

# COMP 4000A/5102F: Distributed Operating Systems

## Winter 2023 Midterm Exam

February 15, 2023

Instructor: Anil Somayaji  
**80 minutes, Open Book**

Answer two out of the following four questions. If you answer more than two questions, clearly indicate which ones should be graded. Please write your answers in a separate exam booklet, or, alternately type them on a computer and submit them via Brightspace or email them to [anil.somayaji@carleton.ca](mailto:anil.somayaji@carleton.ca).

The exam is open book, open note, open Internet. The only thing you may not do is discuss questions with other individuals. In other words, no emailing/IM/texting/whatever with other people during the exam!

**How to Answer the Questions:** Answer each question with a small essay. When the question has multiple parts (e.g., asking for you to discuss two or three separate systems), please do not answer them separately; instead, use them to help structure your small essay answer. Be specific but also make appropriate generalizations. Be concise—the essays will be long enough if you really answer the questions and time is short.

Show me what you understand, not what you remember.

Good luck!

1. Remote procedure calls (RPC) and distributed shared memory (DSM) are both approaches to making what would normally be a local operation work in a distributed context. With RPC, the focus is on the function call, while with DSM the focus is on arbitrary memory access. Compare and contrast RPC and DSM as approaches to achieve network transparency. Specifically, what are their respective implementation requirements, what are the potential benefits, and what are the potential problems? Explain using at least three specific examples.
2. “Early work in distributed operating systems was focused on giving users a consistent computing environment rather than allowing a single application to make use of multiple computers.” Argue for or against using examples from the readings covered in class, being sure to discuss examples that both support and do not support this statement.
3. To what degree have UNIX semantics been violated, changed, or simply ignored in order to build distributed operating systems? Be sure to consider SunRPC, NFS, LOCUS, Sprite, AFS, and Plan9.
4. “Distributed operating systems are defined by their network protocols.” Elaborate on this statement by discussing how different systems we discussed approached communicating over the network. What sort of protocols did they use? What was their purpose? What design constraints did they operate under? You can either discuss this in general or focus on a set of related systems.