2)

a) In FIFO algorithm pages fault occurs will be: -

i) Frames= 16, Page size=512

Each frame will hold one row, therefore after array is accessed in row major order, a[i][j]

The number of page fault generated will be 512. As entire array is on disk when on start. So,

When the first element is accessed i.e. a [0][0] there is a page fault and the first row is placed

on the first frame. The next page fault occurs when the value changes to 1. Similarly, for each

next row page fault occurs.

ii)In Column major: -

for(int i=0;i<512;i++){

for(int j=0;j<512;j++){

a[i][j];

}

}

When first element is accessed a [0][0], it results in page fault. So, the first frame is placed with

0th row like row major order. When the next element a [1][0] is accessed, it results in a

page fault. So for each element accessed in inner loop (a [0][0] to a [511][0], it results in page

fault. Therefore, total page faults are 512 for the first loop. For second loop each element to

be accessed will have page fault therefore, total page faults are: - 512\*512=262144-page faults

b) It will be same as FIFO as the least recently used pages will be replaced.

3)

Sequence

0 1 4 0 2 3 0 1 0 2 3 4 2 3

Page fault= ®

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steps | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pages |  | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|  |  |  | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 4 | 4 | 4 |
|  |  |  |  |  | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

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Page 0 goes in the memory, then page 1 goes in the memory, after that page 4, Then page 0 is a hit.

Then page 2 is put in the memory, Then page 3 is not in the memory, LRU algorithm is used to page 3,

So, 1 is least recently used and therefore is replaced. Then again when page 1 comes again then the least recently used page i.e. page 4 is replaced by page 1, then again when page 4 comes then page 1 is replaced.

Therefore, total hits are 7 and page faults are 7

4)

a)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steps | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|  | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 3 |
| Pages |  | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
|  |  |  | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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* Hit ratio =4/14=0.33
* Average working set size=2.71

b)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steps | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 4 |
| Pages |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
|  |  |  | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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* Hit ratio= 7/14=0.5
* Average working set=2.71

5)

1 0 0 0 0 0 0 1 1 3 0 0 0 1 5 1 5 4 4 2 0 0 4 4

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steps | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 5 | 5 | 5 |  |
| Pages |  |  |  |  |  |  |  |  |  | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |  |
|  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
|  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |