Homework #6 **M1522.000800 System Programming**

Name: _____

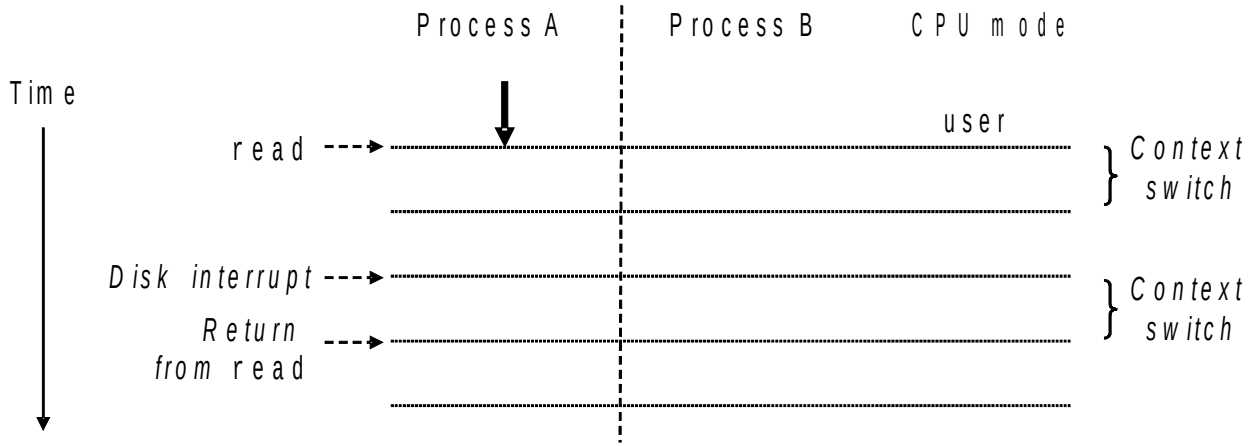
Due Date: Tuesday, April 14, 2015, 23:59 **Student-Number:** _____

Submission: in paper form.
There is a drop off box in class and inside the CSAP Lab in building 301, room 419.

Question 1

Concurrently Running Processes

Modern operating systems provide *time-shared* multitasking. In time-shared multitasking, one CPU is shared among several processes. In the following diagram, draw the control flow and write down in which mode the CPU is running.



Question 2

Implementation of Linux/IA32 System Calls

The following table shows some of the system calls used in Linux/IA32.

%eax	Name	%ebx	%ecx	%edx
1	sys_exit	int		
2	sys_fork	struct pt_regs		
3	sys_read	unsigned int	char*	size_t
4	sys_write	unsigned int	const char*	size_t
5	sys_open	const char*	int	int
6	sys_close	unsigned int		

Consider the following program, which consists of system calls without wrappers in Linux.

```
/* myhello.c */
int main()
{
    int len;
    char buf[10];
    my_write(1, “What is your student id? :\n”, 27);
    len = my_read(2, buf, 10);
    my_write(1, “SID : “, 6);
    my_write(1, buf, len);
    my_exit(0);
}
```

When you compile and execute the above code, it will produce the following result.

```
$ gcc -o my_hello -m32 myhello.c mylib.s
$ ./my_hello
What is your student id? :
2015-12345
SID : 2015-12345
$
```

Write the assembly program that supports the above result. (follow calling conventions)

```
# mylib.s
.section .text
.globl my_write
.globl my_read
.globl my_exit



# void my_write(unsigned int fd,
                const char *string,
                size_t length);
my_write:
```

```
# void my_read(unsigned int fd,
                char *buffer,
                size_t length);
my_read:









# void my_exit(int nr);
my_exit:
```

Question 3

Virtual Memory Address Spaces

Complete the following table, filling in the missing entries and replacing each question mark with the appropriate integer. Use the following units: *K = 2^{10} (Kilo), M = 2^{20} (Mega), G = 2^{30} (Giga), T = 2^{40} (Tera), P = 2^{50} (Peta), or E = 2^{60} (Exa).*

# virtual address bits (n)	# virtual address (N)	Largest possible virtual address
8		
	$2^{?}$ = 64K	
		$2^{32} - 1$ = ?G - 1
	$2^{?}$ = 256T	
64		

Question 4

Address Translation

Given a 32-bit virtual address space and a 24-bit physical address, determine the number of bits in the *virtual page number (VPN), virtual page offset (VPO), physical page number (PPN), physical page offset (PPO)* for the following page sizes *P*:

P	# VPN bits	# VPO bits	# PPN bits	# PPO bits
1 KB				
2 KB				
4 KB				
8 KB				