CS 4323
Operating Systems
HW5

Date: Apr 8, 2019
Points: 80
Questions 2 - 4: 15 points each
Question 1: 35 points

Note: Question 1 is a programming question which can be implemented in any programming language.

Submit a single zipped file containing the following two files:
i) The Source code, and
ii) A text file containing screenshots for the output, and answers to questions 2 -4.

1. Implement Banker's algorithm which will determine whether the state of the system is safe or unsafe.
   [Consider the following input, Chap 7 – Deadlocks, page 332, 9/E]]
   Resource type A has 10 instances, resource type B has 5 instances, and resource type C has 7 instances.

   Suppose now that process P1 requests one additional instance of resource type A and two instances of resource type *C.* Show whether this request can be immediately granted.

	Allocation	**Max**	**Available**
	A B C	A B C	A B C
P0	0 1 0	7 5 3	3 3 2
P1	2 0 0	3 2 2	
P2	3 0 2	9 0 2	
P3	2 1 1	2 2 2	
P4	0 0 2	4 3 3	

2. Consider the following snapshot of a system:

	Allocation	Max	Available
	A B C D	A B C D	A B C D
$\mathbf{P_0}$	2 1 0 1	4 2 1 2	3 3 2 1
$\mathbf{P_1}$	3 1 2 1	5 2 5 2	
$\mathbf{P_2}$	2 1 1 3	2 3 1 6	
$\mathbf{P_3}$	1 3 1 2	1 4 2 4	
$\mathbf{P_4}$	1 4 3 2	3 6 6 5	

   Answer the following questions using the Banker's algorithm **[Show all the work]**

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

   b. If a request from process $\boldsymbol{P_1}$ arrives for (0, 0, 1, 0), can the request be granted immediately?

3. Consider the following snapshot of a system:

	Allocation	Max	Available
	A B C D	A B C D	A B C D
$\mathbf{P_0}$	0 0 1 2	0 0 1 2	1 5 2 0
$\mathbf{P_1}$	1 0 0 0	1 7 5 0	
$\mathbf{P_2}$	1 3 5 4	2 3 5 6	
$\mathbf{P_3}$	0 6 3 2	0 6 5 2	
$\mathbf{P_4}$	0 0 14	0 6 5 6	

Answer the following questions using the banker's algorithm. [**Show all the work]**

a. What is the content of the matrix Need?
b. Is the system in a safe state?
c. If a request from process P1 arrives for (0, 4, 2, 0), can the request be granted immediately?

4. A system has 4 processes and 5 allocatable resource. The current allocation and maximum needs are as follows:

	Allocated	Max	Available
$\mathbf{P_0}$	1 0 2 1 1	1 1 2 1 2	0 0 x 1 1
$\mathbf{P_1}$	2 0 1 1 0	2 2 2 1 0	
$\mathbf{P_2}$	1 1 0 1 0	2 1 3 1 0	
$\mathbf{P_3}$	1 1 1 1 0	1 1 2 2 1	

What is the smallest value of **x** for which this is a safe state.
Also, give the order in which these can finish with this value of **x**.

[Show all the work]