false match pages: 0
```

Page SIMC used:

```
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$ ./select  test  ?,?,a3-001,a4-001,a5-001,?,?,? p
Matched Pages:00000000001000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000
00000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000001000
00000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000
00000000000000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000
000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000
00000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000
00000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000
00000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000
00000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000001
1000001,FrzrmzlYGFvEulQfpDBH,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1004981,wQJHzsqcImpVhpCZhBEB,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1009961,pSGFARwajoYUVKJYvtsb,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1014941,KPDLiedRqGSKoUTYscgC,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1019921,UUdSnNePlcytRfArMqBB,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1024901,cAUrqMwmpxbrfFsQdNqT,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1029881,twEHkkQtlgrXRFJkVFfw,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
1034861,nBbgtfEVGdARXCQICBmF,a3-001,a4-001,a5-001,a6-001,a7-001,a8-333
1039841,jWXcnZBdTXYYwhoHDMyN,a3-001,a4-001,a5-001,a6-001,a7-333,a8-001
1044821,HprOjStwiafZuNduaJOg,a3-001,a4-001,a5-001,a6-001,a7-084,a8-333
1049801,OhdlsWkPvdQHIqQPNPVg,a3-001,a4-001,a5-001,a6-001,a7-416,a8-001
1054781,mTsQWrhqHNuAJUKuTzco,a3-001,a4-001,a5-001,a6-001,a7-167,a8-333
1059761,MAmFdsjMIUhAWheSwoDi,a3-001,a4-001,a5-001,a6-001,a7-499,a8-001
1064741,TPdLJGMSFeVCUjYqjSib,a3-001,a4-001,a5-001,a6-001,a7-250,a8-333
1069721,comVQTkQZceVCSRagcAa,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1074701,FwjXndraMTzWwUnyDPDw,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1079681,cclTBWcjxbicalDvFkaQ,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1084661,vrndnQRmqVvBkOLXkWTK,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1089641,qLIaxDfoqWckBAVjboez,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1094621,TxzGglknnPStGtJHUOeq,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1099601,CRpiSkbCqyaRkJdruLJL,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
Query Stats:
# signatures read:   1725
# sig pages read:    575
# tuples examined:   1218
# data pages read:   21
# false match pages: 0
```

Bit-sliced used:

```
TOPvigossdeMacBook-Pro:9315ass2 topvigoss$ ./select  test  ?,?,a3-001,a4-001,a5-001,?,?,? b
Matched Pages:0000000000100000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000000000000000000000000000000000
0000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000000000000000000000000000000000000000001000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000010000000000000000000000000000000
0000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000
0000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000
0000000000000000000000000000000000010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000100000000000000000000000000000000000000000000000000000000000
0000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000001
1000001,FrzrmzlYGFvEulQfpDBH,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1004981,wQJHzsqcImpVhpCZhBEB,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1009961,pSGFARwajoYUVKJYvtsb,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1014941,KPDLiedRqGSKoUTYscgC,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1019921,UUdSnNePlcytRfArMqBB,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1024901,cAUrqMwmpxbrfFsQdNqT,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1029881,twEHkkQtlgrXRFJkVFfw,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
1034861,nBbgtfEVGdARXCQICBmF,a3-001,a4-001,a5-001,a6-001,a7-001,a8-333
1039841,jWXcnZBdTXYYwhoHDMyN,a3-001,a4-001,a5-001,a6-001,a7-333,a8-001
1044821,HprOjStwiafZuNduaJOg,a3-001,a4-001,a5-001,a6-001,a7-084,a8-333
1049801,OhdlsWkPvdQHIqQPNPVg,a3-001,a4-001,a5-001,a6-001,a7-416,a8-001
1054781,mTsQWrhqHNuAJUKuTzco,a3-001,a4-001,a5-001,a6-001,a7-167,a8-333
1059761,MAmFdsjMIUhAWheSwoDi,a3-001,a4-001,a5-001,a6-001,a7-499,a8-001
1064741,TPdLJGMSFeVCUjYqjSib,a3-001,a4-001,a5-001,a6-001,a7-250,a8-333
1069721,comVQTkQZceVCSRagcAa,a3-001,a4-001,a5-001,a6-001,a7-001,a8-001
1074701,FwjXndraMTzWwUnyDPDw,a3-001,a4-001,a5-001,a6-001,a7-333,a8-333
1079681,cclTBWcjxbicalDvFkaQ,a3-001,a4-001,a5-001,a6-001,a7-084,a8-001
1084661,vrndnQRmqVvBkOLXkWTK,a3-001,a4-001,a5-001,a6-001,a7-416,a8-333
1089641,qLIaxDfoqWckBAVjboez,a3-001,a4-001,a5-001,a6-001,a7-167,a8-001
1094621,TxzGglknnPStGtJHUOeq,a3-001,a4-001,a5-001,a6-001,a7-499,a8-333
1099601,CRpiSkbCqyaRkJdruLJL,a3-001,a4-001,a5-001,a6-001,a7-250,a8-001
Query Stats:
# signatures read:   38
# sig pages read:    36
# tuples examined:   1218
# data pages read:   21
# false match pages: 0
```

Above all ,we can see SIMC is very useful.