# Santa Clara University

Department of Computer Engineering
Advanced Operating Systems (COEN383, Section-1)
Final (35 points)
**Time: 75 minutes**

**Name _____**

**Grades**

| | | |
|---|---|---|
| Problem 1 | 6 | |
| Problem 2 | 6 | |
| Problem 3 | 5 | |
| Problem 4 | 6 | |
| Problem 5 | 6 | |
| Problem 6 | 6 | |
| Total | 35 | |

1. Multicore CPUs are beginning to appear in conventional desktop machines and laptop computers. Desktops and laptops with tens or hundreds of cores are not far off. One possible way to harness this power is to parallelize the application. Mention one application that is attractive to parallelize [3 pts]? Another approach is to parallelize the services offered by the OS (e.g., TCP processing), etc. Which approach is more promising between these two approaches and why [3 pts]?

2. Please answer the following:
   a) Affinity scheduling reduces cache misses. Does it also reduces TLB misses [1.5 pts]? What about page faults [1.5 pts]?

b) Migrating virtual machines may be easier than migrating processes, but migration can still be difficult. What problems can arise when migrating a virtual machine [3 pts]?

3. Can disabling interrupts handle concurrency correctly [2 pts]? What are mutexes and condition variables and how they are used and also if a mutex can perform both functions [3 pts]?

4. Authentication mechanisms are divided into three categories: Something the user knows, something the user has, and something the user is. Imagine an authentication system that uses a combination of these three categories. For example, it first asks the user to enter login name and password, then insert a plastic card (has magnetic strip) and enter a PIN, and finally provide fingerprints. Can you think of two drawbacks of this design [6 pts]?

5. Please answer the following:

a) What does the following Linux shell pipeline do [1.5 pt]?

```
grep   nd    xyz |   wc   -l
```

b) A user at a terminal types the following commands:

```
a | b | c &
d | e | f &
```

How many processes are running [1.5 pt]?

c) Does it makes sense to take away a process' memory when it enters zombie state? Why or why not [1.5 pt]?

d) Explain under what situation a process may request a shared lock or an exclusive lock. What problem may a process requesting an exclusive lock suffer from [1.5 pts]?

6. Why Hadoop is considered a batch processing platform and not an interactive platform [3 pts]? What is YARN, why needed, and how it can be used [3 pts]?