

CSCI-GA.3033-016  
**Virtual Machines: Concepts and Applications**  
**Homework Assignment 4**

Given the following assembly code (the same assembly you used in hw2 and hw3):

```
comp:
    push eax
    push ecx
    push ebp
    mov ebp, esp
    mov ebx, 1
    cmp eax, 1
    jle end
    mov ecx, eax
    dec eax
    call comp
    mul ebx, ecx
end:
    pop ebp
    pop ecx
    pop eax
    ret

start:
    mov eax, 0
loop: inc eax
      call comp
      cmp eax, 3
      jl loop
```

1. Determine the static basic blocks
2. Determine the dynamic basic blocks
3. Is the first instruction in each static basic block unique?
4. Is the first instruction in each dynamic basic block unique?
5. Are all the instructions inside a static basic block unique (i.e. do not appear in any other static BB)?
6. Are all the instructions a dynamic basic block unique?
7. Draw the control flow graph using static basic blocks.
8. Draw control flow graph of dynamic basic blocks and annotate edges and nodes with frequency.
9. Can we annotate the CFG in #7 with frequencies in the same way as we did in #8? If yes, what did we gain from using dynamic BB in translation then? If not, why not?