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For Process A, which is Read Row (by Row Major) there is 20480 page faults. Every time Process A reads in a row into the Page Table is causes a page fault. So after reading in the first 8 rows and causes 8 page faults, then by the LRU algorithm the first row page entry is replaced by the ninth row page entry and this causes a page fault. This LRU algorithm continues for all rows. For every row it reads every column before going to the next row. Therefore after accessing 20480 rows there were 20480 page faults.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Row Major | | | | | | | |
|  |  |  |  |  |  |  | Page Table |
|  |  |  |  |  |  |  | Data |
|  | 0 |  | | | 4096 |  | Code |
|  | Row 1 | | | | |  | Row 1 |
|  | Row 2 | | | | |  | Row 2 |
|  | Row 3 | | | | |  | Row 3 |
|  | Row 4 | | | | |  | Row 4 |
|  | Row 5 | | | | |  | Row 5 |
|  | Row 6 | | | | |  | Row 6 |
|  | Row 7 | | | | |  | Row 7 |
|  | Row 8 | | | | |  | Row 8 |
|  | Row 9 | | | | |  |  |
|  | … | | | | |  |  |
|  | … | | | | |  |  |
|  | Row 20480 | | | | |  |  |
|  | 20480 |  |  |  |  |  |  |

FIGURE 1. Row Major

For Process B, which is Read Column (by Column Major) there is 20480 x 4096 = 83,886,080 page faults. In order for Process B to Read from the matrix in Column Major order, it must load an entire page for each row inside the column, causing a page fault, this is because C stores memory in Row major order. For every column read there are 20480 page faults drastically lowering the performance of the program.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Column Major | | | | | | | |
|  |  |  |  |  |  |  | Page Table |
|  | 0 |  | | | 4096 |  | Data |
|  | Column 1 | Column 2 | Column 3 | … | Column 4096 |  | Code |
|  |  | **Row 1** |  | | |  | Row 1 |
|  | **Row 2** |  | Row 2 |
|  | **Row 3** |  | Row 3 |
|  | **Row 4** |  | Row 4 |
|  |  | **Row 5** |  |  |  |  | Row 5 |
|  |  | **Row 6** |  | | |  | Row 6 |
|  | **Row 7** |  | Row 7 |
|  | **Row 8** |  | Row 8 |
|  | **Row 9** |  |  |
|  | **…** |  |  |
|  | **…** |  |  |
|  | **Row 20480** |  |  |
|  | 20480 |  |  |  |  |  |  |

FIGURE 2. Column Major

For process A and process B there was a total of 83,886,080 + 20480 = 83,906,560 page faults for running the read row and read column algorithms. Additionally there are 2 more page faults for reading in the Data and Code in the Page Table for a grand total of 83,906,562 in this example. Even though there where 8 frames for the matrix, however this made no difference to the performance of the processes because the frames were never reutilized before they were evicted.