188 331 Operating Systems
2010 2nd Semester Midterm Examination
24 December 2010 8:30 – 11:30

Instructions:
1. NO books, NO sheets, NO calculators are allowed.
2. There are 30 questions, 124 marks total, attempts ALL questions.
3. Answer in the space provided ONLY.
4. Do NOT cheat. Any attempts to cheat will result in dismissal from class with an "F" grade.

1. What is an operating system ?(2 marks)

2. Why does an operating system exist ? (2 marks)

3. Is it possible to build a computing system without an operating system ? Why ? (3 marks)

4. Describe main components of an operating system. What are the purposes of those components ? (5 marks)

5. What are differences among *batch processing*, *multiprogramming*, and *time-sharing* (3 marks)

6. What are *system calls* ? Why do we need them ? (3 marks)

7. What are differences between *monolithic kernels* and *microkernels* ? Which one is better ? Why ? (3 marks)

8. There are many different kinds of *interrupts*, what are they ? Explain (5 marks)

9. What are differences between *real mode* and *protected mode* in the x86 architecture ? (3 marks)

10. What is a boot loader ? Why most x86 boot loaders must be divided into many stages (i.e., *first-stage* and *second-stage*)? (3 marks)

11. What are *processes* ? What are differences among *processes*, *programs*, *jobs*, *tasks* ? (3 marks)

12. Describe process states and transitions (5 marks)

13. Suppose the process *P* executes the following code without any error

```
x = fork();
if (x == 0) {
  y = fork();
  if (y != 0) {
    z = fork ();
  }
}
```

Draw the process tree showing parent-child relationships among them, and determine *x y* and *z* in each process. (5 marks)

14. What are *threads* ? What are differences between *threads* and *processes* ? (3 marks)

15. In which conditions that *threads* would be better than *processes* ? Why ? (3 marks)

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17. What are *fibers* ? What are differences between *threads* and *fibers* ?(3 marks)

18. In which conditions that *fibers* are better than *threads* ? Why ? (3 marks)

19. In which conditions that *threads* are better than *fibers* ? Why ? (3 marks)

20. What are *kernel threads* and the *user threads*? (3 marks)

21. Between *kernel thread* and *user thread*, which one is faster? Why ? (5 marks)

22. In which conditions that the *M-1 thread model* would be better than any other thread models ? Why ? (5 marks)

23. Describe *short-term*, *long-term*, and *medium-term schedulers* (3 marks)

24. Why CPU schedulers should be *short-term* ? (3 marks)

25. How can *Intel® Hyper-Threading™ technology* create illusion images of multiprocessor ? From operating system's points of view, what are benefits gained from the technology ? (3 marks)

26. Write a simple program to print a character A, B, and C *concurrently*. (10 marks)

27. Describe differences between *non-preemptive* and *preemptive* scheduling (3 marks)

28. From the following table,

Process	Arrival Time	Burst
A	0	3
B	1	2
C	2	4
D	3	3

28.1 Determine *waiting time* using FCFS (5 marks)

Process	Waiting Time
A	
B	
C	
D	

28.2 Determine *waiting time* using RR with time quantum = 3 (5 marks)

Process	Waiting Time
A	
B	
C	
D	

28.3 Determine *turnaround time*, using non-preemptive SJF (5 marks)

Process	Turnaround Time
A	
B	
C	
D	

28.4 Determine *turnaround time*, using preemptive SJF (5 marks)

Process	Turnaround Time
A	
B	
C	
D	

29. Compare Linux's *O(1) scheduler* and the *Completely Fair Scheduler* (CFS) in term of data structures, and complexity.(3 marks)

	O(1) scheduler	CFS
Data Structure		
Complexity		

30. What is a *preemptible kernel* ? What are advantages and disadvantages of preemptible kernels compared to non-preemptible kernels.? (3 marks)