

## Spring 2015 COMP 3511 Homework Assignment #3

Handout Date: April 2, 2015 Due Date: April 16, 2015

Name: \_\_\_\_\_ ID: \_\_\_\_\_ E-Mail: \_\_\_\_\_

**Please read the following instructions carefully before answering the questions:**

- You should finish the homework assignment **individually**.
- There are a total of **4** questions.
- When you write your answers, please try to be precise and concise.
- Fill in your name, student ID, email and Section number at the top of each page.
- Please fill in your answers in the space provided, or you can type your answers in the MS Word file.
- **Homework Collection: the hardcopy** is required and the homework is collected in collection box #16. The collection boxes locate outside Room 4210, near lift 21 (there are labels attached on the boxes).

1. (20 points) Multiple choices

1) Which of the following conditions must be satisfied to solve the critical section problem?

①Aging   ②Mutual Exclusion   ③Deadlock   ④Progress   ⑤Bounded Waiting

A) ①②③⑤

B) ②③④⑤

C) ②④⑤

D) ③④⑤

2) At a particular time of computation the value of a counting semaphore is 7. Then 20 P operations and 15 V operations were completed on this semaphore. The resulting value of the semaphore is \_\_\_\_.

A) 42

B) 2

C) 7

D) 12

3) \_\_\_\_\_ occurs when a higher-priority process needs to access a data structure that is currently being accessed by a lower-priority process.

A) Deadlock

B) Priority inversion

C) A race condition

D) A critical section

- 4) Which of the following condition is required for deadlock to be possible?
- A) Mutual exclusion
  - B) A process may hold allocated resources while awaiting assignment of other resources.
  - C) No resource can be forcibly removed from a process holding it.
  - D) All of the mentioned.
- 5) One way to ensure that the circular wait condition never holds is to \_\_\_\_\_.
- A) impose a total ordering of all resource types and to determine whether one precedes another in the ordering
  - B) to let a process wait for only one resource at a time
  - C) to never let a process acquire resources that are held by other processes
  - D) All of these.
- 6) A system has 12 magnetic tape drives and 3 processes: P0, P1, and P2. Process P0 requires 10 tape drives, P1 requires 4 and P2 requires 9 tape drives. Currently, 5 tape drives are allocated to P0, 2 are allocated to P1, 2 are allocated to P2. Which of the following sequence is a safe sequence?
- A) P0, P1, P2
  - B) P1, P0, P2
  - C) P2, P0, P1
  - D) P1, P2, P0
- 7) The solution to starvation is \_\_\_\_\_.
- A) the number of rollbacks must be included in the cost factor
  - B) the number of resources must be included in resource preemption
  - C) resource preemption be done instead
  - D) All of these
- 8) An address generated by a CPU is referred to as a \_\_\_\_\_.
- A) physical address
  - B) logical address
  - C) post relocation register address
  - D) Memory-Management Unit (MMU) generated address

- 9) Given the logical address 0xAB A8 (in hexadecimal) with a page size of 256 bytes, what is the page offset?
- A) 0xAB
  - B) 0xA8
  - C) 0xA
  - D) 0xA800
- 10) Consider a logical address of 32 pages with 1024 words per page; mapped onto a physical memory of 16 frames. Thus, \_\_\_\_\_bits are required in the logical address; \_\_\_\_\_bits are required in the physical address.
- A) 15, 14
  - B) 15, 16
  - C) 14, 16
  - D) 14, 15
2. (30 points) Please answer the following questions in a few sentences
- 1) (3 points) What are the three general ways that a deadlock can be handled?
- 2) (5 points) Consider a system consisting of four resources of the same type that are shared by three processes, each of which needs at most two resources. Show that the system is deadlock-free.

- 3) (4 points) What are the differences between internal and external fragmentation?
- 4) (6 points) Please illustrate how swapping and sharing can increase the degree of multiprogramming.
- 5) (6 points) Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?

- 6) (6 points) Consider a paging system with the page table stored in memory. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take? If we add TLBs, and 75 percent of all page-table references are found in the TLBs, what is the effective memory reference time? (Assume that finding a page-table entry in the TLBs takes zero time, if the entry is there.)

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

	<u>Allocation</u>	<u>Max</u>	<u>Available</u>
	A B C D	A B C D	A B C D
P <sub>0</sub>	0 0 1 0	0 1 1 2	1 1 3 1
P <sub>1</sub>	2 0 0 1	2 1 2 2	
P <sub>2</sub>	4 0 2 1	6 1 5 2	
P <sub>3</sub>	1 2 3 0	2 4 5 2	
P <sub>4</sub>	1 2 0 3	2 2 4 6	

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.

2) (6 points) If a request from process P0 arrives for (0, 1, 0, 1), can the request be granted immediately?

3) (6 points) If a request from process P4 arrives for (1, 0, 1, 0), can the request be granted immediately?

4. (30 points) Memory management

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

<u>Segment</u>	<u>Base</u>	<u>Length</u>
0	90	100
1	300	99
2	2500	150
3	150	10
4	1283	200

What are the physical addresses of the following logical address?

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

2) (15 points) Consider a paging system: the page size is 1K bytes, and the physical memory is 64K bytes. For a given process, it contains 6 pages and its page table is shown below (note that page number is the index into the page table, and itself is not part of the page table).

Page No.	Frame No. (decimal)
0	11
1	3
2	9
3	40
4	23
5	1

- a) Please give the corresponding physical address (in binary) of the decimal virtual address 2211. Briefly show your steps. (5 points)
- b) Please give the physical address (in decimal) of the decimal virtual address 4321. Briefly show your steps. (5 points)
- c) Consider a process with a logical address space of 64 Mbytes in size. Paging is used with a page size of 1 Kbytes. The physical memory size is 1 Mbytes. Please specify the size of the page table (in bytes). You can ignore all the control bits and suppose each page table entry consists of 4 bytes. Briefly show your steps. (Hint: use hierarchical paging scheme if necessary) (5 points)