University of Colorado at Colorado Springs
Operating Systems Assignment 2

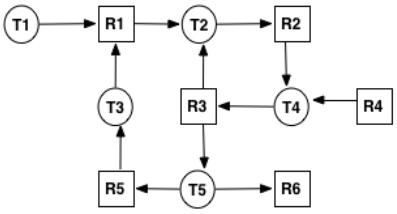
Instructor: Yanyan Zhuang
Total Points: 50
Out: 3/5/2025 Due: 3/14/2025

Please read the following:

- Assignments are to be completed individually, no teamwork please.
- Using third-party platforms such as (but not limited to) Chegg and ChatGPT to get answers is prohibited. Asking former students for solutions is also prohibited.
- Please format your answers in the order of the questions asked, i.e., don't randomize the order of the questions. **If the format or writing is hard to follow, your TA has the right to deduct up to 10pts.** Please submit your work in Canvas.

Chapter 2 (30pts, 5pts each)

1. What are the differences between processes and threads?
2. With a five-state process model, please explain each state and the transitions.
3. Please discuss the advantages/disadvantages of using user-level and kernel-level threads.
4. What are the advantages/disadvantages of busy-waiting and sleep-and-wakeup approaches for mutual exclusion?
5. Why are semaphores needed? What are the similarities and differences between a semaphore and a mutex?
6. In the dining philosophers problem's solution (Section 6.1.3, Figure 6-5, or Lec7 slide 43-44), explain briefly what does the function `test(i)` do (two roles) and how it works.



(a) Chapter 6, Question 1.

	C matrix				R matrix			
P1	0	0	1	1	2	0	0	0
P2	0	1	0	1	0	0	1	1
P3	0	1	1	0	1	1	0	2
P4	1	0	1	0	1	2	1	0
P5	0	0	0	1	2	2	0	3

(b) Chapter 6, Question 2.

Figure 1: Chapter 6 questions.

Chapter 6 (20pts)

1. Show how the deadlock detection algorithm works on the resource graph in Figure 1a (previous page) to find all potential deadlocks. **Please show your work, and identify the processes and resources involved** (8 pts).

2. A system has four resources and five processes. The resources in existence vector is E = (2 2 4 4). The current allocation (C matrix) and requests (R matrix) are shown in Figure 1b (previous page). What is the resources available vector A? Can you detect any deadlock? **Please show your work** (12 pts).