ELEC6027: VLSI Design Project
Part 1: Microprocessor Research
Topic: Subroutines

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The assembler held in listing 1 and 2 is written for the Intel 8086 microprocessor. A basic example of how stack frames are built to pass parameters to and from a subroutine. The main program in listing 1 loads two immediate values into registers then begins building a stack frame by pushing them to the stack. Calling the procedure to act upon the arguments passed via the stack and finally destroying the stack frame by popping data, including any return arguments, into registers.

Listing 1: Caller.asm

```
main:           ; Main loop
   mov  ax,42   ; Load arg1
   mov  bx,69   ; Load arg2
   push ax      ; Push arg1 to stack
   push bx      ; Push arg2 to stack
   call adder   ; Call the subroutine
   pop  ax      ; Dummy pop from arg2 spot
   pop  ax      ; Result pop from arg1 spot
   jmp main
```

When the subroutine, in listing 2, is called the return address is pushed onto by using the *call* instruction. This will be

Listing 2: Callee.asm

```
adder proc      ; Subroutine
   push bp      ; Push base ptr to stack
   mov  bp,sp   ; Set base ptr to stack ptr
   add  bp,4    ; Move to arg2 in stack
   mov  ax,[bp] ; Load into working reg
   add  bp,2    ; Move to arg1 in stack
   add  ax,[bp] ; Add to contents of working reg
   mov  [bp],ax ; Replace arg1 with result
   pop  bp      ; Restore base ptr
   ret
adder endp
```

This code was tested upon an 8086 emulator [1]. The emulator provides a complete overview of the flow of data within the processor, including the stack.

3 Conclusion

References

[1] Daniel B. Sedory, Randall Hyde, Eric Isaacson, Barry Allyn, Tomasz Grysztar, Saul Coval, Bob Brodt, Jordan Russell, and Jeremy Gordonii. emu8086. `http://www.emu8086.com/`, 2013. Online. Acessed Feb 2014.

Bibliography

[1] Leslie Lamport, *LaTeX: A Document Preparation System*. Addison Wesley, Massachusetts, 2nd Edition, 1994.