COSC 6360 SECOND **MIDTERM** **OCTOBER 20, 2004**

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

1. Which features of CSP required the introduction of guarded commands and alternative commands? (2×5 points)

CSP uses

a) Explicit naming of sender and receiver processes _____

b) Unbuffered sends and receives_____

2. A system of physical clocks consists of two clocks, one that is slow and loses 5 minutes every hour and another that is fast and advances by 5 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 2:00 PM given that (a) both clocks indicated the correct time at noon; (b) the processors on which the clocks reside continuously exchange messages between themselves; and (c) the message transmission delays are negligible. (2×5 points)

The fast clock will indicate 2____ hours 10___ minutes plus or minus a few seconds.

The slow clock will indicate 2____ hours 10____ minutes plus or minus a few seconds.

3. What is the function of *authenticators* in Kerberos? (5 points). What could be done to defeat their purpose? (5 points)

Authenticators associate a timestamp with ticket submitted by a client. This allows the server to detect, and reject, replays of previous requests sent by intruders.

Their purpose could be defeated by **rolling back** the clock of the server to which the credentials are sent.

4. Comparing Spring and Nooks,

a) Which of the two systems offer the best protection against incorrect extensions and why? (5 points)

Spring offers the best protection against incorrect extensions as it protects against malicious extensions.

b) Which of the two systems is likely to run faster and why? (5 points)

Spring is likely to run faster as all the it does not require any change of protection domains within the kernel.

c) Which of the two approaches is more likely to be quickly adopted and why? (5 points)

Nooks because it does not require a rewrite of the whole kernel.

5. Describe the three implementations of door invocations that Spring offers (3×5 points)

a) A fast path that supports the case when all door arguments are simple values and total less than 16 bytes: this fast path masks registers instead of saving them; ___

b) A vanilla path that copies the argument data into the target domain and moves any argument doors across; _____

c) A **bulk path** that is used to transfer large quantities of page-aligned data using Spring's virtual memory services. _____

6. What are the two basic components of an exokernel-based system? (2×2 points) What are their major functions? (2×3 points)

a) The exokernel itself___**, which** __ protects the system resources but delegates their management to the user processes._____

b) **The library OS____, which** __ hide low-level resources behind traditional OS abstractions for applications that do not want to manage themselves their resources_____

7. Which conditions should be met before a ***multiple-ring Totem*** can deliver ***an agreed delivery*** message**?** (2×5 points)

a) The process must have delivered all prior messages that have been issued by processors in the current configuration and have time-stamps within the duration of that configuration. _____

b) All other processors in the configuration have received it. _____

8. What is the major disadvantage of ***logical clocks*** over ***physical clocks***? (10 points)

They exhibit anomalous behaviors in the presence of external interactions. _____

9. Consider a RAID-5 having four data blocks, namely, b_0, b_1, b_2, and b_3, and one parity block p per stripe.

a) How many disk drives does it require? (5 points) five _____ drives

b) Assuming that block b_2 suddenly becomes unavailable, how could you reconstruct its contents? (5 points)

b_2 = _ b_0 XOR b_1, *XOR* b_3 XOR p _____