Homework 4: Due 10/31/2022 at 11:59 PM

Your programs – if requested – must compile with gcc and execute on **snowball.cs.gsu.edu**! Please see https://cscit.cs.gsu.edu/sp/guide/snowball for more details. You may use whatever IDEs / text editors you like, but you must submit your responses on iCollege.

1. **(10 Points)** Provide a **deadlock-prone** pseudocode for two processes each accessing two semaphores A and B.

2. **(20 Points)** Prove the correctness or give a counterexample for each of the following statements. You must state whether the statement is true or false and then show your arguments. ("->" means "implies").

   a. Cycle -> Deadlock

   b. Knot -> Deadlock

3. **(20 Points)** Consider the following maximum-claim reusable resource system with four processes (P_0, P_1, P_2, P_3) and three resource types (R_0, R_1, R_2). The maximum claim matrix C is given by

	R_0	R_1	R_2
P_0	4	1	4
P_1	3	1	4
P_2	5	6	13
P_3	1	1	6

   where C_{ij} denote maximum claim of process i for resource j. The total number of units of each resource type is given by the vector

R0	R1	R2
5	8	15

   The current allocation of resources is given by the matrix A

	R_0	R_1	R_2
P_0	0	1	4
P_1	2	0	1
P_2	1	2	1
P_3	1	0	3

   where $A_{i,j}$ denotes the units of resources of type j currently allocated to process i. For the state shown above, determine if a new request by process P_1 for 1 unit of resource R_1 can be safely granted. (Remark: You can assume that the system state above does not yet consider this request.)