

OLLSCOIL NÁISIÚNTA NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

Summer Examinations 2010

CS2503 Operating Systems 1

Dr C. Shankland
Professor J. Bowen
Dr J. G. Vaughan

Total Marks: 40

Answer TWO QUESTIONS

TIME ALLOWED: 1.5 hours

QUESTION 1 (20 Marks)

(a) (i) How many bits are necessary to address 32 bytes, 1K byte and 256 bytes?

3 Marks

(ii) What are the maximum and minimum unsigned integers that can be represented by 7 bits, 9 bits and 10 bits?

3 Marks

(b) Convert the following decimal numbers to octal, showing all workings: 74D, 7549D, 255D, 15D.

6 Marks

(c) Convert the following decimal numbers to binary, showing all workings: 74D, 7549D, 255D, 15D. You may continue from part (b) if you wish.

4 Marks

(d) Convert the following decimal numbers to hexadecimal, showing all workings: 74D, 7549D, 255D, 15D. You may continue from part (c) if you wish.

4 Marks

QUESTION 2 (20 Marks)

(a) What is a process? How is it represented in the operating system? Draw a 3-state process diagram and briefly explain the function of each state and state transition.

8 Marks

(b) State and explain briefly the three conditions for a correct solution to the critical section problem.

3 Marks

(c) Describe the structure of a semaphore and the primitives that operate on it.

4 Marks

(b) Give semaphore-based outline code for a producer and a consumer process in the bounded-buffer producer-consumer problem. You may assume the existence of high-level operations “Produce Item”, “Consume Item”, “Place Item in Buffer” and “Take Item from Buffer”.

5 Marks

QUESTION 3 (20 Marks)

The program below is written in Intel 80x86 assembly language. Assume that an opcode plus one register address can be contained in a single byte. Any immediate data requires at least one additional byte, depending on the value of the data. Assume that the offset of a memory address requires 16 bits. Ignore segmentation.

- (a) Describe how a two-pass assembler would process the source code file containing this program, mentioning all tables used and output files produced. **5 Marks**
- (b) Show the addresses generated by the first pass of the assembler, in the form of a table with the addresses in Column 1 and the corresponding contents in Column 2. It is not necessary to translate the contents. **5 Marks**
- (c) List the contents of the relocatable file generated by the assembly process. Comment on each feature introduced by relocatability and pay attention to endianness. You must give everything here in numeric form, with the exception of opcodes and register addresses. For example, you can write MOV AX, 1 in exactly this form throughout your answer. **10 Marks**

```
CSEG  
  
MOV  AX, 1  
ADD  AX, 0  
MOV  RESULT, AX  
HLT  
  
RESULT  DW  0  
  
END
```