C1. Operating Systems (25 points)

Answer all parts.

1) (6 points) Describe the four techniques for addressing deadlock.

2) (6 points) Describe the "Banker's Algorithm." Which of the above techniques does it address? Under what circumstances can/should it be used?

3) (8 points) Define, compare and contrast "semaphore", "mutex" and "monitor".

4) (5 points) Describe a starvation and deadlock-free algorithm for the readers/writers problem. Recall that "writers" need exclusive access to the resource, while "readers" do not.

C2. Operating Systems (25 points)

Answer all parts.

1) (8 points) Describe filesystem allocation considerations and tradeoffs. Example considerations include, but are not limited to, storage units and metadata management approach. Give examples.

2) (8 points) Describe the flow of data when performing I/O to and from the disk or network (with regard to the Operating System's kernel and libraries rather than e.g. network protocols and filesystem mechanisms.)

3) (5 points) Describe, compare and contrast "programmed I/O", "non-blocking I/O" and "double buffered I/O".

4) (4 points) Describe the pros and cons of polling and interrupts.

C3. Operating Systems (25 points)

Answer all parts.

1) (5 points) Cooperating processes require an interprocess communication (IPC) mechanism that allows them to exchange data. List two fundamental models of IPC, and use figures to describe how they are implemented on uniprocessor systems.

2) (5 points) What resources are used when a process is created? How do they differ from those used when a thread is created?

3) (8 points) Discuss the pros and cons of `many-to-one' and `one-to-one' threading models that map user threads to kernel threads.

4) (7 points) Describe scheduling considerations and algorithms for both processes and threads.

C4. Operating Systems (25 points)

Answer all parts.

1) (5 points) Discuss the various hardware features useful for implementing virtual memory systems.

2) (5 points) What is thrashing? What is the cause of thrashing? The `working-set' model has been used to prevent thrashing. What is the principle behind the `working-set' model?

3) (8 points) Describe the pros and cons of paging and segmentation memory management schemes.

4) (7 points) Explain how LRU and LFU work and how they differ.