

This exam is closed book. You can have two sheets of notes. UH expels cheaters.

1. *Advantage and disadvantages: you will get **no credit** if you answer mentions a disadvantage when an advantage is asked and vice versa.* (4×5 points)

- (a) What is the major advantage of replicating the superblock of a UNIX disk partition at different offsets?

It protects it against a head crash damaging a whole cylinder

- (b) What is the major advantage of *physical clocks* over *logical clocks*?

Unlike logical clocks, physical clocks do not have anomalous behaviors in the presence of external interactions

- (c) What is the major advantage of *mapped files*?

Once a file block has been brought into main memory, it can be accessed by user processes without any kernel intervention.

- (d) What is the major limitation of Kerberos?

- Best Answer: Kerberos requires its clients to trust the workstation from where they access the service
- Other Correct Answer: Kerberos security relies on the correctness of the time service serving clients and servers.

2. Assume that an intruder knows the session key $K_{c,tgs}$ of a Kerberos user. What harm could the intruder do? (5 points) Will the victim of the penetration have to change his or her password? (5 points)

Session keys are primarily used to create authenticators. The intruder will only have to get the user's ticket $T_{c,tgs}$ to be able to access all the user's resources.

The victim of the penetration will not have to change his or her password because the stolen ticket (and its associated session key) will ultimately expire.

3. Consider a virtual memory systems with 64-bit addresses and a clustered page table with a clustering factor of 4. Assuming that each address occupies 8 bytes, what would be the length of a page table entry assuming that we are implementing:

(a) *partial subblocking* (5 points)? 3_ bytes

(b) *complete subblocking* (5 points)? 6_ bytes

4. More questions with short answers. (4×5 points)

- (a) What is the main purpose of the UNIX *set used-id* bit?

To let the owner of a resource let other people access this resource in a controlled fashion through a program that he or she has written and by no other means.

- (b) What is a *library OS* ?

A library providing user processes running on an exokernel system with the same user interface as a conventional OS.

- (c) Why is the VMS *page replacement policy* poorly suited to UNIX?

Because it requires the kernel to be able to estimate the memory demands of a process at process creation time.

- (d) What is *crash failure semantics*?

It specifies that any process failing will stop sending messages: in other words, it excludes Byzantine failures.

5. What are the four ACID properties of atomic transactions? (4×5 points)

A_tomicity_ means that _ a transaction should either successfully complete or not alter the state of the system. _____

C_onsistency_ means that _ a transaction finding a system in a consistent state will always leave that system in a consistent state. _____

I_solation_ means that _ other transactions will never see the partial system changes that occur while a transaction is executed. _____

D_urability_ means that _ changes brought to a system by a transaction must be recorded in stable storage. _____

6. What would be the major drawback of an implementation of Totem lacking *guaranteed vector messages*? (10 points)

It would result in very long delays in accepting messages anytime one of the Totem rings has no messages to transmit.

7. What does a programmer need to do to ensure that a given program will execute correctly on Munin? (10 points)

The programmer needs to identify all calls to synchronization primitives (semaphores, locks, barriers, ...) and replace them by Munin specific calls.