UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

COLLEGE *of* INFORMATICS *and* ELECTRONICS
Department of Computer Science and Information Systems

Repeat Exam

Academic Year:	2006/2007	**Semester:** Autumn
Module Title:	Operating Systems	**Module Code:** CS4023 & CS4145
Exam Duration:	2½ Hours	**Total Marks:** 95
Lecturer:	Dr. N. S. Nikolov	

Instructions to Candidates:

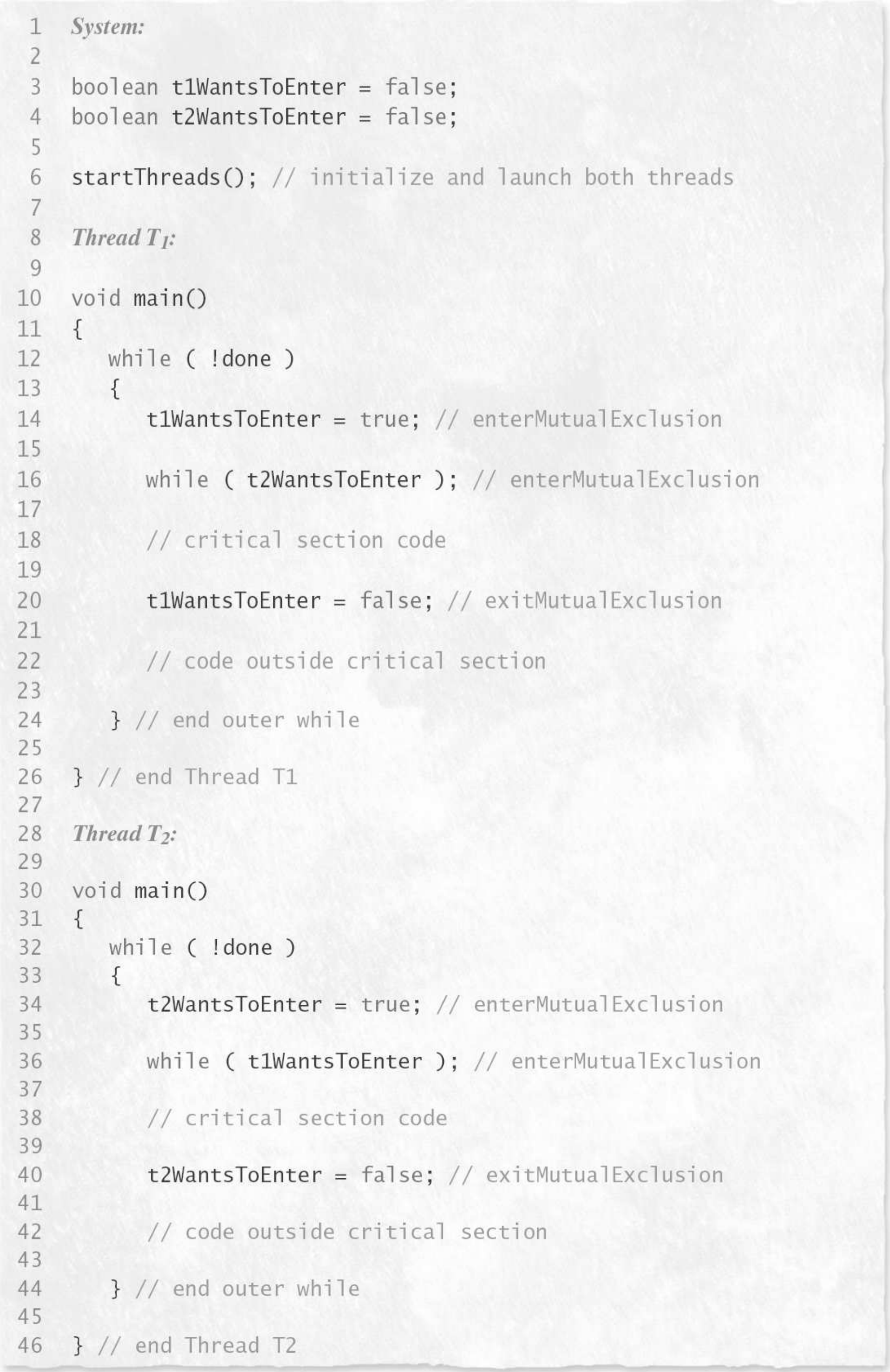
Answer ALL questions!
Please write **ALL** answers in the answer booklet.
State clearly any assumptions you make.

QUESTIONS

Q1. (20 marks) Processes and threads.

a. Give a definition of *process*.
b. How does the operating system prevent a process from monopolizing a processor?
c. Draw a generic diagram of the state transitions of a process in an operating system with three states: running, ready and blocked.
d. What is the appeal of using threads instead of a processes communication with each other?
e. What key advantage would you get by running a multithreaded application on a multiprocessor system over running it on a uniprocessor system?

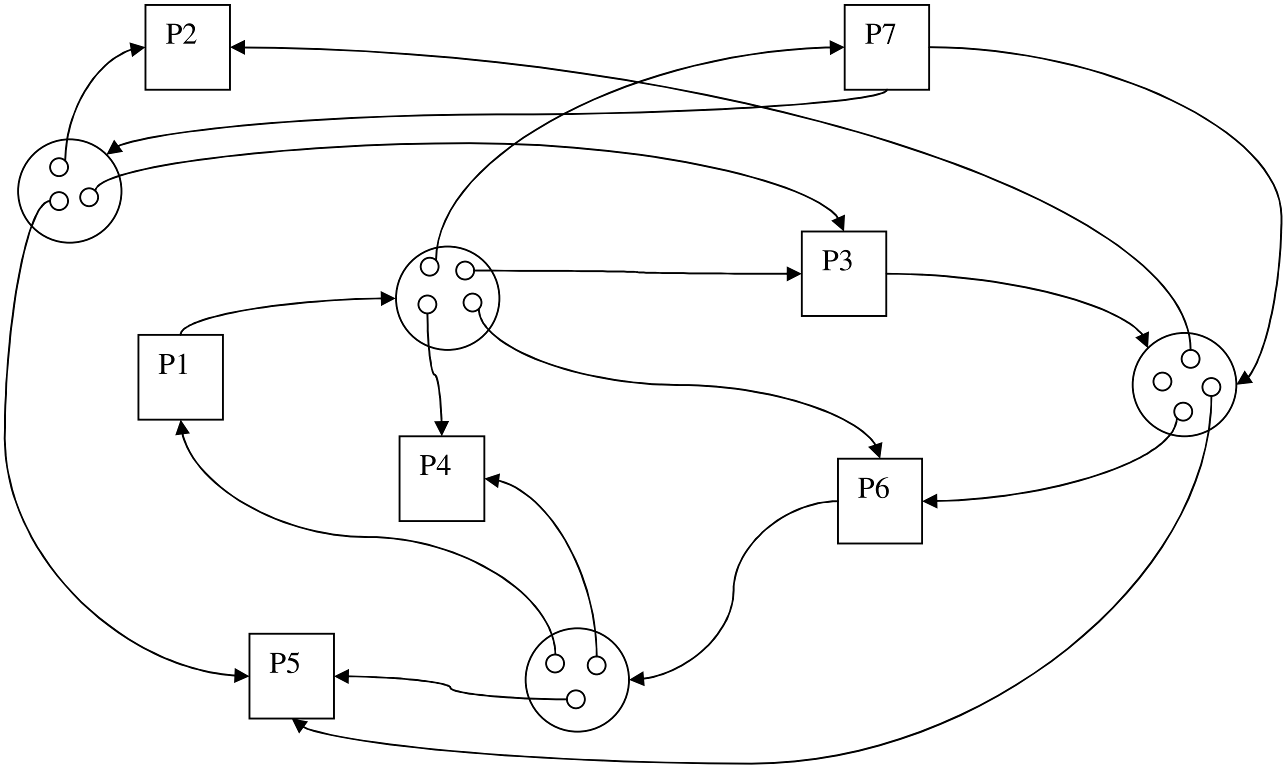
Q2. (15 marks) The following mutual exclusion implementation contains an imperfection. Comment the code and explain what can go wrong?



```
System:

boolean t1WantsToEnter = false;
boolean t2WantsToEnter = false;

startThreads(); // initialize and launch both threads

Thread T1:

void main()
{
   while ( !done )
   {
      t1WantsToEnter = true; // enterMutualExclusion

      while ( t2WantsToEnter ); // enterMutualExclusion

      // critical section code

      t1WantsToEnter = false; // exitMutualExclusion

      // code outside critical section

   } // end outer while

} // end Thread T1

Thread T2:

void main()
{
   while ( !done )
   {
      t2WantsToEnter = true; // enterMutualExclusion

      while ( t1WantsToEnter ); // enterMutualExclusion

      // critical section code

      t2WantsToEnter = false; // exitMutualExclusion

      // code outside critical section

   } // end outer while

} // end Thread T2
```

Q3. (15 marks) What semaphores are used for? Define the P and V operations of a semaphore. What is the difference between binary and counting semaphores?

Q4. (15 marks) In the following resource allocation graph,, the squares represent processes, the larger circles are classes of identical resources, and the small circles are the resources. Reduce the graph by process. Draw each step. Is the system represented by the graph deadlocked?



Q5. (15 marks) Explain the difference between a process's virtual address space and the system's physical address space. Explain the appeal of artificial contiguity.

Q6. (15 marks) Explain paging address translation with combined associative/direct mapping. Draw a diagram.

END OF EXAM