

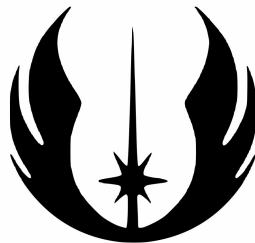
Final Exam

CSE 3320.001

Spring 2018

Name: \_\_\_\_\_

UTA ID: \_\_\_\_\_



Jedi Order Version

“I certify that the following work is my work alone and I will follow the highest standards of integrity and uphold the spirit of the Honor Code”

Signature: \_\_\_\_\_

Directions: This is a closed book, closed notes exam. You may use a hand written 3x5 index card with notes. Please answer the questions briefly but completely. Write your answers legibly. Unreadable answers will be counted wrong. You may write on back if needed. There is a powers of two tables on the last page.

1. 5pts A user types www.google.com into their web browser. How does the fully qualified domain name get translated into the unique identifier for the remote machine?

2. 6pts Describe locality of reference and its role in thrashing?

Process ID	Arrival Time	Runtime (seconds)	Priority
1	0	6	3
2	1	4	4
3	3	4	1
4	6	2	4
5	10	2	1
6	13	6	2
7	14	2	1

3. 8pts You are tasked with implementing the preemptive job scheduler for new touch screen tablet for artists. Due to the tactile nature of the consumer use cases a responsive GUI is your key characteristic. Given a representative set of tasks in the table above, determine what the optimal scheduling algorithm is for your device. Quantify your choice with Gantt charts and other calculations.

Extra Space If Needed

4. 4pts Suppose you had a computer that supported virtual memory and had 32-bit virtual addresses and 8 KB pages. If a process actually uses 1024 pages of its virtual address space, how much space would be occupied by the page table for that process if a single-level page table was used?

5. 4pts You are given an index allocated file system with disk blocks that are 1 KB in size and a pointer to a disk block is 32 bit. This file system's index nodes have 11 direct disk blocks, as well as 5 indirect disk blocks, 4 double indirect blocks and 1 triple indirect blocks. What is the largest file that can be held using this inode layout?

6. 4pts Consider a reference string 1,2,3,4,2,5,6,2,3,2,1,6,7; and a system with only 4 frames, pure demand paging, and all frames initially empty.

(a) How many page faults would occur with a FIFO replacement scheme? What are the identities of pages in the frames when the reference string has completed?

(b) How many page faults would occur with a perfect LRU replacement scheme? What are the identities of pages in the frames when the reference string has completed?

(c) Would increasing the number of frames always decrease the number of page faults for a particular reference string for FIFO? for LRU? Why or why not? You need not provide “proof”, just an explanation.



Extra Space If Needed

7. 6pts. What is the difference between the OS executing a user-level instruction and a privileged instruction on an x86-64 CPU? Include software and hardware differences in your answer.

8. 4pts Given the following request queue -- 2, 27, 8, 76, 42, 20 84, 31, 92, 97 with the disk head initially at the track 50 initially moving in the positive direction (towards 100). The beginning of the disk is at 0 and the end of the disk is at 100. Calculate the travel distance for the C-LOOK algorithm. Assume all reads are made in the positive direction if applicable.

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9. 4pts You are given a choice of two TLB cache. Type A executes lookups serially and has a memory access time of 150ns and a TLB lookup time of 20ns with a 80% hit rate. Type B executes lookups in parallel and has a memory access time of 150ns and a TLB lookup time of 40ns with a 90% hit rate. From a purely performance perspective, which TLB should you choose? Quantify why.

10. 4pts What is a process? What is a thread? How are they similar/different?

11. 4pts Describe the SCAN (elevator) disk scheduling algorithm. What is the advantage of the SCAN (elevator) algorithm over the shortest-seek-first algorithm?

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12. 3pts What is a positive consequence of abstraction? What is a negative consequence of abstraction? Give an example of a layer of abstraction used in the Unix operating system.

13 . 7pts List the 7 layers of the OSI network model and give an example of each if one exists.

14. 6pts Alice and Bob have previously exchanged public keys. Now Alice wants to send a confidential message to Bob. What should Alice do? Fill in each blank with one of the following words: signs, encrypts, Alice, Bob, public, private.

Alice \_\_\_\_\_ the message with \_\_\_\_\_'s \_\_\_\_\_ key

then Bob \_\_\_\_\_ the result with \_\_\_\_\_'s \_\_\_\_\_ key.



15. 3pts Answer the following True or False:

- A. A smaller page size leads to more TLB misses
- B. A smaller page size leads to smaller page tables
- C. A smaller page size leads to fewer page faults

16. 10pts Describe demand based paging. You should consider addresses spaces, pages, frames, page tables, and Memory Management Units in your answer. What are the benefits?

17. 4pts True/False. Mark each of the following statements as true or false

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(a) DMA is a mechanism for allowing an I/O device to transfer data to and from memory without involving the CPU in the transfer.

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(b) Memory mapped I/O determines how the pages of an I/O-bound process are mapped to page frames.

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(c) A context switch from one process to another can be accomplished without executing OS code in kernel mode.

(f) An advantage of implementing threads in user space is that they don't incur the overhead of having the OS schedule their execution.

(g) Deadlock can never occur if no process is allowed to hold a resource while requesting another resource.

(h) In round robin scheduling, it is advantageous to give each I/O bound process a longer quantum than each CPU-bound process

(i) For machines with 32-bit addresses (i.e. a 4GB address space), since 4GB physical memories are common and cheap, virtual memory is really no longer needed.

(j) TLB miss could occur even though the requested page was in memory.

18. 4pts We discussed three different techniques for organizing the data blocks for each file in a file system. Briefly describe each approach, identifying the strengths and weaknesses of each.

Bonus:

5pts. Suppose a computer has a file system for a 128GB ( $2^{37}$  byte) disk, where each disk block is 8KB ( $2^{13}$  bytes). If the OS for this computer uses a FAT, what is the smallest amount of memory that could possibly be used for the FAT (assuming the entire FAT is in memory)? Explain.

5pts. In the syllabus you were asked to email me something. What was it?

$n$	$2^n$	$n$	$2^n$	$n$	$2^n$
0	1	11	2,048	22	4,194,304
1	2	12	4,096	23	8,388,608
2	4	13	8,192	24	16,777,216
3	8	14	16,384	25	33,554,432
4	16	15	32,768	26	67,108,864
5	32	16	65,536	27	134,217,728
6	64	17	131,072	28	268,435,456
7	128	18	262,144	29	536,870,912
8	256	19	524,288	30	1,073,741,824
9	512	20	1,048,576	31	2,147,483,648
10	1,024	21	2,097,152	32	4,254,967,296