CSC 139: Operating Systems Principles
Second Quiz, Fall 2020
Friday, April 17th, 2020
Section 4
Instructor: Dr. Ghassan Shobaki

Student Name: Key **Student Number:** _____

Q1. Answer with TRUE or FALSE. **[40 points]**

1. If in the **avoidance** version of the **Banker's algorithm**, we fail to find a **safe sequence**, the system **will necessarily** have a deadlock. TRUE (FALSE)

2. If there are multiple processes that are holding some resources and waiting for other resources, we necessarily have a deadlock. TRUE (FALSE)

3. A deadlock cannot happen unless mutual exclusion is required for some resources. (TRUE) FALSE

4. In theory, it is possible to recover from a deadlock by preempting some processes from some resources **without** terminating any process. (TRUE) FALSE

Q2. Circle the right answer. There is only **one** correct answer. **[60 points]**

1. The worst-case running time for finding a safe sequence in the **Banker's algorithm** for deadlock detection on a system with p processes and q resource types is:
   a. $O(p^2)$ b. $O(q^2)$ (c.) $O(p^2q)$ d. $O(pq^2)$ e. $O(pq)$ f. $O(p^2q^2)$

2. Which of the following statements is (are) true about cycles in the Resource Allocation Graph (RAG)?
   ✓a. Having a cycle in the RAG is always a necessary condition for deadlocks.
   b. Having a cycle in the RAG is always a sufficient condition for deadlocks.
   c. Having a cycle in the RAG necessarily implies a deadlock if all resource types have multiple instances
   ✓d. Having a cycle in the RAG necessarily implies a deadlock if all resource types have single instances.
   e. Both a and c are true. (f.) Both a and d are true. g. a, b and d are true.

3. Which of the following is a **necessary** condition for deadlocks:
   a. Some resources are preemptive b. All resources are preemptive
   (c.) Some resources are non-preemptive d. All resources are non-preemptive
   e. Both a and b are true. f. Both c and d are true.

4. Given the following state of a system that has one resource type:

	Current Allocation	Current Request
P_0	2	4
P_1	3	8
P_2	1	2
P_3	1	6

Avail: 2 → 3 → 4; P_2: 3 → 4; P_0: 6; P_3: 7 → 8

What's the minimum value for the **total** number of instances that will make the system deadlock free?
a. 7 b. 8 c. 9 d. 10 (e.) 11 f. 12 g. 13 h. 14

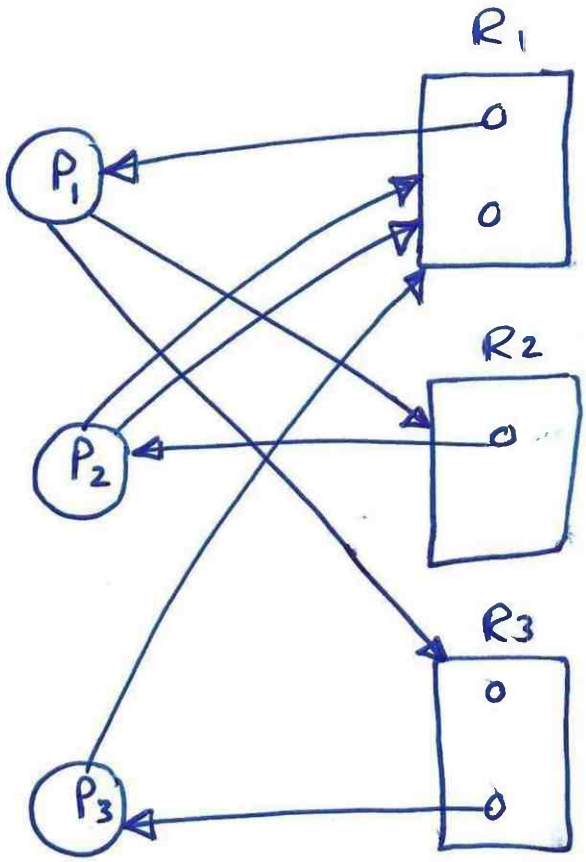
$4 + (2 + 3 + 1 + 1) = 11$

5. Consider a system with processes P_1, P_2 and P_3 and resource types R_1, R_2 and R_3. There is **one** instance of R_2 and there are **two** instances of each of R_1 and R_3. P_1 is currently holding an instance of R_1 and requesting an instance of R_2 and an instance of R_3, P_2 is holding an instance of R_2 and requesting two instances of R_1, and P_3 is holding an instance of R_3 and requesting an instance of R_1. What's the current state of the system?
   a. P_2 and P_3 are in a deadlock but P_1 is not in a deadlock.
   (b.) P_1 and P_2 are in a deadlock but P_3 is not in a deadlock.
   c. P_1 and P_3 are in a deadlock but P_2 is not in a deadlock.
   d. All three processes are in a deadlock. e. There is no deadlock in the system.

6. Consider a system with processes P_1, P_2 and P_3 and resource types R_1 and R_2. There are **two** instances of each resource type. If P_1 is currently holding an instance of R_1, P_2 is holding an instance of R_2, and P_3 is holding an instance of R_2, which of the following sequences of requests will **necessarily** cause a deadlock?

a. P_1 requests one instance of R_2, P_2 requests one instance of R_1 and P_3 requests one instance of R_1
b. P_1 requests one instance of R_2, P_2 requests one instance of R_1 and P_3 requests two instances of R_1
c. P_1 requests one instance of R_2, P_3 requests one instance of R_1 and P_2 requests two instances of R_1
d. P_1 requests one instance of R_2,P_2 requests two instances of R_1 and P_3 requests two instances of R_1
e. b and d are correct
f. c and d are correct
g. b, c and d are correct

Q 5



Q 6