SYSTEM PROGRAMMING MIDTERM EXAM **October 28, 2008**

CRN	Id	Name	Signature

100 minutes

Q1a	Q1b	Q1c	Q2	Q3a	Q3b	Q3c	Total
/20	/20	/15	/20	/10	/10	/5	/100

1. Consider the following two pieces of code which could be part of a C-language implementation of the A5 encryption algorithm:

```
int threshold(unsigned int r1,
              unsigned int r2,
              unsigned int r3)
{
    int total;

    total = (((r1 >>  9) & 0x1) == 1) +
            (((r2 >> 11) & 0x1) == 1) +
            (((r3 >> 11) & 0x1) == 1);
    if (total > 1)
        return 0;
    else
        return 1;
}
```

```
void main(void)
{
    char k0=1, k1=2, k2=3, k3=4,
         k4=5, k5=6, k6=7, k7=8;
    int r3;
    ...
    r3 = k5 << 15 | k6 << 8 | k7;
    ...
}
```

   (a) *ANSWER THIS QUESTION ON THE FRONT SIDE OF THE SECOND PAPER.* Write the Assembly equivalent of the *threshold* function in NASM format.

   (b) What does the *threshold* function do? What is its purpose in the A5 encryption mechanism?

   (c) Write the Inline Assembly equivalent of the `r3=...` assignment statement in the *main* function.

2. Linkers and loaders perform several related but conceptually separate actions. In the past there have been all-in-one linking loaders which performed all the functions. What are the underlying reasons which motivated the separation of linkers and loaders?

3. From the text: “The design of an object format is a compromise driven by the various uses to which an object file is put.”

   (a) List the "various uses" for object files.

   (b) Which information should each type of object file contain? Briefly explain each.

   (c) List three commonly used object file formats you know.