FALL 2017 COMP 3511 Homework Assignment

Handout Date: October 30, 2017 Due Date: November 11, 2017

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 **3** 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 #20. The collection boxes locate outside Room 4210, near lift 21 (there are labels attached on the boxes).

1. (20 points) Multiple choices

   1) All processes share a semaphore variable mutex, initialized to 1. Each process must execute wait(mutex) before entering the critical section and signal(mutex) afterward.

      i) Suppose a process executes in the following manner :
      signal(mutex);
      …..
      critical section
      …..
      wait(mutex);

      In this situation :
      A) a deadlock will occur
      B) processes will starve to enter critical section
      C) several processes maybe executing in their critical section
      D) All of these

   2) A deadlock free solution to the dining philosophers problem :
      A) necessarily eliminates the possibility of starvation
      B) does not necessarily eliminate the possibility of starvation
      C) eliminates any possibility of any kind of problem further
      D) None of these

   3) A system is in the safe state if
      A) the system can allocate resources to each process in some order and still avoid a deadlock

B) there exist a safe sequence
C) both (a) and (b)
D) none of the mentioned

4) To ensure no preemption, if a process is holding some resources and requests another resource that cannot be immediately allocated to it :
A) then the process waits for the resources be allocated to it
B) the process keeps sending requests until the resource is allocated to it
C) the process resumes execution without the resource being allocated to it
D) then all resources currently being held are preempted

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 with 5 processes P0 through P4 and three resource types A, B, C has A with 10 instances, B with 5 instances, and C with 7 instances. At time t0, the following snapshot has been taken :

Process
P0
P1
P2
P3
P4

Allocation (process-wise : P0 through P4 top to bottom)
A B C
0 1 0
2 0 0
3 0 2
2 1 1
0 0 2

Max (process-wise : P0 through P4 top to bottom)
A B C
7 5 3
3 2 2
9 0 2
2 2 2
4 3 3

Available
A B C
3 3 2
The sequence leads the system to :
A) an unsafe state
B) a safe state
C) a protected state
D) a deadlock

7) If we preempt a resource from a process, the process cannot continue with its normal execution and it must be :
A) aborted
B) rolled back
D) terminated
D) queued

8) Run time mapping from virtual to physical address is done by
A) memory management unit
B) CPU
C) PCI
D) none of the mentioned

9) If there are 32 segments, each of size 1Kb, then the logical address should have :

A) 13 bits

B) 14 bits

C) 15 bits

D) 16 bits

10) Consider a computer with 8 Mbytes of main memory and a 128 K cache. The cache block size is 4 K. It uses a direct mapping scheme for cache management. How many different main memory blocks can map onto a given physical cache block ?
A) 2048
B) 256
C) 64
D) 8

2. (30 points) Please answer the following questions in a few sentences

   1) (6 points) List the factors on the basis of which the process to be aborted is chosen.

   2) (5 points) Discuss the tradeoff in terms of fairness and throughput in the solution to the first readers-writers problem. Propose a method for solving the readers- writers problem without causing starvation.

3) (4 points) Compare the circular-wait scheme used in deadlock prevention with the deadlock-avoidance schemes (like the banker's algorithm) with respect to the following two issues:

   a. Runtime overheads

   b. System throughput

4) (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.

5) (5 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) (5 points) Explain the difference between internal and external fragmentation.

3. (35 points) Consider the following snapshot of a system:

1)

	Allocation	Max	Available
	A B C D E	A B C D E	A B C D E
P_0	1 0 0 1 0	4 2 1 2 3	1 4 2 1 1
P_1	2 1 0 1 1	2 3 1 6 1	
P_2	1 0 1 2 2	1 4 2 3 2	
P_3	1 1 3 2 0	3 6 6 8 4	
P_4	3 1 2 1 0	5 2 5 2 2	

Answer the following questions using the banker's algorithm:

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

b. (6 points) If a request from process P1 arrives for (0, 1, 0, 1, 0), can the request be granted immediately?

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

2) (15 points) Consider a system consisting of m resources of the same type, being shared by n processes. Resources can be requested and released by processes only one at a time. Show that the system is deadlock free if the following two conditions hold:

a. The maximum need of each process is between 1 and m resources

b. The sum of all maximum needs is less than $m + n$

3) (15 points) Memory management

Consider the following segment table:

Segment	Base	Length
0	220	540
1	2400	600
2	100	90
3	150	60
4	800	200

What are the physical addresses for the following logical addresses?

a. 0,300 b. 1,100 c. 2,500 d. 3,40 e. 4,250