

188 331 Operating Systems
Final Examination
22 February 2012 13:00 – 16:30

Instructions:

1. **NO** books, sheets, materials, calculators are allowed.
 2. There are 15 questions, 91 marks total, attempts **ALL** questions.
 3. Answer questions in **ENGLISH ONLY**, other languages will **NOT** be considered as an answer.
 4. Answer questions in the space provided **ONLY**.
 5. **DO NOT CHEAT**. Any attempts to cheat will result in dismissal from class with an “F” grade.
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1. Describe the following terms (10 marks)

1.1 Race condition

1.2 Starvation

1.3 Deadlocks

1.4 Semaphores

1.5 Belady's anomaly

2. What is the *Dining Philosophers problem* ? Describe the problem and solution (5 marks)

3. Describe solutions for process synchronizations in interprocess communications (12 marks)

3.1 Software solution

3.2 Hardware solution

3.3 Programming language solution

3.4 Operating system solution

4. Determine a safe sequence using the *Banker's algorithm* (5 marks)

$$A = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 0 & 1 \\ 0 & 0 & 2 \\ 3 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \quad N = \begin{bmatrix} 8 & 2 & 3 \\ 3 & 2 & 2 \\ 9 & 5 & 2 \\ 2 & 2 & 2 \\ 4 & 3 & 3 \end{bmatrix} \quad E = [10 \quad 5 \quad 7]$$

Row Selected	P	$E - P$
-		

5. What is the *paging* ? What are advantages of using the paging ? (3 marks)

6. Describe how paging works (5 marks)

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

8. A server is equipped with a processor running at the clock speed of 3.33 GHz and memory running at 200 MHz. Determine EAT of the server if TLB lookup requires 40 cycles, memory access requires 20 cycles and the hit ratio is 90%. (5 marks)

9. 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 = 2 pages

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Process C created size = 8 pages

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Process B destroyed

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Process A destroyed

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Process D created size = 7 pages

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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

11. Suppose a system can access memory 100 times faster than disk, determine how many times does the demand paging slow the system down if page faults rate is 1% (page fault and restart overhead can be ignored.) (5 marks)

12. 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, 4, 5, 4, 3, 4, 3, 3, 1 ?

12.1 Using FIFO (3 marks)

1										
2										
3										

Page faults = 3 +

12.2 Using the optimal algorithm (3 marks)

1										
2										
3										

Page faults = 3 +

12.3 Using stack implementation of LRU (3 marks)

3										
2										
1										

Page faults = 3 +

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

13.1 Files

13.2 Directories

13.3 File systems

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

Allocation	Description	Advantages	Disadvantages
Contiguous			
Linked			
Indexed			

15. A disk with 64 cylinders (0 – 63) receives the reading sequence as the followings:

8, 24, 52, 60, 46, 23, 53, 28, 7, 30

Determine the number of cylinders the disk head must be moved to complete the reading if current head position is at cylinder 7.

15.1 Using FCFS (3 marks)

Schedule:

Number of cylinders:

15.2 Using SSTF (3 marks)

Schedule:

Number of cylinders:

15.3 Using SCAN (3 marks)

Schedule:

Number of cylinders: