CSC 139: Operating Systems Principles
Second Quiz, Fall 2017
Friday, November 17th, 2017
Instructor: Dr. Ghassan Shobaki
Section 1, Form A

Student Name: _____ Student Number: _____

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

1. If at some point, every process in the system is either holding resources or waiting for resources but not both, the system cannot be in a deadlock at that point. TRUE FALSE
2. If the **avoidance** version of the **Banker's algorithm** finds that a given request will put the system in an **unsafe state**, then that request will **necessarily** cause a deadlock. TRUE FALSE
3. The **Banker's algorithm** for deadlock detection can be used **only if** there are at least two instances of each resource type. TRUE FALSE
4. The only way to recover from a deadlock is to terminate all the processes that are involved in the deadlock. TRUE FALSE

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

1. Which of the following is a **necessary** condition for deadlocks:
   a. All resources are preemptive b. Some resources are preemptive
   c. All resources are non-preemptive d. Some resources are non-preemptive

2. Which of the following statements is true about cycles in the resource allocation graph (RAG)?
   a. Whenever the RAG has a cycle, the system has a deadlock.
   b. The system may have a deadlock even if there are no cycles in the RAG.
   c. If there is a cycle in the RAG and there are multiple instances of each resource, there is no deadlock.
   d. A cycle in the RAG implies a deadlock only if there is a single instance of each resource.

3. Given the following state of a system with one resource type:

	Current Allocation	Current Request
P_0	1	8
P_1	5	9
P_2	3	2
P_3	1	3

   What is the **minimum** number of instances of the resource that must be **available** at this point to ensure that the system is **not** in a deadlock?
   a. 2 b. 3 c. 4 d. 5 e. 6 f. 7 g. 8 h. 9

4. Consider a system with processes P_1, P_2 and P_3 and resource types R_1, R_2 and R_3. There is a **single** instance of each resource. If P_1 is currently holding R_1 and requesting R_3, P_2 is holding R_2, and P_3 is holding R_3, which of the following events will cause a deadlock?
   a. P_2 requests R_1 b. P_3 requests R_1 c. P_2 requests R_3 d. P_3 requests R_2 e. P_1 requests R_2

5. Consider a system with processes P_1, P_2 and P_3 and resource types R_1, R_2 and R_3. There are **two** instances of each resource. P_1 is currently holding an instance of R_1 and requesting an instance of R_3, P_2 is holding an instance of R_3 and requesting an instance of R_1, and P_3 is holding an instance of R_1 and an instance of R_3, and requesting an instance of R_2. What's the current state of the system?
   a. P_1 and P_2 are in a deadlock but P_3 is not in a deadlock.
   b. P_1 and P_3 are in a deadlock but P_2 is not in a deadlock.
   c. P_2 and P_3 are in a deadlock but P_1 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, R_2 and R_3. There are **two** instances of each resource. If P_1 is currently holding two instances of R_1, P_2 is holding an instance of R_2, and P_3 is holding the other instance of R_2, which of the following **sequences of events** will cause a deadlock?
   a. P_1 requests an instance of R_2, P_2 requests an instance of R_1 and P_3 requests an instance of R_3
   b. P_1 requests an instance of R_2, P_2 requests an instance of R_3 and P_3 requests an instance of R_1
   c. P_1 requests an instance of R_2, P_2 requests an instance of R_1 and P_3 requests an instance of R_1
   d. P_1 requests an instance of R_3, P_2 requests an instance of R_3 and P_3 requests an instance of R_3
   e. A deadlock can never happen when there are two instances of each resource