CSC 139 Operating System Principles

4/11/2019 In-class Group Assignment

1. Consider an array named data with 128*128 elements. Each row is stored in one page (of size 128 words).
   Program 1:

```
for (j = 0; j < 128; j++)
        for (i = 0; i < 128; i++)
                data[i][j] = 0;
```

   How many page faults will occur?

   Program 2:

```
for (i = 0; i < 128; i++)
        for (j = 0; j < 128; j++)
                data[i][j] = 0;
```

   How many page faults will occur?

2. A memory system has three frames and eight virtual pages. The three frames are initially empty. Consider the reference string 01232304523143263212. How many page faults will occur when FIFO, LRU, and Optimal algorithms are used respectively?

3. Belady's anomaly: Intuitively, it seems that the more frames the memory has, the fewer page faults a program will get. Surprisingly enough, this is not always true. Belady (1969) discovered an example in which FIFO page replacement causes more faults with four-page frames than with three. This strange situation has become known as Belady's anomaly. To illustrate, a program with five virtual pages numbered from 0 to 4 references its pages in the order: 0 1 2 3 0 1 4 0 1 2 3 4
   1) Using FIFO replacement, compute the number of page faults with 3 frames. Repeat for 4 frames.
   2) Compute the number of page faults under LRU and the optimal algorithm.