

x86 (Part 1)

For the following assembly code:

```
1  loop:
2    movl    %esi, %ecx
3    movl    $1, %edx
4    movl    $0, %eax
5    jmp     .L2
6  .L3:
7    movq    %rdi, %r8
8    andq    %rdx, %r8
9    orq     %r8, %rax
10   salq    %cl, %rdx
11  .L2:
12   testq   %rdx, %rdx
13   jne     .L3
14   rep; ret                                // ignore rep, it's not important
here
```

1. Construct its control flow diagram:

2. Answer the following questions:

a. Which registers hold program values `x`, `n`, `result`, and `mask`?

b. What are the initial values of `result` and `mask`?

c. What is the test condition for `mask`?

d. How does `mask` get updated?

e. How does `result` get updated?

3. Fill in the C code generated by compiling the above assembly code:

```
1  long loop(long x, int n)
2  {
3      long result = _____;
4      long mask;
5      for (mask = _____; mask _____; mask = _____)
6          {
7              result |= _____;
8          }
9      return result;
10 }
```

(Adapted from *Computer Systems: A Programmer's Perspective*, 3rd ed, Problem 3.60.)

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