CSCE 742 - Practice Final
Name:

This is a 150-minute exam. On all essay type questions, you will receive points based on the quality of the answer - not the quantity.

Make an effort to write legibly. Illegible answers will not be graded and awarded 0 points.

There are a total of 10 questions and 100 points available on the test.

Problem 1

Speculate as to why none of the architecture description languages other than UML have achieved widespread use.

Problem 2

Create an attack tree describing how an attacker might attempt to steal money from an Automated Teller Machine (ATM).

Problem 3

What difficulties do cyclic component dependencies lead to in an architecture? What can be done to break cyclic dependencies?

Problem 4

We have described RPCs and messaging schemes as inter-process communications mechanisms. Suppose we restrict our attention to one process with multiple threads.

1. Are there analogous concepts to RPCs and messaging between threads?

2. Describe an additional means of communication that is available between threads.

3. Do the same benefits/drawbacks between RPCs and messaging schemes exist when considering interthread communication as interprocess communication?

Problem 5

What are the benefits and drawbacks of using XML vs. binary protocols for messaging between processes?

Problem 6

Big Bang, Parallel Run, and *Staged Migration* are all techniques for upgrading existing software installations.

1. **Briefly** explain each technique:

2. Describe advantages and disadvantages for each technique with respect to the others in terms of data migration, complexity, and rollback in case of failure.

3. Describe installation scenarios where you might use each technique. Do not use examples from class.

Problem 7

What are the **availability** benefits and risks associated with the following architectural styles: Pipe and Filter, Repository, Event-based, Layered.

In your answers, consider how each technique might be used to construct highly-available systems and what failure modes might be introduced.

Problem 8

Write the guarantees for the following AADL component describing a dishwasher mode controller:

```
system Dishwasher_Mode
	features
		door_closed: in data port Base_Types::Boolean;
		time_remaining: in data port Base_Types::Integer;
		pump_on: out data port Base_Types::Boolean;
		dishwasher_mode: out data port Base_Types::Integer;

	annex agree {**
		const SETUP_MODE : int = 0;
		const WASHING_MODE : int = 1;
		const RINSE_MODE : int = 2;
		const DRYING_MODE : int = 3;

		guarantee "the pump shall be off if the door is open" : true;
		guarantee "If the dishwasher was in WASHING_MODE and time
remaining is zero, it shall enter RINSE_MODE" : true;
		 guarantee "The dishwasher shall never transition directly from
WASHING_MODE to DRYING_MODE" : true;
		guarantee "The dishwasher shall start in SETUP_MODE" : true;
	**};
end Dishwasher_Mode;
```

Problem 9

On performance.

1. What is the difference between response time and throughput?

2. Give an example of a system with excellent throughput but poor response time and vice versa.

Problem 10

What is the distinguishing characteristic of a *real time,* as opposed to a *non-real time* system? What is the difference between hard and soft real time systems?