CS 304 Homework 5 October 1, 2007

Due: 9AM, Wednesday, **October 17** in class 10 points total

**Please show your answers (and all work) on these two sheets**. Fold your paper the long way and write **your name** and **Homework 5** on the outside.

1. (1 point) Consider the following C functions and assembly code:

```
int fun1(int a, int b)
{
    return (a == b) ? b : a;
}

int fun2(int a, int b)
{
    unsigned int c = b;
    if (a <= c)
        return a;
    else
        return c;
}

int fun3(int a, int b)
{
    if (b > a)
        return b;
    else
        return a;
}
```

```
        pushl    %ebp
        movl     %esp, %ebp
        movl     8(%ebp), %edx
        movl     12(%ebp), %eax
        cmpl     %edx, %eax
        jge      .L8
        movl     %edx, %eax
.L8:
        popl     %ebp
        ret
```

Which of the functions compiled into the assembly code shown? **answer⇒**

2. (1 point) Consider the following C functions and assembly code:

```
int fun4(int a)
{
    return a * 17;
}

int fun5(int a)
{
    return a * 58;
}

int fun6(int a)
{
    return a * 27;
}
```

```
        pushl    %ebp
        movl     %esp, %ebp
        movl     8(%ebp), %eax
        leal     (%eax,%eax,2), %eax
        leal     (%eax,%eax,8), %eax
        popl     %ebp
        ret
```

Which of the functions compiled into the assembly code shown? **answer⇒**

3. (5 points) Consider the following assembly code for a C `while` loop:

```
loop:
        pushl        %ebp
        movl        %esp, %ebp
        movl        8(%ebp), %edx
        movl        12(%ebp), %ecx
        movl        $4, %eax
        cmpl        %ecx, %edx
        jge        .L4
        movl        $4, %eax
.L5:
        addl        %edx, %eax
        addl        $1, %edx
        cmpl        %ecx, %edx
        jne        .L5
.L4:
        popl        %ebp
        ret
```

Based on the assembly code above, fill in the blanks below in its corresponding C source code. (Note: you may only use the symbolic variables `i`, `x`, `y`, and `r` in your expressions below — *do not use register names.*)

```
int loop(int x, int y)
{
  int i;
  int r = _________________________;

    for (i=__________; ____________________________; ___________) {


         ______________________________________________;

   }

   return r;

}
```

4. (3 points) Each of the assembler routines on the left were created by applying `gcc -S -O` to a C source program. Match each assembler routines on the left with the equivalent C function on the right.

```
fun7:
        pushl    %ebp
        movl     %esp, %ebp
        movl     8(%ebp), %eax
        shrl     $31, %eax
        popl     %ebp
        ret

fun8:
        pushl    %ebp
        movl     %esp, %ebp
        movl     $0, %eax
        popl     %ebp
        ret

fun9:
        pushl    %ebp
        movl     %esp, %ebp
        movl     8(%ebp), %eax
        sall     $31, %eax
        sarl     $31, %eax
        popl     %ebp
        ret
```

```
int choice1(int x)
{
   return (x>>31)<<31;
}

int choice2(int x)
{
   return x>>31;
}

int choice3 (int x)
{
        unsigned u=x;
   return (x<<31)>>31;
}

int choice4(int x)
{
   return (x < 0U);
}

int choice5(int x)
{
   return x<<31;
}

int choice6(int x)
{
   return (x < 0);
}
```

**Fill in your answers here:** (enter "none" if no choices match)

fun7 corresponds to choice _____.

fun8 corresponds to choice _____.

fun9 corresponds to choice _____.