Alexander Sigler

Dan Ortiz

Angad Singh

Jesus Guzman-Torres

CPSC 351-03

May 18, 2019

## Assignment #2 Design

For assignment 2, we had to write a simulation that demonstrates the effects of the limited memory and memory management policies. Our Simulation loads the processes from the file and simulates them running in memory. We had to consider the arrival time of the process, how long it was supposed to run in memory and how much space it would take up. We could only allocate memory if there was enough space. To do this we implemented three files; our main program, process manager program and, memory manager program.

The first part we needed for this project was the maker file. We used makefile to make commands that can be use in the command line to set up our code before we run the our actual code.

Before starting the main three programs we had to write two header files. One header file created a class called process which contain all relevant information about the process once it has been loaded from the file as well as keeps track of various stages in memory. The other header file just includes the necessary libraries that we needed to complete the code.

For our main program defines and requests a handful of things from the user such as the text file, memory size and page size. It adjusts the pages size so it can be a proper page size. It also reads the file. Finally, it starts the process manager and simulator setting up for the next program.

The next program, the process manager, will be taking care of adding all of the processes and simulate of time. It first creates a class called ProcessManager which takes care of the variables and vectors that we will be using to keep track of things. This class has a bit of functions. Our deconstructor deletes the newly created memory manager. The ProcessManager function begins with initializing the clock time as well as the memory manager which then breaks the memory into pages. Next it loads all of the process from the file such as total number of process and so on. It then figures out how much memory is needed and creates the process that will then be added to the total process list. It then final runs the simulation. The next function is the run function. It first finds the process's arrival time. Then it handles the process that are completed as well as starting to put the process into memory. It finally updates the time of each process. The class also have print functions for the memory map, input queue, arrival message, and completion message.

The final program, MemoryManager, is set up the same way with is own class and functions. The deconstructor deletes the pages that were used. The MemoeryManager function connects the variables to addresses. The first function is the addprocess function first checks if there are enough pages open then assigns the pages to the open slots in memory. We also have a

function that removes a process. A function that returns the number of free pages and a print memory map function.

We have a little trouble with this project since it was had to meet up with our busy schedules but we figured it out. We also has a little trouble simulating the clock in order to find when the process was made.

In conclusion, this program really helped us understand and visualize the effects of memory and memory management policies. Learning about it in class was a little confusing and hard to visualize so this program did just that. Beside the technical knowledge that we got working on this program it also reinforced our basic coding skills, problem solving skills, and teamwork skills. Working with other people is something we will be doing a lot of in the future and this gave us experience with that very thing.

```
xander@xander-VirtualBox:~/Desktop/cpsc351_project2_ortiz-sigler-singh-torres-ma
ster$ make
make: Nothing to be done for 'all'.
xander@xander-VirtualBox:~/Desktop/cpsc351 project2 ortiz-sigler-singh-torres-ma
ster$ make
g++ -std=c++17 -Wall -Wpedantic -cpp main.cpp -o simulator
In file included from main.cpp:2:0:
ProcessManager.cpp: In member function 'void ProcessManager::run()':
ProcessManager.cpp:94:27: warning: comparison between signed and unsigned intege
r expressions [-Wsign-compare]
         for (int i = 0; i < totalProcesses.size(); i++){
ProcessManager.cpp:107:27: warning: comparison between signed and unsigned integ
er expressions [-Wsign-compare]
         for (int i = 0; i < inProgressProcesses.size(); i++) {
ProcessManager.cpp:121:27: warning: comparison between signed and unsigned integ
er expressions [-Wsign-compare]
         for (int i = 0; i < unloadedProcesses.size(); i++){</pre>
xander@xander-VirtualBox:~/Desktop/cpsc351 project2 ortiz-sigler-singh-torres-ma
ster$ ./simulator
```

```
t = 0: Process 1 arrives
                                                            Input Oueue: [1 ]
Process 1 arrives
                                                            Memory map:
Input Queue [ 1 ]
                                                                0-1999: Free frame(s)
Process 2 arrives
                                                    5
                                                               Process 2 arrives
                                                            Input Queue: [1 2 ]
Input Queue [ 1 2 ]
                                                    6
                                                            Memory map:
MM moves Process 1 to memory
                                                                0-1999: Free frame(s)
Input Queue [ 2 ]
                                                            MM moves process 1 to memory
                                                    9
Memory Map:
                                                   10
                                                            Memory map:
                                                                0-199: Process 1, Page 1
                                                   11
                                                                200-399: Process 1, Page 2
    200-399: Process 1, Page 2
                                                                400-1999: Free frame(s)
    400-1999: Free frame(s)
                                                  14
                                                            MM moves process 2 to memory
MM moves Process 2 to memory
                                                  15
                                                            Memory map:
Input Queue [ ]
                                                                0-199: Process 1, Page 1
                                                  16
                                                   17
                                                                200-399: Process 1, Page 2
Memory Map:
                                                                400-599: Process 2, Page 1
                                                  18
    0-199: Process 1, Page 1
                                                                600-799: Process 2, Page 2
                                                  19
    200-399: Process 1, Page 2
                                                                800-999: Process 2, Page 3
                                                  20
    400-599: Process 2, Page 1
                                                  21
                                                                1000-1999: Free frame(s)
    600-799: Process 2, Page 2
                                                        t = 100: Process 3 arrives
                                                  22
                                                  23
                                                            Input Queue:[3 ]
                                                  24
                                                            Memory map:
    1000-1999: Free frame(s)
                                                  25
                                                                0-199: Process 1, Page 1
                                                   26
                                                                200-399: Process 1, Page 2
                                                                400-599: Process 2, Page 1
                                                  27
Process 3 arrives
                                                                600-799: Process 2, Page 2
                                                  28
                                                                800-999: Process 2, Page 3
                                                  29
Input Queue [ 3 ]
                                                                1000-1999: Free frame(s)
Process 4 arrives
                                                  31
                                                                Process 4 arrives
Input Queue [ 3 4 ]
                                                  32
                                                            Input Queue: [3 4 ]
MM moves Process 3 to memory
                                                  33
                                                            Memory map:
                                                                0-199: Process 1, Page 1
Input Queue [ 4 ]
                                                  34
                                                   35
                                                                200-399: Process 1, Page 2
Memory Map:
                                                                400-599: Process 2, Page 1
                                                  36
    0-199: Process 1, Page 1
                                                                600-799: Process 2, Page 2
                                                  37
    200-399: Process 1, Page 2
                                                                800-999: Process 2, Page 3
                                                  38
    400-599: Process 2, Page 1
                                                   39
                                                                1000-1999: Free frame(s)
    600-799: Process 2, Page 2
                                                  40
                                                            MM moves process 3 to memory
                                                  41
                                                            Memory map:
                                                  42
                                                                0-199: Process 1, Page 1
    1000-1199: Process 3, Page 1
                                                                200-399: Process 1, Page 2
                                                  43
    1200-1399: Process 3, Page 2
                                                  44
                                                                400-599: Process 2, Page 1
    1400-1999: Free frame(s)
                                                  45
                                                                600-799: Process 2, Page 2
                                                  46
                                                                800-999: Process 2, Page 3
MM moves Process 4 to memory
                                                  47
                                                                1000-1199: Process 3, Page 1
Input Queue [ ]
                                                                1200-1399: Process 3, Page 2
                                                  48
Memory Map:
                                                                1400-1999: Free frame(s)
                                                  49
                                                  50
                                                            MM moves process 4 to memory
    200-399: Process 1, Page 2
                                                  51
                                                            Memory map:
                                                                0-199: Process 1, Page 1
                                                  52
    400-599: Process 2, Page 1
                                                  53
                                                                200-399: Process 1, Page 2
    600-799: Process 2, Page 2
                                                                400-599: Process 2, Page 1
                                                  54
    800-999: Process 2, Page 3
                                                                600-799: Process 2, Page 2
                                                  55
    1000-1199: Process 3, Page 1
                                                  5.6
                                                                800-999: Process 2, Page 3
                                                                1000-1199: Process 3, Page 1
    1200-1399: Process 3, Page 2
                                                  57
                                                                1200-1399: Process 3, Page 2
                                                  58
    1400-1599: Process 4, Page 1
                                                                1400-1599: Drocess 4 Dags 1
```

```
100 t = 1800: Process 5 completes
= 1800:
                                       101
                                                 Memory map:
 Process 5 completes
                                       102
                                                      0-399: Free frame(s)
 Memory Map:
                                       103
                                                      400-799: Process 2, Page 1
                                       104
                                                      800-1199: Process 2, Page 2
    800-1199: Process 2, Page 2
                                       105
                                                      1200-1599: Free frame(s)
    1200-1599: Free frame(s)
                                       106
                                                      1600-1999: Process 4, Page 1
                                       107
                                                 MM moves process 6 to memory
                                       108
                                                 Memory map:
 Memory Map:
                                       109
                                                      0-399: Process 6, Page 1
    0-399: Process 6, Page 1
                                       110
                                                      400-799: Process 2, Page 1
                                       111
                                                      800-1199: Process 2, Page 2
                                       112
                                                      1200-1599: Free frame(s)
    1200-1599: Free frame(s)
                                       113
                                                      1600-1999: Process 4, Page 1
 MM moves Process 8 to memory
                                       114
                                                 MM moves process 8 to memory
                                       115
                                                 Memory map:
                                       116
                                                      0-399: Process 6, Page 1
    0-399: Process 6, Page 1
                                       117
                                                      400-799: Process 2, Page 1
                                                      800-1199: Process 2, Page 2
                                       118
    800-1199: Process 2, Page 2
                                                     1200-1599: Process 8, Page 1
                                       119
                                       120
                                                      1600-1999: Process 4, Page 1
                                       121 t = 2000: Process 4 completes
                                       122
                                                 Memory map:
 Process 2 completes
                                       123
                                                      0-399: Process 6, Page 1
 Memory Map:
                                       124
                                                      400-799: Process 2, Page 1
    400-1199: Free frame(s)
                                       125
                                                      800-1199: Process 2, Page 2
                                                     1200-1599: Process 8, Page 1
                                       126
                                       127
                                                      1600-1999: Free frame(s)
 Process 4 completes
                                       128
                                                      Process 2 completes
 Memory Map:
                                       129
                                                 Memory map:
                                       130
                                                      0-399: Process 6, Page 1
    400-1199: Free frame(s)
                                       131
                                                      400-1199: Free frame(s)
    1600-1999: Free frame(s)
                                       132
                                                      1200-1599: Process 8, Page 1
                                       133
                                                      1600-1999: Free frame(s)
 Input Queue [ ]
                                       134
                                                 MM moves process 7 to memory
 Memory Map:
                                       135
                                                 Memory map:
                                                      0-399: Process 6, Page 1
                                       136
    800-1199: Process 7, Page 2
                                       137
                                                      400-799: Process 7, Page 1
    1200-1599: Process 8, Page 1
                                       138
                                                      800-1199: Process 7, Page 2
    1600-1999: Free frame(s)
                                       139
                                                      1200-1599: Process 8, Page 1
                                       140
                                                      1600-1999: Free frame(s)
                                       141
                                            t = 2300: Process 8 completes
                                       142
                                                 Memory man.
 Memory Map:
```

```
1500-1599: Process 7, Page 5
        1000-1099: Process 7, Page 2
                                                     204
                                                                           1600-1699: Process 7, Page 6
                                                                           1700-1799: Process 7, Page 7
                                                     206
                                                                           1800-1899: Process 7, Page 8
       1300-1399: Process 4, Page 1
                                                     207
                                                                           1900-1999: Process 8. Page 1
       1400-1499: Process 4, Page 2
       1500-1599: Process 7, Page 5
                                                     210
       1600-1699: Process 7, Page 6
                                                           t = 2000: Process 2 completes
                                                     211
                                                                  Memory Map: 0-99: Process 6, Page 1
                                                     213
                                                                            100-199: Process 6, Page 2
                                                     214
                                                                            200-299: Process 6, Page 3
                                                     215
                                                                            300-399: Process 7, Page 1
                                                     21€
                                                                            400-999: Free frame(s)
   Memory Map:
                                                     217
                                                                          1000-1099: Process 7, page 2
       0-99: Process 6, Page 1
                                                                          1100-1199: Process 7, page 3
                                                     218
       100-199: Process 6, Page 2
                                                                          1200-1299: Process 7, page 4
                                                     219
       200-299: Process 6, Page 3
                                                     220
                                                                          1300-1399: Process 4, Page 1
                                                                           1400-1499: Process 4, Page 2
       300-399: Process 7, Page 1
                                                                          1500-1599: Process 7, Page 5
       400-999: Free frame(s)
                                                     223
                                                                           1600-1699: Process 7, Page 6
       1000-1099: Process 7, Page 2
                                                     224
                                                                           1700-1799: Process 7. Page
                                                                          1800-1899: Process 7, Page 8
                                                     225
       1200-1299: Process 7, Page 4
                                                     226
                                                                           1900-1999: Process 8, Page 1
                                                     227
                                                                     Process 4 completes
       1300-1499: Free frame(s)
                                                     228
                                                                    Memory Map: 0-99: Process 6, Page 1
                                                                            100-199: Process 6, Page 2
                                                     229
                                                     230
                                                                            200-299: Process 6, Page 3
                                                     231
                                                                           300-399: Process 7, Page 1
                                                                           400-999: Free frame(s)
       1800-1899: Process 7, Page 8
                                                                          1000-1099: Process 7, page 2
       1900-1999: Process 8, Page 1
                                                                          1100-1199: Process 7, page 3
                                                     234
                                                                           1200-1299: Process 7, page 4
                                                     235
   Memory Map:
                                                     236
                                                                          1300-1499: Free frame(s)
                                                                          1500-1599: Process 7, Page 5
       0-99: Process 6, Page 1
                                                     237
                                                     238
                                                                           1600-1699: Process 7, Page 6
       100-199: Process 6, Page 2
                                                     239
                                                                          1700-1799: Process 7, Page 7
       200-299: Process 6, Page 3
                                                     240
                                                                           1800-1899: Process 7, Page 8
       300-1899: Free frame(s)
                                                                           1900-1999: Process 8, Page 1
                                                     241
       1900-1999: Process 8, Page 1
                                                     242
                                                                     Process 7 completes
                                                                    Memory Map: 0-99: Process 6, Page 1
                                                     243
                                                     244
                                                                            100-199: Process 6, Page 2
t = 2100:
                                                     245
                                                                            200-299: Process 6, Page 3
   Process 8 completes
                                                                            300-1899: Free frame(s)
                                                     246
   Memory Map:
                                                     247
                                                                           1900-1999: Process 8, Page 1
                                                     248
                                                     249
       100-199: Process 6, Page 2
                                                     250
                                                          t = 2100: Process 8 completes
       200-299: Process 6, Page 3
                                                     251
                                                                    Memory Map: 0-99: Process 6, Page 1
       300-1999: Free frame(s)
                                                     252
                                                                            100-199: Process 6, Page 2
                                                                            200-299: Process 6, Page 3
t = 3000:
                                                     254
                                                                            300-1999: Free frame(s)
   Process 6 completes
                                                     256
                                                          t = 3000: Process 6 completes
   Memory Map:
                                                     257
                                                                    Memory Map: 0 - 1999: Free frame(s)
       0-1999: Free frame(s)
                                                     258
                                                     259
                                                          Average Turnaround Time: 1175.00
                                                     260
                                                     261
```