16.317: Microprocessor Systems Design I

Fall 2013

Homework 4

Due **Wednesday, 3/26/14**

Notes:

- While typed solutions are preferred, handwritten solutions to these problems are acceptable.
- Any handwritten solutions that are scanned and submitted electronically must be clearly legible and combined into a single file—simply sending a picture of each scanned page is not an acceptable form of submission.
- This assignment is worth a total of 50 points.

1. *(20 points)* Write the following subroutine in x86 assembly:

```
int f(int v1, int v2, int v3) {
   int x = v1 + v2;
   return (x + v3) * (x – v3);
}
```

Recall that:

- Subroutine arguments are passed on the stack, and can be accessed within the body of the subroutine starting at address EBP+8.
- At the start of each subroutine:
  i. Save EBP on the stack
  ii. Copy the current value of the stack pointer (ESP) to EBP
  iii. Create space within the stack for each local variable by subtracting the appropriate value from ESP. For example, if your function uses four integer local variables, each of which contains four bytes, subtract 16 from ESP.
  iv. Local variables can then be accessed starting at the address EBP-4.
- A subroutine's return value is typically stored in EAX.

See Lectures 15-18 for more details on subroutines, the x86 architecture, and the conversion from high-level concepts to low-level assembly.

2. *(30 points)* Write the following subroutine in x86 assembly:

```
int fib(int n)
```

Given a single integer argument, `n`, return the `n`th value of the Fibonacci sequence—a sequence in which each value is the sum of the previous two values. The first 15 values are shown below—note that the first value is returned if n is 0, not 1.

n	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
fib(n)	0	1	1	2	3	5	8	13	21	34	55	89	144	233	377