

# Wayne State University

## CSC 4421 - Winter 2020

### Computer Operating Systems Labs

### Lab 08 - Memory

#### Instructors

Rui Chen - section 001

Points Possible: 100

#### Tasks \* (100 points)

1. *free* is a command that displays used and available memory in your system.
2. Read the man page of the *free* command.
3. Run the command *free -w* several times, running other programs in between, and store the results in a file.

Take note of the memory used, memory used for buffers, memory used for cache, and swap used.

Run ram-intensive programs, or enough instances of programs, that there are significant (noticeable) changes to the available memory, buffers, cache, and swap. Do this at least until you can see meaningful changes to swap.

Keep track of which programs you started between samples.

Choose five meaningful samples points. Keep them in chronological order. They do not have to be a sequence of 5 runs, but sample  $i$  should occur before sample  $j$  for all  $i < j$ .

4. Draw a graph as follows: X-axis: Time (or sample number); Y-axis: memory use, use (i) Memory Used per unit time, (ii) Memory Buffered per unit time, (iii) Memory Cached per unit time, and (iiii) Swap Used per unit time.

Note:

Indicate for each of the five samples (Time on X-axis) the programs that you started and are still running when the sample is taken. This means to indicate all programs started between the two selected samples, not just the new instances of programs started between  $(j - 1$  and  $j)$ .

Note: you may use the Y-axis on the left and right side for difference scales (Used/Available ram may be in the millions of bytes while swap may be in the thousands).

Be sure to properly label your graph.

5. Explain the behavior of this graph with respect to memory utilization in the presence of running various applications.

FILES TO SUBMIT:

1. (\*10 points) File labeled "data.txt" with the raw results of your samples
2. (\*10 points) File labeled "data-selected.txt" with the five meaningful points that you've chosen to graph.
3. (\*50 points) The graph. You can draw this by hand or with computer software. Make sure that it is legible. Preferably, use a flat-bed scanner if hand-drawn. If you use a phone camera app to "scan" a hand-drawn document, make sure it has a high resolution, does not have any shadows, does not have any glare, and is easy to read.
4. (\*30 points) File labeled "analysis.txt" with your explanation of the behavior of the graph with respect to memory utilization.