188 331 Operating Systems
Final Examination
27 February 2010 13:00 – 16:00

Instructions:
1. NO books, sheets, calculators are allowed.
2. There are 20 questions, 104 marks total, attempts ALL questions.
3. 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.

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

   1.2 Starvation

   1.3 Spinlocks

   1.4 Deadlocks

   1.5 Semaphores

   1.6 Mutexes

   1.7 Degree of Multiprogramming

   1.8 Monitors

   1.9 Mutual Exclusions

   1.10 Thrashing

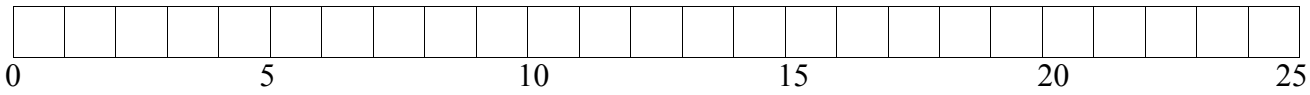
2. Task schedulers can either be *preemtive* or *non-preemtive*. What are differences between them ? (3 marks)

3. Between the preemtive task scheduler and the non-preemtive task scheduler, which one is more suitable for time-sharing systems ? Why ? (3 marks)

4. From the following table, determine waiting time, and turnaround time of each process

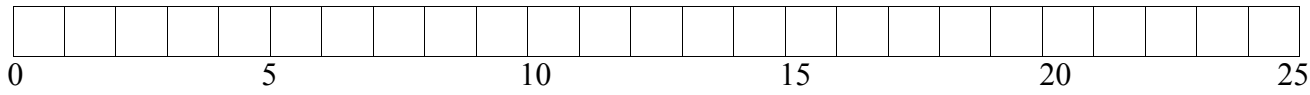
Processes	Arrival Time	Burst
A	2	5
B	0	4
C	1	2
D	3	3

4.1 Using FIFO (3 marks)



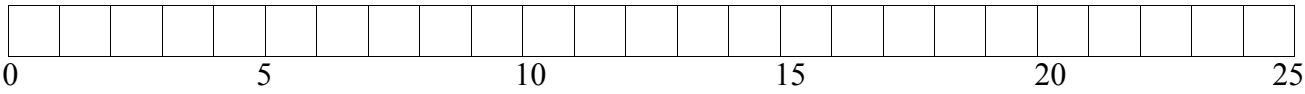
Process	Waiting Time	Turnaround Time
A		
B		
C		
D		

4.2 Using non-preemtive SJF (3 marks)



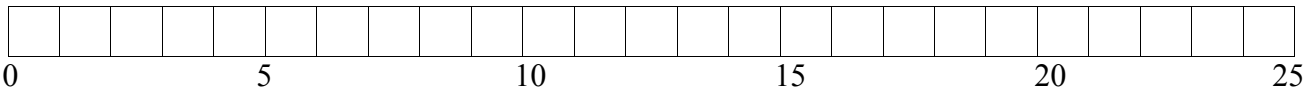
Process	Waiting Time	Turnaround Time
A		
B		
C		
D		

4.3 Using preemtive SJF (3 marks)



Process	Waiting Time	Turnaround Time
A		
B		
C		
D		

4.4 Using RR with time quantum = 2 (3 marks)



Process	Waiting Time	Turnaround Time
A		
B		
C		
D		

5. Given $\alpha = 0.9$ and $\tau_0 = 10$, predict bursts during $\tau_1 - \tau_5$ from the actual bursts of 5, 2, 2, 7, 4. (5 marks)

$\tau_1 =$

$\tau_2 =$

$\tau_3 =$

$\tau_4 =$

$\tau_5 =$

6. What are advantages and disadantages of a *preemptible kernel*, compared to *non-preemtible kernel* ? (3 marks)

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

$$A=\begin{bmatrix}2&0&1&1\\1&1&0&0\\1&1&0&0\\1&0&1&0\\0&1&0&1\end{bmatrix} \quad N=\begin{bmatrix}1&2&0&0\\0&1&0&2\\0&0&2&0\\2&2&0&0\\2&0&0&1\end{bmatrix} \quad E=[6 \quad 4 \quad 4 \quad 2]$$

Row Selected	P	$E - P$
-		

8. How can we *prevent* deadlock to occur in the *dining philosophers problem*? (5 marks)

9. What are primary purposes of *paging* ? (3 marks)

10. Describe the the following address binding techniques (3 marks):
    10.1 Compile-time

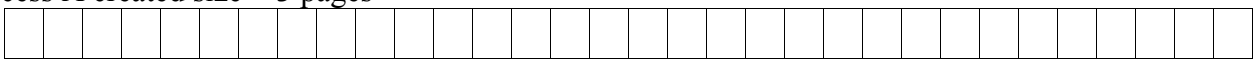
    10.2 Load-time

    10.3 Execution-time

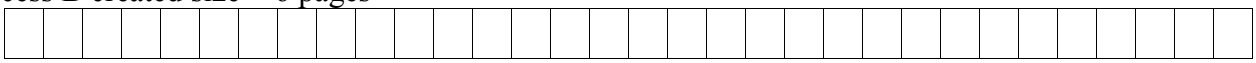
11. Paging in IA-32 has been design to be multilevel of 10+10+12 bits, why ? (5 marks)

12. Given a system equipped with an Intel Core™ i7-920XM processor running at 2 GHz, and a 4-GB DDR3-1333 running at the memory clock of 166.667 MHz, determine EAT of the system if TLB lookup requires 14 cycles, memory access requires 7 cycles and the hit ratio is 95%. (5 marks)

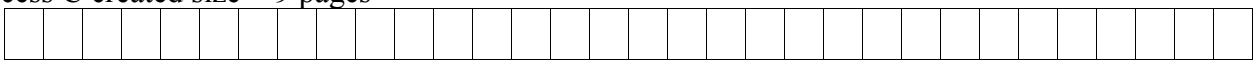
13. From the following requests, show page allocation using the buddy system with 32 pages (3 marks)
    Process A created size = 3 pages

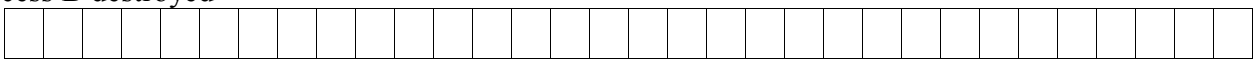
    Process B created size = 6 pages

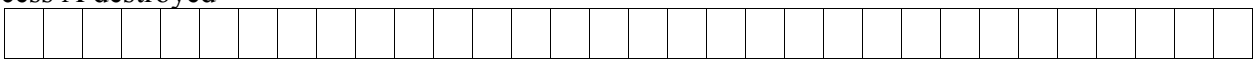
    Process C created size = 9 pages

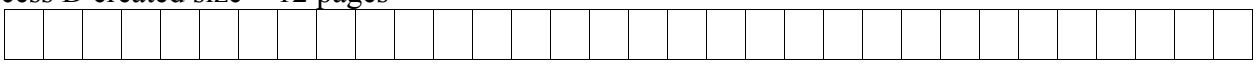
    Process B destroyed

    Process A destroyed

    Process D created size = 12 pages

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

15. 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 0.5% and all overhead (page fault and restart) can be ignored. (5 marks)

16. 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

16.1 Using FIFO (3 marks)

1							
2							
3							

Page faults = 3 +

16.2 Using the optimal algorithm (3 marks)

1							
2							
3							

Page faults = 3 +

16.3 Using stack implementation of LRU (3 marks)

1							
2							
3							

Page faults = 3 +

17. What are purposes of the followings: (3 marks)
    17.1 Files

    17.2 Directories

    17.3 File systems

18. Give a short description, advantages, and disadvantages for contiguous allocation, linked allocation, and indexed allocation. (5 marks)

Allocation	Description	Advantages	Disadvantages
Contiguous			
Linked			
Indexed			

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

    837, 519, 148, 494, 706, 526, 457, 402, 501, 20

    Determine the number of cylinders the disk head must be moved to complete the reading if current head position is at cylinder 681.

    19.1 Using FCFS (3 marks)

        Schedule:

        Number of cylinders:

19.2 Using SSTF (3 marks)

Schedule:

Number of cylinders:

19.3 Using C-SCAN (3 marks)

Schedule:

Number of cylinders:

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