

# Homework 1

**Submit your *typed* answers at the start of class on Friday, May 30th. Figures and equations can be done by hand. Remember to submit your homeworks with a cover page that includes your name, netid and student number.**

*You are permitted to discuss homework questions with other students, but you must write out the answers yourself and give the names of the students with whom you discussed the homework. We will not look favorably on answers that are copied from online sources.*

1. Should the operating system include applications such as web browsers, mail programs and shell utilities? Which of the two alternatives do most operating systems choose today? What are the pros and cons of this approach?
2. Silberschatz 2.4
3. Silberschatz 2.9
4. Process *A* wants to send some data to process *B*.
  - (a) Explain how you could perform the transfer using fixed-size kernel mailboxes.
  - (b) An alternative transfer mechanism, provided by many operating systems, is shared memory. Suppose that the following system calls exist for sharing existing memory regions among processes:
    - `share(name, address, size)`: make `size` bytes, starting at location `address` registered with the kernel under `name`.
    - `size = map(name, address)`: map the memory region identified by `name` into this process's address space, starting at location `address`, and return the size of the region.
    - `unmap(name)`: cancel a previous `map` operation.Explain how you could perform the transfer using these shared memory primitives.
  - (c) Discuss the advantages and disadvantages of using message-passing rather than shared memory, especially with respect to performance.
5. What advantages do threads have over multiple processes? What major disadvantage do they have? Suggest one application that would benefit from the use of threads, and one that would not.
6. Read section 3.5.3 on microkernels. Although there has been a lot of research done on microkernel designs for operating systems, full microkernels have not caught on in mainstream systems. What major disadvantage does a microkernel design have compared to a conventional "macrokernel" design? Hint: Think about the steps required to perform system calls on top of a microkernel compared to doing so on a "macrokernel".
7. Many operating systems allow applications to invoke system services either through a relatively small number of powerful system calls or through system libraries, implemented in terms of the underlying system calls, that applications link with. Explain the reasons for this layered design.