Systems Qualifier Exam
Spring, 2011

Name :_____________________________

SID:     _____________________________

Score : _____________________________
1. For client-server applications, if a client and a server are placed far apart, we may see network latency dominating overall performance. How can we tackle this problem?

2. What is persistent and transient communication in distributed systems and what is synchronous and asynchronous communication in distributed systems. Then draw figures to describe the differences between persistent asynchronous communication and response-based transient synchronous communication.
3. Draw a picture illustrating how recursive name resolution works in a distributed naming system. Explain in one or two sentences why recursive name resolution might be a bottleneck in a naming system such as DNS.

4. Explain briefly why message logging allows a distributed application to take infrequent checkpoints and yet recover quickly from a crash.
5. Does it make sense to restrict the lifetime of a session key? If so, give an example how that could be established.

6. Java and other languages suppose exceptions, which are raised when an error occurs. How would you implement exceptions in RPCs and RMIs?
7. Explain how the write-ahead log in distributed transactions can be used to recover from failures.

8. Design a simple election algorithm assuming that the system has an efficient broadcast facility. Explain all steps of your algorithm clearly. Be sure to state any assumptions you make.
9. **Consistent model**
Assume initially \( x = y = 0 \).

<table>
<thead>
<tr>
<th>Process P1</th>
<th>Process P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x = 1; )</td>
<td>( y = 1; )</td>
</tr>
<tr>
<td>( \text{if} \ (y == 0) \text{ kill (P2);} )</td>
<td>( \text{if} \ (x == 0) \text{ kill (P1);} )</td>
</tr>
</tbody>
</table>

(a) Define what the sequential consistency (SC) and first-in first-out (FIFO) model are.
(b) Is it possible to have both the processes killed in SC and FIFO model?
(c) Provide arguments to support your answer given in (b)