178 330 Operating Systems
Final Examination
22 February 2009 14:00 – 17:00

Instructions:
1. NO books, sheets, calculators are allowed.
2. There are 20 questions, 100 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.

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1. Why CPU schedulers are short-term scheduler ? (3 marks)

2. When the CPU scheduling decisions may take place ? (3 marks)

3. The equation $\tau_{n+1} = \alpha t_n + (1-\alpha)\tau_n$ defines exponential average to predict the next CPU bursts. Prove that the equation is exponential. (5 marks)

4. Given $\alpha = 0.8$ and $\tau_0 = 5$, predict bursts during $\tau_1 - \tau_5$ from the actual bursts of 3, 4, 8, 6, 1. (5 marks)

5. From the following table, find waiting time, and turnaround time of each process

Processes	Arrival Time	Burst
A	2	4
B	0	4
C	3	3

5.1 Using FIFO (3 marks)

5.2 Using SJF (3 marks)

5.3 Using RR with time quantum = 3 (3 marks)

6. What is kernel preemption ? What are benefits could a system achieve from a preemptible kernel ? (3 marks)

7. Describe the following terms:(5 marks)
   7.1 Race condition

   7.2 Critical sections / Remainder sections

   7.3 Spinlocks

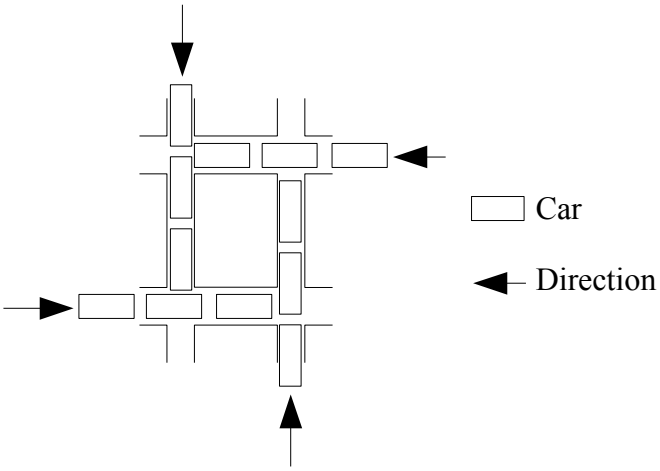
   7.4 Semaphores

   7.5 Mutexes

8. Is there any safe state from the followings if the system resource = 8 (5 marks)

Processes	Use	Max
A	2	3
B	2	4
C	3	5

9. From the following scene, how can we prevent deadlock to occur ? (5 marks)



10. Describe and provide solutions for the Dining Philosopher Problem. (5 marks)

11. Contiguous memory allocation may cause external fragmentations, why ? (3 marks)

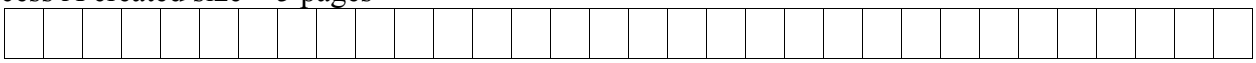
12. Paging causes internal fragmentations, why ? (3 marks)

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

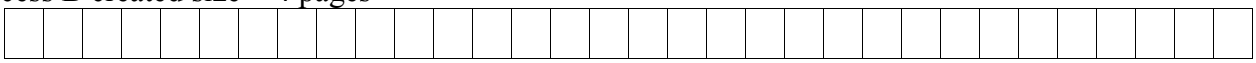
14. Given a system equipped with Intel Core™ 2 processor running at 2 GHz, with 2 GB DDR2-800 installed on 200 MHz memory bus, determine EAT of the system if TLB lookup requires 14 cycles, memory access requires 10 cycles and the hit ratio is 0.9. (5 marks)

15. From the following requests, show page allocation using the buddy system with 32 pages (3 marks)

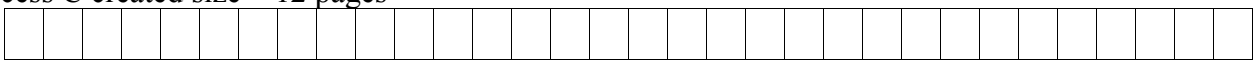
Process A created size = 5 pages



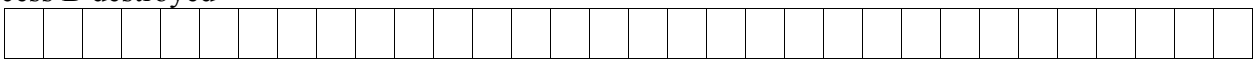
Process B created size = 4 pages



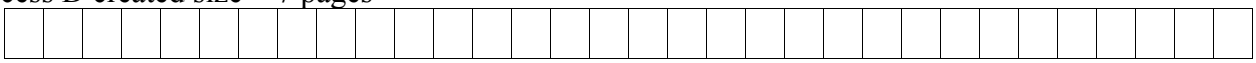
Process C created size = 12 pages



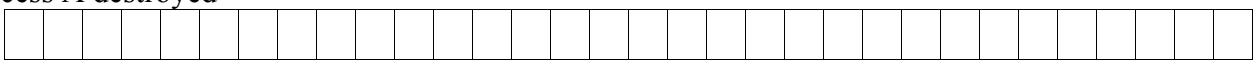
Process B destroyed



Process D created size = 7 pages



Process A destroyed



16. Suppose a system can access 4-kB pages in memory 1000 times faster than those pages on disk, determine how much the demand paging system slow the system down if page faults rate is 0.001 and all overhead (page fault and restart) can be ignored. (5 marks)

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

17.1 Using FIFO (3 marks)

1					
2					
3					

Page faults = 3 +

17.2 Using the optimal algorithm (3 marks)

1					
2					
3					

Page faults = 3 +

17.3 Using stack implementation of LRU (3 marks)

1					
2					
3					

Page faults = 3 +

18. Why do we need files, directories, and file systems ? (5 marks)

19. What are advantages and disadvantages of contiguous allocation, linked allocation, and indexed allocation. ? (5 marks)

20. A disk, with a geometry of 4 heads, 63 sectors, 1024 cylinders, receives the reading sequence as the followings 163, 286, 800, 994, 88, 860, 134, 590, 503, 1001

    Determine the number of cylinders the disk head must be move to complete the reading if current head position is at cylinder 511.

    20.1 Using FCFS (3 marks)

    20.2 Using SSTF (3 marks)

    20.3 Using C-LOOK (3 marks)