NAME: _____ (FIRST NAME FIRST) **SCORE**: ____

COSC 6360 SECOND MIDTERM JULY 31, 2006

This exam is **closed book**. You can have **one sheet** (i.e., **two pages**) of notes.
Please answer every part of every question.

1. Explain the following terms: (3×5 points)

(a) ***Stateless program:*** A program that does not have static variables

(b) ***LFU cache replacement policy:*** A policy that expels the least frequently used pages

(c) ***Logical clock:*** A clock that orders event without measuring the flowmof time as a physical clock would do.

2. Having applied for admission to both Harvard and MIT, Alice now runs the following CSP program:

***[Harvard ? acceptance() -> Harvard ! "yes" || MIT ? acceptance() -> MIT ! "yes"]**

(a) How could her program make both Harvard and MIT very unhappy? (5 points)

If both Harvard and MIT accept her, she will say yes to both.

(b) What should she do to avoid that? (5 points) (***Hint:*** *the answer is very short!*)

Remove the star so that the repetitive command will become an alternative command.

3. A system of physical clocks consists of two clocks, one that is slow and loses ten minutes every hour and another that is fast and advances by ten minutes every hour. Assuming that the clocks are managed by Lamport's physical clock protocol , what will be the time marked by each clock at two o'clock given that (a) both clocks indicated the correct time at noon; (b) the processor on which the fast clock resides sends at one o'clock a single message to the other processor; and (c) the message transmission delays are negligible. (2×5 points)

The fast clock will indicate __2__ hours __20__ minutes plus or minus a few seconds.

The slow clock will indicate __2__ hours ___0_ minutes plus or minus a few seconds.

4. In his note on the confinement problem, Butler Lamport states that an untrusted program should not be allowed to computer itself the bills it sends to its customers. Could you explain why? (5 points)

The untrusted program should encode some confidential information in the billed price (like the last digit of the price will be a "6" if some specific event has happened.)

5. The ARC cache replacement policy is said to be both ***scan-toleran***t and ***self-tuning***. Explain these terms and state why they apply to the ARC policy (4×5 points).

A ***scan-tolerant*** cache replacement policy is a policy _ that keeps useful pages (or blocks) in the cache when processing an input string consisting of a large number of pages (or blocks) that are accessed only once (as when a process is scanning the file system) _____

ARC is ***scan-tolerant*** because _ the contents of its T2 list remain unchanged when it processes an input string consisting of a large number of pages (or blocks) that are accessed only once_____

A ***self-tuning*** cache replacement policy is a policy that _does not require any tuning to operate properly _____

ARC is ***self-tuning*** because _ it has no user-settable parameter _____

6. What are ***replays***? (5 points) What does Kerberos to allow servers to distinguish replays from authentic messages? (10 points)

A replay is a retransmission of a legitimate message transmitted by an intruder that does not understand its contents. Kerberos detects replays by asking clients to include authenticators in their messages. These authenticators contain among other things a timestamp and are encrypted with a session key shared between the service and the user. Since the intruder does not know this session key, it cannot create new authenticators and can only resent them.

Kerberos detects previously sent authenticators by keeping track of the timestamps of recent authenticators and rejecting older ones.

7. What would happen to Totem if it did not have ***guaranteed vector messages*** (or any similar mechanism)? Why? (10 points)

Processes will be prevented to deliver any messages whenever they do not recive any messages from any given ring.

8. Give one technique that a mischievous extension could use to circumvent the measures taken by Nooks to protect the kernel. (5 points)

The mischievous extension could remove the restrictions on its page map.

9. How does Spin pass references to extensions that are not written in a type-safe language? Why**?** (2×5 points)

It passes to these extensions integer values that are indexes into a per-application table of safe references to kernel data structures. This prevents the extension from doing any kind of pointer arithmetic.