NAME_____

ASSIGNMENT #9 91.308 OPERATING SYSTEMS

DUE DECEMBER 5, 2005

VIRTUAL MEMORY. The following problem deals with a virtual memory system with **a 12 bit address space (from 0 to 4096 (4K) locations).** The system is byte addressable and uses a **256 byte per page** organization. The real memory is the same size as virtual memory. Therefore, both memory spaces are organized into **16 page frames of 256 bytes** each. Assume the operating system itself occupies the last six pages permanently, and that user programs will page against the **first 10 pages** as they run. Remember, the 12 bit address space will allow each user process to have a virtual address space of **4096 bytes** (16 pages) even though only 10 real pages will be available for all running processes to share during execution. The current status of this system is shown below for a time when 3 processes, **A, B and C**, are active in the system. All processes are full size programs using all 16 virtual pages available. **A is presently in the running state** while B and C are in the ready state. As you look at the current CPU registers you can see that **process A has just fetched a JUMP instruction** from its code path. The **PROGRAM COUNTER (PC)** value shown is the (binary) **VIRTUAL address** of the JUMP instruction itself, which is now in the INSTRUCTION REGISTER (**IR**), and the JUMP instruction shows a (binary) **VIRTUAL address to jump to** as it executes.

A. From what **REAL physical byte address** did the current JUMP instruction in the **IR** come from ? (You can give a <page, offset> combination or the single number actual address, but use base 10 numbers either way)

Give a base 10 answer_____

B. To what **REAL physical byte address** will control be transferred when the current JUMP instruction executes ?? (Remember, **a page fault can occur** if a process thread references an invalid page, and faults are satisfied by connecting a virtual page to an available free physical page.) (Again, you can give a <page, offset> combination or the single number actual address, but use base 10 numbers either way)

Give a base 10 answer_____

Tables on next page ➔

SYSTEM PAGE FRAME TABLE AND CURRENT PAGE TABLE FOR RUNNING PROCESS A ARE SHOWN BELOW (THE OS KEEPS THESE IN ITS SPACE)

SYSTEM PAGE FRAME TABLE (PHYSICAL PAGES)

PAGE #	STATUS
0	OWNED BY A
1	OWNED BY B
2	OWNED BY C
3	OWNED BY B
4	OWNED BY A
5	FREE
6	OWNED BY A
7	OWNED BY C
8	OWNED BY C
9	OWNED BY A
10	OP SYS
11	OP SYS
12	OP SYS
13	OP SYS
14	OP SYS
15	OP SYS

PAGE TABLE FOR PROCESS A

FRAME # (BASE 2)	VALID BIT
NONE	0
NONE	0
NONE	0
0000	1
NONE	0
0110	1
NONE	0
1001	1
NONE	0
NONE	0
0100	1
NONE	0
NONE	0
NONE	0
NONE	0
NONE	0

CPU

PC(BASE 2) 101010010110

IR(BASE 2) JUMP 111011011011

Credits: These problems were developed by Prof. Moloney, UML CS Dept.