SYSTEM PROGRAMMING MIDTERM **November 06, 2007**

100 minutes

1. *(40 pts)* Consider the following C function that recursively computes the greatest common divisor of two unsigned numbers (assuming $a > 0$ and $b \geq 0$):

```
unsigned int gcd(unsigned int a, unsigned int b)
{
    if (b == 0)
        return a;
    else
        return gcd(b, a%b);
}
```

   (a) Write the assembly equivalent of this function in NASM format.

   (b) Explain how this function works when it is called as $gcd(24, 18)$ by showing the contents of the stack at each step.

2. *(30 pts)* Briefly answer the following questions:

   (a) What are the differences between linkable, executable and loadable object files?

   (b) List the major differences between the aout and ELF object file formats.

3. *(30 pts)* For each of I/O scenarios given below, would you design the operating system to use buffering, spooling, caching, or a combination? Would you use polled I/O or interrupt-driven I/O? Give reasons for your choices.

   (a) A mouse used with graphical user interface.

   (b) A tape drive on a multi-tasking operating system (assume no device reservation is available).

   (c) A disk drive containing user files.