CS 4310 Operating Systems
Exam 2
Max: 200 points
(12/12/2024)

Name: _____

Read these instructions before proceeding.

- Closed book. Closed notes. You can use calculator.
- You have 110 minutes to complete this exam.
- *Important Notes:*
  - *Box your answers.*
  - *No questions will be answered during the exam period about the exam questions. Write down your assumptions and answer the best that you can.*
  - *Just in case you have trouble of submitting your exam here @Canvas, alternative way is to submit your completed exam to Prof. Young by emailing*
    gsyoung@cpp.edu
- You need to submit your completed exam paper in ***one PDF file***.
  Two popular ways that students work on the exam are:
  - (1) Print out the exam paper. Write your answers on the exam paper. Scan your completed exam papers or take photos of them. Then turn **in *one PDF file*** here @ *Canvas*.
  - (2) Read the exam from the computer screen and answer questions on your own white papers (number your answers). Scan your exam answers or take photos of them. Then turn in ***one PDF file*** here @ *Canvas*.
- Answer the problems on the blank spaces provided for each problem.

Q.#1 (40)	Q.#2 (40)	Q.#3 (40)	Q.#4 (40)	Q.#5 (40)	Total (200)

1. (40 points) Fill in the blanks & short answer

(a) (4 pts) Files whose bytes or records can be read in any order are called _____ access files.

(b) (4 pts) When the computer is booted, the BIOS reads in and executes Section 0 of the disk, called _____.

(c) (4 pts) A compute with a 32-bit address uses a three-level page table. Virtual addresses are split into a 6-bit top-level page table field, a 5-bit second-level page table field, a 5-bit third-level page table field, and an offset.

How many pages are there in the address space? _____

(d) (4 pts) In theory, we can build secure systems as long as we keep the computer systems simple. However, as we introduce more _____, more complexity arises, thus compromising the ability to develop a secure system.

(e) (4 pts) MD5 is a cryptographic hash function that produces a 16-byte result. Given a result (output), the practical infeasibility of brute force guessing in the worst-case scenario requires that we must guess an input _____ number of times in order to find a match.

(f) (4 pts) Stack algorithm, such as LRU, does not suffer from _____.

(g) (h) (i) (j) (16 pts)
A deadlock situation can arise if and only if the following four conditions hold simultaneously in a system. (Coffman et al.)

_____

_____

_____

_____

2. (40 points) Consider a swapping system in which memory consists of the following holes sizes in memory order: 11 KB, 13 KB, 10 KB, 12 KB, 14 KB, 15 KB, and 26 KB. Which hole is taken for successive segment requests of

12 KB,
13 KB,
10 KB,
11 KB,

(a) for first-fit?

(b) for worst-fit?

(c) for best-fit?

(d) for next-fit?

3. (40 points)

(a) If ***FIFO*** page replacement is used with four page frames and eight pages, how many page faults will occur with the reference string 01234016457365 if four frames are initially empty? *Show all your steps.*

(b) Repeat the problem in part (a) for ***LRU***. *Show all your steps.*

4. (40 points)

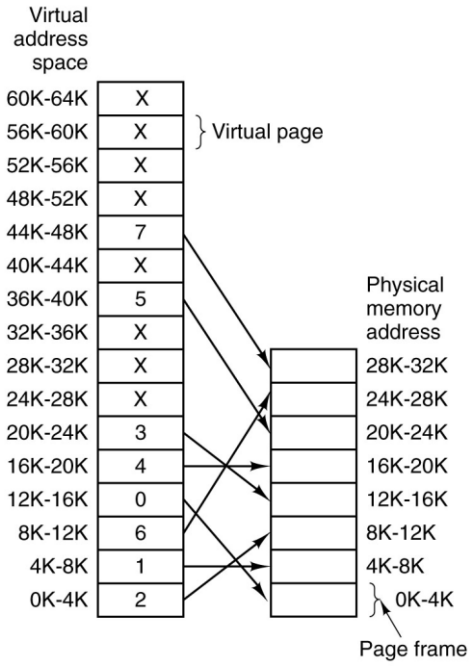
	Has	Max
A	**1**	**3**
B	**0**	**1**
C	**2**	**6**
D	**2**	**7**
E	**1**	**3**
Free: 2		

Take a careful look at the above. Use the Banker's Algorithm for a Single Resource to determine if each of the following requests leads to a safe state or an unsafe state.

(a) If ***C*** asks for one more unit, does this lead to a safe state or an unsafe state? Justify your answer by showing all your steps.

(b) If ***E*** asks for one more unit (instead of C), does this lead to a safe state or an unsafe state? Justify your answer by showing all your steps.

5. (40 points) A computer has 16-bit virtual addresses and 4-KB pages. It has 32 KB physical memory. A snap shot of the mapping from pages to page frames is as follows.



Calculate the physical address for each of following virtual addresses:

a) virtual address 21

b) virtual address 4097

c) virtual address 13002

d) virtual address 20003