188 331 Operating Systems
Final Examination
4 March 2011 8:30 – 11:30

Instructions:
1. **NO** books, sheets, materials, calculators are allowed.
2. There are 15 questions, 89 marks total, attempts **ALL** questions.
3. **BE CONCISE** and **PRECISE**, carefully choose your answers, write them in the space provided **ONLY!**
4. **DO NOT CHEAT!** Any attempts to cheat will result in dismissal from class with an "F" grade.

1. Describe the following terms:(10 marks)
   1.1 Race condition

   1.2 Dining Philosophers Problem

   1.3 Starvation

   1.4 Spinlocks

   1.5 Deadlocks

   1.6 Semaphores

   1.7 Mutual Exclusions

   1.8 Mutexes

   1.9 Monitors

   1.10 Atomic

2. Describe solutions for interprocess communications.(12 marks)
   2.1 Software

   2.2 Hardware

   2.3 Programming language

   2.4 Operating system

3. Find the safe state of the followings using the *Banker's algorithm* (5 marks)

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 2 & 0 & 0 \\ 3 & 0 & 2 \\ 2 & 1 & 1 \\ 0 & 0 & 2 \end{bmatrix} \quad N = \begin{bmatrix} 7 & 5 & 3 \\ 3 & 2 & 2 \\ 9 & 0 & 2 \\ 2 & 2 & 2 \\ 4 & 3 & 3 \end{bmatrix} \quad E = \begin{bmatrix} 10 & 5 & 7 \end{bmatrix}$$

Row Selected	P	$E - P$
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4. Why do we need the memory *paging* ? (3 marks)

5. What is the execution-time address binding ? Why is it required in the dynamic linking and shared library implementation ? (3 marks)

6. Paging in IA-32 has been designed to be multilevel of 10+10+12 bits, why ? (5 marks)

7. An Intel Core™ i7-2920XM Extreme Edition processor running at the clock speed of 2.5 GHz equipped with 8-GB DDR3-1600 running at the memory clock of 200 MHz, determine EAT of the system if TLB lookup requires 14 cycles, memory access requires 26 cycles and the hit ratio is 95%. (5 marks)

8. From the following requests, show page allocation using the buddy system with 32 pages (3 marks)
   Process A created size = 3 pages

   Process B created size = 3 pages

   Process C created size = 9 pages

   Process B destroyed

   Process A destroyed

   Process D created size = 7 pages

9. What are differences between *swapping* and *demand paging* ? What are advantages of the demand paging ? (3 marks)

10. Suppose a system can access 4-kB pages in memory 200 times faster than those pages on disk, determine how many times does the demand paging system slow the system down if page faults rate is 0.1% and all overhead (page fault and restart) can be ignored. (5 marks)

11. Given a system with 3 frames occupied by page 1, 2, and 3, respectively. How many page faults occurred from the page request of 2, 3, 4, 3, 1, 2, 5, 1, 2

   11.1 Using FIFO (3 marks)

1
2
3

   Page faults = 3 +

   11.2 Using the optimal algorithm (3 marks)

1
2
3

   Page faults = 3 +

   11.3 Using stack implementation of LRU (3 marks)

1
2
3

   Page faults = 3 +

12. What are purposes of the followings: (3 marks)

    12.1 Files

    12.2 Directories

    12.3 File systems

13. Give a short description, advantages, and disadvantages for contiguous allocation, linked allocation, and indexed allocation. (9 marks)

Allocation	Description	Advantages	Disadvantages
Contiguous			
Linked			
Indexed			

14. A disk, with a geometry of 4 heads, 63 sectors, 1024 cylinders (0 - 1023), receives the reading sequence as the followings:

    597 , 604 , 988 , 19 , 815 , 904 , 543 , 268 , 924 , 644

    Determine the number of cylinders the disk head must be moved to complete the reading if current head position is at cylinder 381.

    14.1 Using FCFS (3 marks)

        Schedule:

        Number of cylinders:

    14.2 Using SSTF (3 marks)

        Schedule:

        Number of cylinders:

    14.3 Using CLOOK (3 marks)

        Schedule:

        Number of cylinders:

15. Why do computer engineering/science students need to study operating system courses ? (5 marks)