

## HW #3 Exploring Memory

This is an individual assignment but you are welcome to discuss it with your classmates as long as you turn in answers in your own words.

**Deliverables:** Some form of document (openable on a lab computer) that contains your text answers.

### Exploring Memory on the Mac

Open Activity Monitor and terminal so that you can see them both.

#### Part1: Activity Monitor vs. vm\_stat

Typing the command “vm\_stat” in terminal gives you detailed information about memory pages in your system. **Use “man vm\_stat” to learn more about the command.** Use the information from vm\_stat and from the memory tab of activity monitor to answer the following questions.

1. What is the page size on this computer?
2. According to vm\_stat, how much memory (in GB) is in pages that are active? How does this compare to “memory used” in activity monitor?
3. According to vm\_stat, how much memory (in GB) is in pages that are wired down? How does this compare to “wired memory” in activity monitor?
4. Why is the amount of memory in pages give by vm\_stat slightly different than the amount of memory given by activity monitor for the categories in the 2 above questions? Will the number given by vm\_stat always be larger or smaller than the number from activity monitor? Or could it be either?
5. Which categories in vm\_stat are included in the “cache” category in activity monitor?
6. Which category in vm\_stat corresponds to “compressed” memory used in activity monitor?
7. How does the number of pageins compare to pageouts? Why is this the case?
8. What is the difference between swap in/out and page in/out? Which is most important for determining if your system has enough RAM to function smoothly/quickly?

## Part2: taxing memory

**Note: I do NOT recommend doing this on your own computer.** Given that, I tested it on mine, and a simple reboot fixes all woes =)

Download the inf.py program I have provided and take a look to see what it does. On the command line (in the same folder as the inf.py file), type

```
python inf.py 1
```

to run the test program. Note a Java program won't work well for this question as the Java VM does all sorts of things to manage memory itself as opposed to leaving everything up to the native OS.

Keep an eye on the memory tab of activity monitor as the program runs, though it only gets interesting when you get close to using all of the RAM, so you may want to have something else to do for a few minutes while the program sucks up memory. On the loaner laptop I have from Carleton right now it took over 15min after starting the program to get to much really interesting going on. It will also be helpful to note the initial values of "Swap used", "Cache", and "Compressed" memory.

Answer the following questions, some of the "why's" are speculative at this point, so do your best between class and the readings in the book to make an educated guess that explains the behavior.

9. As used RAM approaches available RAM, what happens to the amount of memory in the "cached files" category? Why?
10. At what point does the amount of compressed memory start increasing for the Python process? Is it simply when all RAM is in use?
11. Why is the memory pressure in activity monitor still green (low pressure)?
12. The amount of compressed memory shown for the Python process will be much higher than the "compressed" value given in activity monitor for all compressed memory. How can this be?
13. Check vm\_stat again after your program has run for awhile, what is the lowest number of available pages you see?
14. Try and actually put some pressure on the memory, it can handle just this Python program, but do a bunch of other things in succession until you see the memory pressure go yellow. Open a bunch of browser tabs, open a bunch of word documents, make a tiny change and save them, just open several applications in a row that weren't already running. When memory pressure does go yellow, are you now using swap?
15. Finally quit the Python program and watch what happens to memory. Wait just a few seconds after quitting and show vm\_stat again a few times. How quickly does the pages available value go up? How quickly does the number of pages in the compressor fall? If you managed to use swap, does that immediately go away? Why or why not?