



UNIVERSITY of LIMERICK

O L L S C O I L L U I M N I G H

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

End-of-Semester Exam

Academic Year:	2006/2007	Semester:	Autumn
Module Title:	Operating Systems	Module Code:	CS4023 & CS4145
Exam Duration:	2½ Hours	Total Marks:	80
Lecturer:	Dr. N. S. Nikolov		

Instructions to Candidates:

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

QUESTIONS

Q1. (10 marks) What does the term multiprogramming refer to? What is the degree of multiprogramming of a system? What are the key motivations for the development of multiprogramming systems?

Q2. (10 marks) Give a definition of *process*. How does the operating system prevent a process from monopolizing a processor? Draw a generic diagram of the state transitions of a process in an operating system with three states: running, ready and blocked.

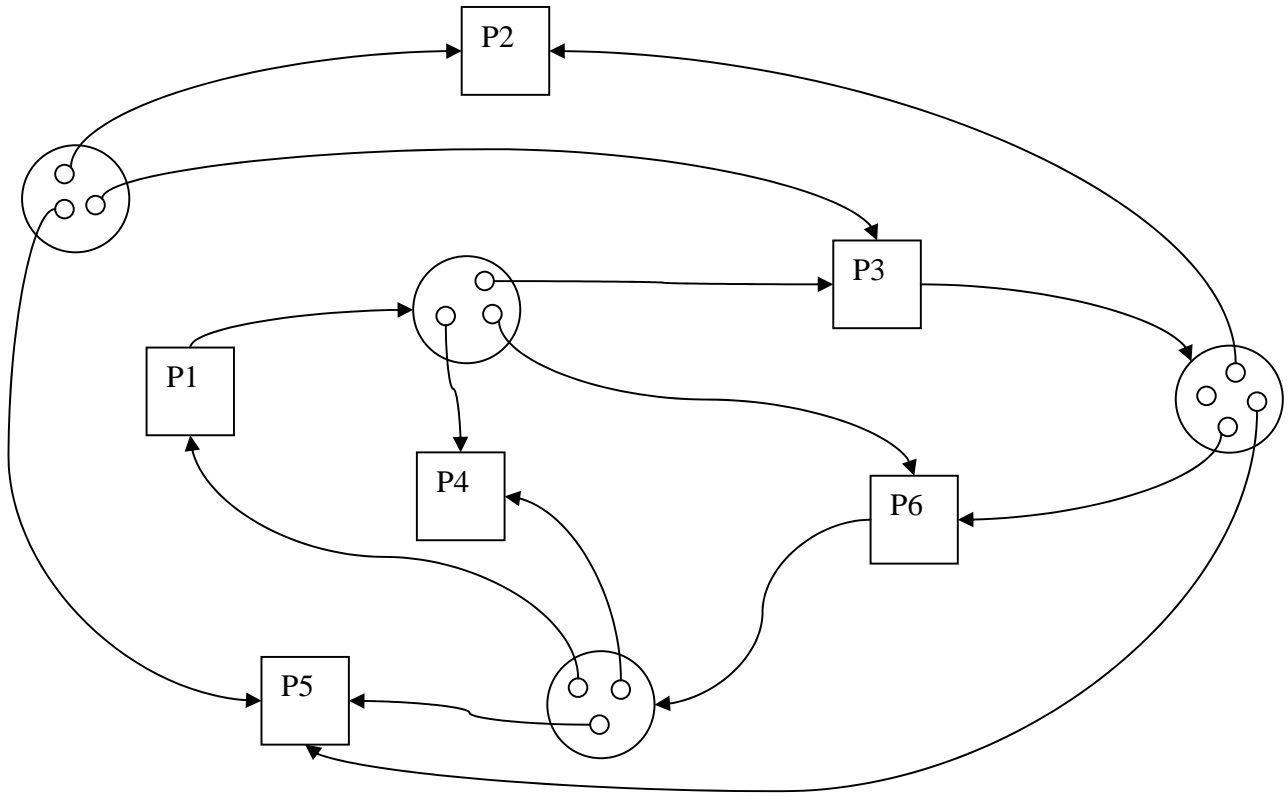
Q3. (10 marks) Define thread and describe its basic properties. What key advantage would you get by running a multithreaded application on a multiprocessor system over running it on a uniprocessor system?

Q4. (10 marks) The following mutual exclusion implementation contains an imperfection. Explain what can go wrong?

```
1  System:
2
3  boolean t1WantsToEnter = false;
4  boolean t2WantsToEnter = false;
5
6  startThreads(); // initialize and launch both threads
7
8  Thread T1:
9
10 void main()
11 {
12     while ( !done )
13     {
14         t1WantsToEnter = true; // enterMutualExclusion
15
16         while ( t2WantsToEnter ); // enterMutualExclusion
17
18         // critical section code
19
20         t1WantsToEnter = false; // exitMutualExclusion
21
22         // code outside critical section
23
24     } // end outer while
25
26 } // end Thread T1
27
28 Thread T2:
29
30 void main()
31 {
32     while ( !done )
33     {
34         t2WantsToEnter = true; // enterMutualExclusion
35
36         while ( t1WantsToEnter ); // enterMutualExclusion
37
38         // critical section code
39
40         t2WantsToEnter = false; // exitMutualExclusion
41
42         // code outside critical section
43
44     } // end outer while
45
46 } // end Thread T2
```

Q5. (10 marks) What semaphores are used for? Define the P and V operations of a semaphore. What is the difference between binary and counting semaphores?

Q6. (10 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. Does the graph represent a deadlocked system?



Q7. (10 marks) Explain the difference between a process's virtual address space and the system's physical address space. Explain the appeal of artificial contiguity.

Q8. (10 marks) Explain paging address translation with combined associative/direct mapping. Draw a diagram.

END OF EXAM