Exercise 1

- Run 'free -t -h' in the shell or 'vm_stat' on macOS

- **Mem** represents physical memory size
- **Swap** represents size of memory available for swapping
- **Total** represents virtual memory size

Exercise 1(windows)

- There is no command such as '*free*' but we can get the physical and virtual memory size using the following commands.
  - systeminfo | find "Physical Memory"
  - systeminfo | find "Virtual Memory"

Exercise 2

- Write a C program that runs for 10 seconds. Every second it should:
  - allocate 10 MB of memory
  - fill it with zeros
  - sleep for 1 second
- Compile and run the program in the background (./ex2 &) and run '*vmstat 1*' at the same time. Observe what happens to the memory. Pay attention to **si** and **so** fields.
- Add comments to your source code with your findings.
- Hint: use *memset(ptr, value, size)* to fill the allocated memory

Exercise 3

- Run '*top -d 1*' or '*top -i 1*' on macOS
- Run ex2 program in the background and then run 'top'
- Add comments to your source code with your findings.

Exercise 4

- Write a C program that runs for 10 seconds. Every second it should:
  - allocate 10 MB of memory
  - fill it with zeros
  - print memory usage with getrusage() function
  - sleep for 1 second

Exercise 5

- What is the difference between a physical and a virtual address? Describe using **your own words**. Save your answer to ex5.txt

Exercise 6

- A machine has 16-bit virtual addresses. Pages are 8 KB. How many entries are needed for a single-level linear page table? Explain your computations. Save your answer to ex6.txt
- (Hint: Modern Operating Systems, 3.3.2)

Extra exercise

- Download and run Memory Management Simulator
- Installation instructions:
  `http://www.ontko.com/moss/memory/install_unix.html`
- Download:
  `http://www.ontko.com/moss/memory/memory.tgz`
- User guide:
  `http://www.ontko.com/moss/memory/user_guide.html`