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UNIVERSITY OF TORONTO
Faculty of Arts and Science

St George Campus

August 2016 EXAMINATIONS

CSC 369H1Y
Instructor — Sina Meraji
Duration — 3 hours
No Aids Allowed

Student Number: |_|_|_|_|_|_|_|_|_|

Last (Family) Name(s): _____

First (Given) Name(s): _____

You must get at least 40% of the marks on this exam in order to pass this course.

*Do **not** turn this page until you have received the signal to start.*
(In the meantime, please fill out the identification section above, and read the instructions below *carefully*.)

This final examination consists of 8 questions on 13 pages (including this one). *When you receive the signal to start, please make sure that your copy of the examination is complete.*

If you need more space for one of your solutions, use the last pages of the exam and indicate clearly the part of your work that should be marked.

In your written answers, be as specific as possible and explain your reasoning. Clear, concise answers will be given higher marks than vague, wordy answers. **Marks will be deducted for incorrect statements in an answer.** Please make your handwriting legible!

MARKING GUIDE

# 1:	_____/12
# 2:	_____/16
# 3:	_____/12
# 4:	_____/12
# 5:	_____/10
# 6:	_____/ 9
# 7:	_____/11
# 8:	_____/ 8
TOTAL:	_____/90

Question 1. True / False [12 MARKS]

TRUE FALSE The main task of Operating systems is to manage accesses to computer resources.

TRUE FALSE There is no difference between processes and threads in OS.

TRUE FALSE Busy waiting is a common locking approach.

TRUE FALSE Priority inversion happens when a high priority process prevents a low priority process from making progress by holding some resource.

TRUE FALSE Dynamic partitioning is the most common memory management technique in modern operating systems.

TRUE FALSE Two-level page tables double the memory access time.

TRUE FALSE Opening a file using a hard link requires at least as many disk accesses as opening the same file using a symbolic link.

arm movement?

TRUE FALSE Disks rotation time is the main bottleneck in disk access time.

TRUE FALSE In file systems, a Master Block determines location of root directory.

TRUE FALSE The main difference of linux EXT2 and EXT1 file systems is the cylinder groups in EXT2.

TRUE FALSE Public key cryptography algorithms are much slower than private key algorithms.

TRUE FALSE Confidentiality is preventing unauthorized modification of info.

Question 2. Acronym Bingo [16 MARKS]

For each of the following, (1) expand the acronym if it is an acronym, (2) briefly explain what it is

Part (a) [2 MARKS] DOS

Part (b) [2 MARKS] RR

denial of service
round robin
process control block
least recently used
index nodes
translation lookaside buffer
secure socketlayer
access control list

Part (c) [2 MARKS] PCB

Part (d) [2 MARKS] LRU

Part (e) [2 MARKS] Inodes

Part (f) [2 MARKS] TLB

Part (g) [2 MARKS] SSL

Part (h) [2 MARKS] ACL

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Question 3. Virtual Memory [12 MARKS]

A system has a 32-bit virtual address space and uses a two-level page table. 9 bits are used to index the top-level page table, and 11 bits are used to index the second-level page table.

Part (a) [3 MARKS] How large are the pages (in bytes)?

determined by the size of offset 12 bit -> 2^12 = 4kb size blocks

Part (b) [2 MARKS] How many virtual pages can the process have?

2^32 / 2^12 = 2^20 virtual pages

Part (c) [2 MARKS] What is the size (in bytes) of an entry in the second-level page table, assuming the second-level page table is stored in a single physical page frame?

1 page = 4kb / 2^11 = 2 bytes / PTE

Part (d) [2 MARKS] If each page table entry includes valid, reference, and dirty bits in addition to the page frame number, what is the maximum number of physical page frames in the system?

16 bits - 3 bits = 13 bits

2^13 possible physical frames

Part (e) [3 MARKS] Assuming the page size is fixed, how can the address translation scheme be altered to support more physical page frames?

10, 10 bit first and second level
have 4 bytes / PTE, and 32 - 3 = 29 bits
2^29 physical frames

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Question 4. Processes/Threads and Synchronization [12 MARKS]

Part (a) [4 MARKS] Draw the process life cycle graph and explain the different states of a process in that graph

new -> ready -> run -> exit
— l__ wait__l

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Part (b) [8 MARKS] having 1 writer and n readers use a semaphore to solve the mutual exclusion problem(readers/writer problem)

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Question 5. Disk [10 MARKS]

Part (a) [5 MARKS] Describe seek time, rotation time and transfer time. How long do these typically take?

Part (b) [5 MARKS] Assuming that the disk head is pointing to block 0 and the requested blocks are 56, 32, 78, 3, 15, 23, 42, 8 how would the scan algorithm retrieve them from disk(what would be the order of returned blocks). If the seek time for one block is 2 ms what would be the total seek time to retrieve all the blocks?

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Question 6. File Systems [9 MARKS]

Consider a Unix-like file system that maintains a unique index node for each file in the system. Each index node includes 8 direct pointers, 2 indirect pointers, and a double indirect pointer. The file system block size is **B** bytes, and a block pointer occupies **P** bytes.

Part (a) [3 MARKS] Write an expression for the maximum file size that can be supported by this index node, in terms of **B** and **P**

Part (b) [3 MARKS] How many disk operations will be required if a process reads data from the N^{th} block of a file? Assume that the file is already open, the buffer cache is empty, and each disk operation reads a single file block. Your answer should be given in terms of **N**, **B**, and **P**. *Hint: Your answer can include multiple expressions to cover different values of N.*

1 for N<= 8
2 for 8 < N < 8 + B/P
3 for N > 8 + B/P

Part (c) [3 MARKS] Briefly explain the windows NTFS file system

journaling
long unicode file name
master file table containing pointers to contiguous data blocks
enhanced secury, compresssion

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Question 7. Deadlock [11 MARKS]

Consider the following system snapshot using data structures in the Bankers algorithm, with resources A, B, C, and D, and process P0 to P4:

C - current allocation matrix

Max

	(A)	(B)	(C)	(D)
P0	6	0	1	2
P1	1	7	5	0
P2	2	3	5	6
P3	1	6	5	3
P4	1	6	5	6

Allocation

	(A)	(B)	(C)	(D)
P0	4	0	0	1
P1	1	1	0	0
P2	1	2	5	4
P3	0	6	3	3
P4	0	2	1	2

Need

R - request matrix

	(A)	(B)	(C)	(D)
P0	2	0	1	1
P1	0 ~~1~~	6 ~~1~~	5 ~~0~~	0 ~~2~~
P2				
P3	1	0	2	0
P4	1	4	4	4

A - available resource vector

Available

	(A)	(B)	(C)	(D)
P0	3	2	1	1

Using Bankers algorithm, answer the following questions.

Part (a) [2 MARKS] How many resources of type A, B, C, and D are there?

algo: sum of columns in allocation matrix + available

1 look for unmarked process P_i, where R (need) ith row < available A

2 if such process found, mark process, and add ith row of C to A

3. loop previous 2 step, the unmarked process will be deadlocked

safe state-> if there is some scheduling order in which every process run to completion even if all of them request their max number of resources immediately

banker's algo: check if granting request leads to unsafe state, if so request denied

Part (b) [2 MARKS] What are the contents of the Need matrix? need = max - allocated

Part (c) [3 MARKS] Is the system in a safe state? Why?

safe

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Part (d) [4 MARKS] If a request from process P4 arrives for additional resources of (1,2,0,0,), can the Bankers algorithm grant the request immediately? Show the new system state and other criteria.

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Question 8. Security [8 MARKS]

Part (a) [4 MARKS] Briefly explain four requirements of computer security

confidentiality
integrity
availability
authenticity

Part (b) [4 MARKS] Briefly explain the SSL protocol

client server
ack each other, both get each others Random number + agreed cipher algoclient verify
client verify certificate
client generates premaster, encode wtih server pub E(pub, preMs), send to server
server decrypt with server private key
client, server computes master secret with f(Rc, Rs, preMs)
communicate by encrypting with master secret

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Total Marks = 90

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