## Fall 2015 COMP 3511 Homework Assignment #3 Handout Date: Oct 28, 2015 Due Date: Nov 11, 2015

		Name:ID	<u> </u>
		Name:        ID           E-Mail:        Section	on:
Ple	ease	se read the following instructions carefu	ally before answering the questions:
•	You	ou should finish the homework assignment	nt individually.
•		here are a total of 4 questions.	
•		When you write your answers, please try to	
•	Plea	ill in your name, student ID, email and Se lease fill in your answers in the space pro IS Word file.	ction number at the top of each page.  ovided, or you can type your answers in the
•	coll		required and the homework is collected in <b>box #17</b> (for <b>L2</b> ). The collection boxes are here are labels on the boxes)
1.	(20	20 points) Multiple choices	
	1)	) A mutex lock	
		A) is exactly like a counting semaphoral	ore
		B) is essentially a boolean variable	
		C) is not guaranteed to be atomic	t
		D) can be used to eliminate busy wait	ing
	2)	with multiprocessing capabilities. Wh A) A waiting thread may spin while w B) A waiting thread may sleep while w C) The adaptive mutex is only used to	accessing shared data on a Solaris system ich of the following statements is not true? vaiting for the lock to become available. waiting for the lock to become available. protect short segments of code. es are never used in place of an adaptive
	3)	How many philosophers may eat simular problem with 5 philosophers?  A) 1  B) 2  C) 3  D) 5	ltaneously in the Dining Philosophers
	4)	A cycle in a resource-allocation graph A) a necessary and sufficient condition resource has more than one instance B) a necessary and sufficient condition	on for deadlock in the case that each

resource has exactly one instance

- C) a sufficient condition for a deadlock in the case that each resource has more than once instance
- D) is neither necessary nor sufficient for indicating deadlock in the case that each resource has exactly one instance
- 5) Which of the following statements is true?
  - A) A safe state is a deadlocked state.
  - B) A safe state may lead to a deadlocked state.
  - C) An unsafe state is necessarily, and by definition, always a deadlocked state.
  - D) An unsafe state may lead to a deadlocked state.
- 6) Suppose that there are ten resources available to three processes. At time 0, the following data is collected. The table indicates the process, the maximum number of resources needed by the process, and the number of resources currently owned by each process. Which of the following correctly characterizes this state?

Process	Maximum Needs	Currently Owned
$P_0$	10	4
$\mathbf{P}_{1}$	3	1
$P_2$	6	4

- A) It is safe.
- B) It is not safe.
- C) The state cannot be determined.
- D) It is an impossible state.
- 7) \_\_\_\_\_ is the method of binding instructions and data to memory performed by most general-purpose operating systems.
  - A) Interrupt binding
  - B) Compile time binding
  - C) Execution time binding
  - D) Load-time binding
- 8) \_\_\_\_\_ is the dynamic storage-allocation algorithm which results in the smallest leftover hole in memory.
  - A) First fit
  - B) Best fit
  - C) Worst fit
  - D) None of the above
- 9) Assume a system has a TLB hit ratio of 90%. It requires 15 nanoseconds to access the TLB, and 85 nanoseconds to access main memory. What is the effective memory access time in nanoseconds for this system?
  - A) 108.5
  - B) 100

- C) 22
- D) 176.5
- 10) Given the logical address 0xAEF9 (in hexadecimal) with a page size of 256 bytes, what is the page number?
  - A) 0xAE
  - B) 0xF9
  - C) 0xA
  - D) 0x00F9
- 2. (20 points) Please answer the following questions in a few sentences.
  - 1) (4 points) What are the main differences between deadlock prevention and deadlock avoidance?

2) (6 points) One way to eliminate the circular-wait condition is to impose a total ordering of all resource types, for instance it requires that each process requests resources in an increasing order of enumeration  $-R = \{<R1, R2, ..., Rm\}$ . Please sketch a proof that this ensures no circular-wait (Hint: proof by contradiction)

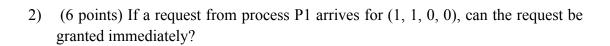
3)	(5 points)	How	does	external	fragmentations	occur?	How	could	we	resolve	this
	problem?										

3. (20 points) Consider the following snapshot of a system:

	Allocation	<u>Max</u>	Available
	A B C D	A B C D	A B C D
PO	2 0 0 1	4 2 1 2	3 3 2 1
P1	3 1 2 1	5 2 5 2	
P2	2 1 0 3	2 3 1 6	
Р3	1 3 1 2	1 4 2 4	
P4	1 4 3 2	3 6 6 5	

Answer the following questions using the banker's algorithm:

1) (8 points) Illustrate that the system is in a safe state by demonstrating an order in which the processes may complete.



3) (6 points) If a request from process P4 arrives for (0, 0, 2, 0), can the request be granted immediately?

## 4. (30 points) Memory management

1) (15 points) Consider the following segment table:

Segment	Base	Length		
0	90	200		
1	500	100		
2	3500	150		
3	160	10		
4	1382	200		

What are the physical addresses of the following logical address?

- a) 0,99
- b) 1, 101
- c) 2, 56
- d) 3, 100
- e) 4, 2

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In a 32-bit machine we subdivide the virtual address into 3 segments as follows:

page n	page offset	
10-bit	10-bit	12-bit

We use a two-level page table (in memory) such that the first 10 bits of an address is an index into the first level page table and the next 10 bits are an index into a second level page table. Each page table entry is 32 bits in size.

- a) (2 points) What is the page size in such a system?
- b) (3 points) How many entries are in the 1<sup>st</sup> level page table? How many entries are in the 2<sup>rd</sup> level page table?

c) (3 points) How much memory do the 1<sup>st</sup> page table occupy? How much memory do the 2<sup>rd</sup> page table occupy?

d) (7 points) How much space is occupied in memory by the page tables for a process that has 128MB of actual virtual address space allocated? Show your work with detailed explanation.