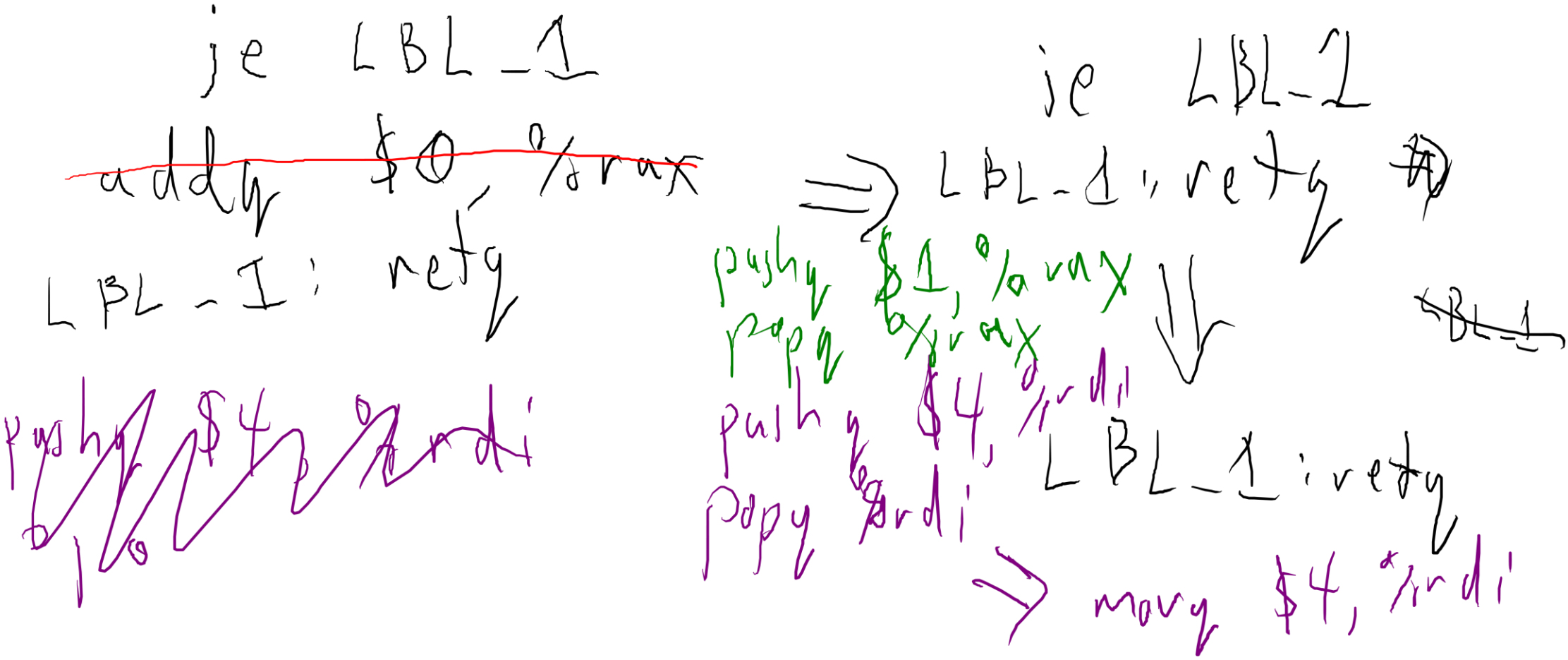
Check-in #33

Give an example of a snippet of x64 code that benefits from two peephole optimizations



Flipped Wednesday

Quiz 3

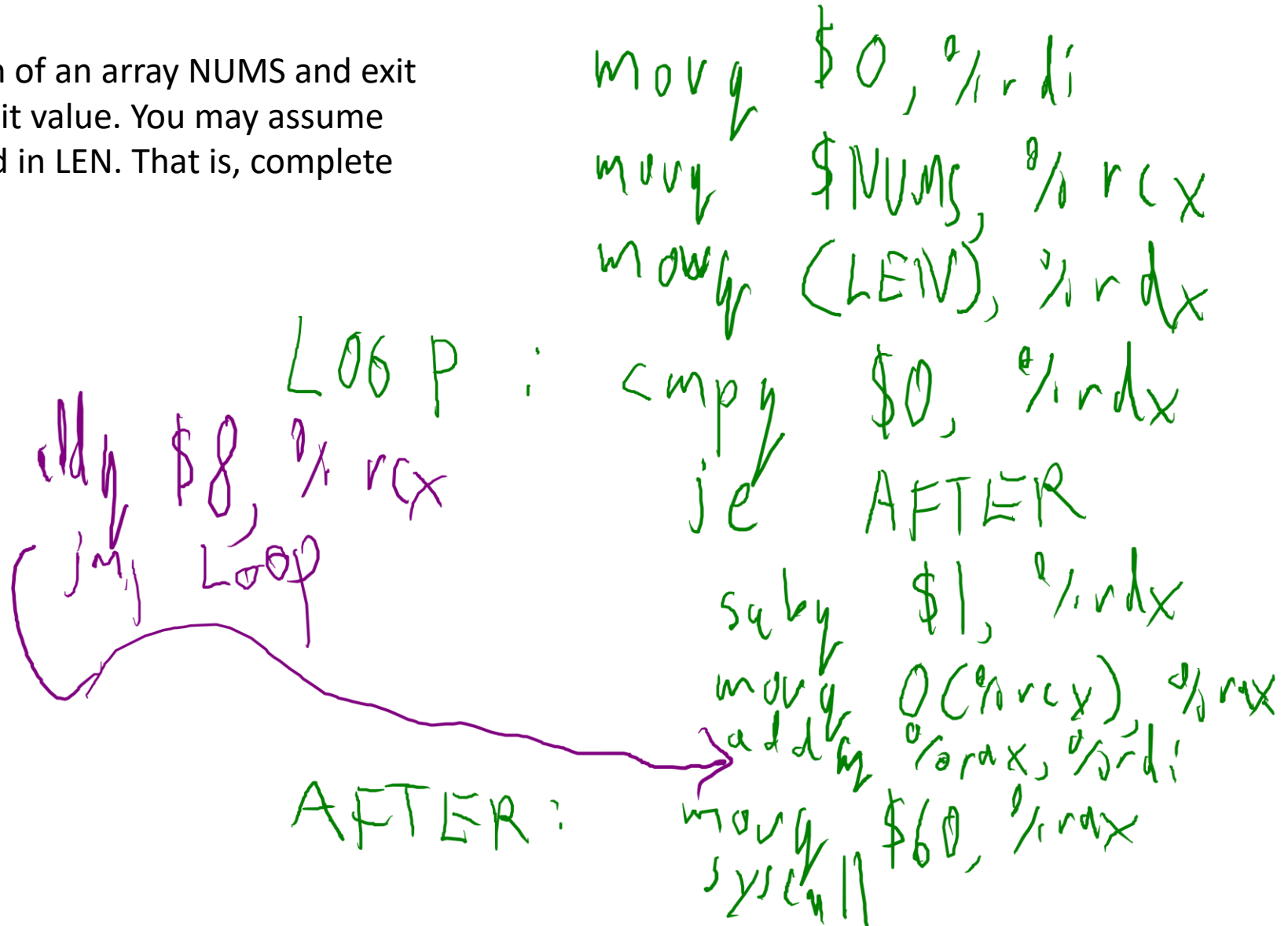
Quiz 3 – Question 1

Many compilers, including levic, uses multiple intermediate representations. Describe why each of these IRs are used.

Quiz 3 – Question 2

Write x64 code to compute the sum of an array NUMS and exit the program with the sum as the exit value. You may assume that the length of the array is stored in LEN. That is, complete the following assembly program:

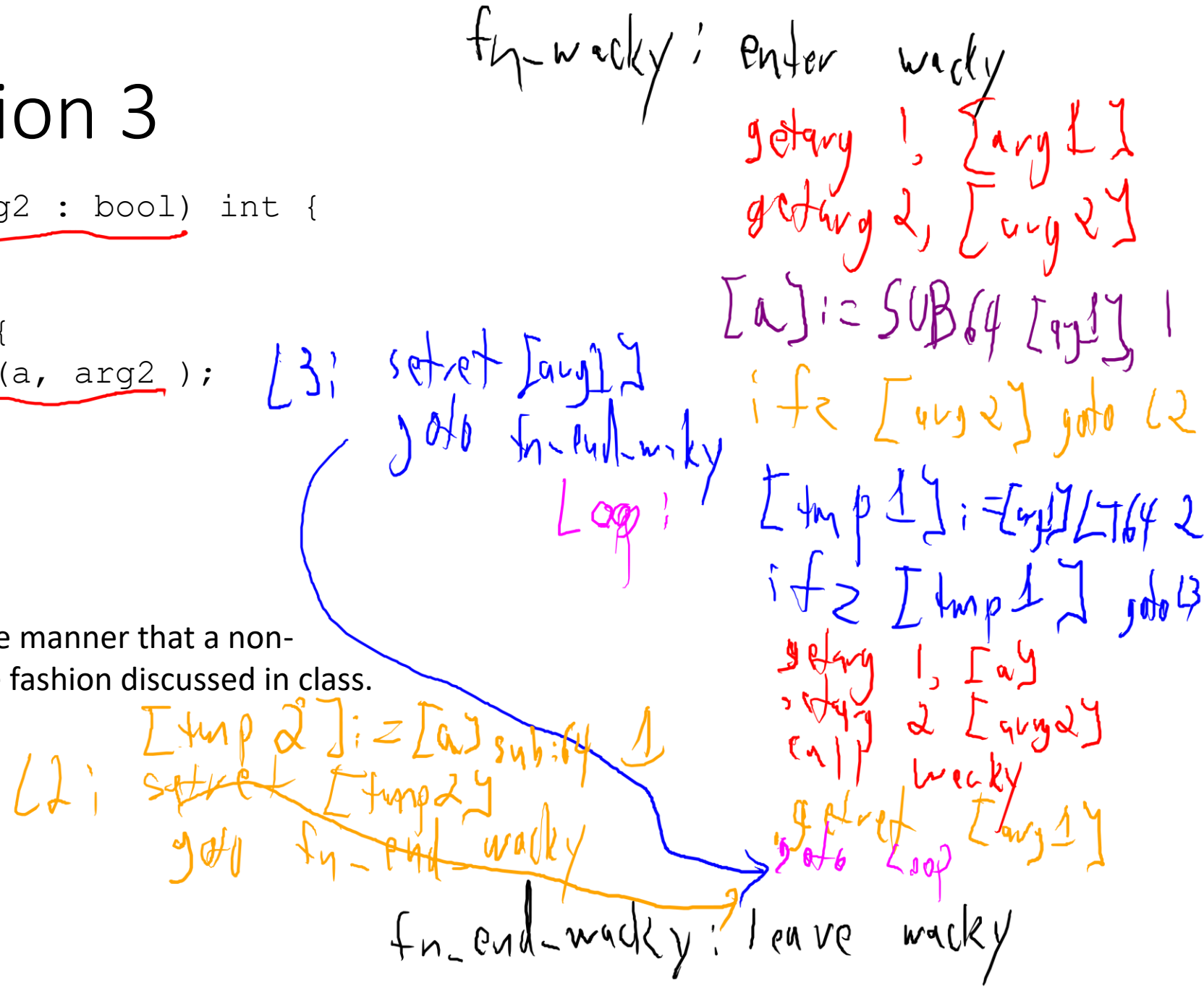
```
.globl _start
.data
NUMS: .quad 6, 3, 2, ...
LEN: .quad ?
.text
_start :
( your code here)
```



Quiz 3 – Question 3

```
wacky : (arg1 : int , arg2 : bool) int {
    a : int = arg1 - 1;
    if (arg2){
        while (arg1 < 2){
            arg1 = wacky(a, arg2 );
        }
    L3: return arg1 ;
    }
    return a - 1;
}
```

Convert the above code to 3AC in the manner that a non-optimizing compiler would do, in the fashion discussed in class.



Quiz 3 – Question 4

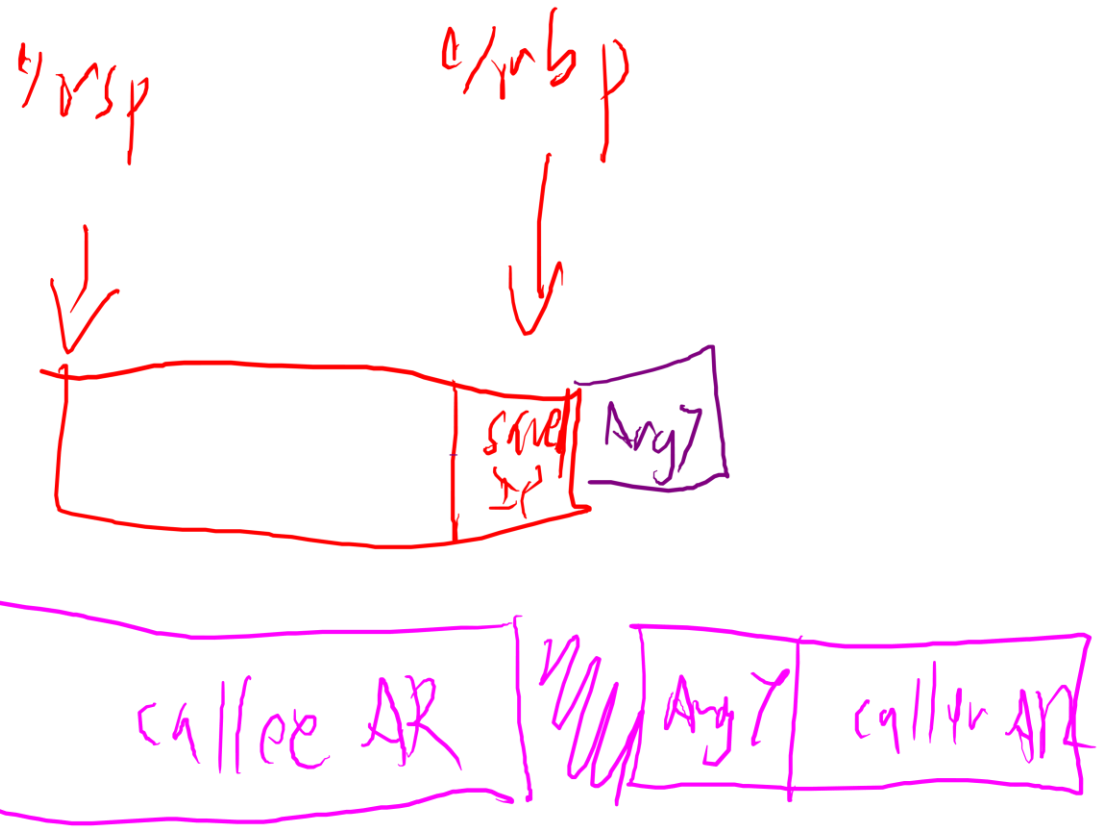
What is a runtime environment?

What is the runtime environment for the Levi language?

Quiz 3 – Question 5

Imagine the following code is intended to represent an x64 function call. It violates the System V ABI in (at least two ways). Point out two violations

```
movq $20, %rdi          # set argument 1
movq $30, %rsi          # set argument 2
movq $40, %rdx          # set argument 3
movq $50, %rcx          # set argument 4
movq $90, %r8           # set argument 5
movq $12, %r9           # set argument 6
pushq $276              # set argument 7
callq my_callee         # make the call
movq %rbx, -32(%rbp)    # retrieve the return
nop                     #(end of the call)
```



W7 – Question 2

Convert the following function into 3AC

```
int v(int a){
    while (a < 2){
        while (a < 3){
            a++;
        }
        a++;
    }
    return a;
}
```

```
 fn_v: enter v
       getarg 1, [a]
LBL_1: [tmp1] := [a] LT64 2
       ifz [tmp1] goto LBL_2
LBL_3: [tmp2] := [a] LT64 3
       ifz [tmp2] goto LBL_4
       [a] := [a] ADD64 1
       goto LBL_3
LBL_4: nop
       [a] := [a] ADD64 1
LBL_2: nop
       setret [a]
       goto end_fn_v
end_fn_a: leave v
```

W7 – Question 3

Convert the 3AC procedure into source code

```
    fn_k: enter k
          getarg 1, [b]
          [i] = [b]
  lbl_1: [t] = [i] LT64 10
          ifz [t] goto lbl_2
          [i] = [i] ADD64 1
          WRITE [i]
          goto lbl_1
  lbl_2: nop
fn_end_k: leave k
```

```
k : (b : int) void {
  i : int;
  i = b;
  while (i < 10){
      i++;
      out << I;
  }
}
```

W7 – Question 4

Assume a language that allows for pass-by-reference or pass-by-value parameters. What would the 3AC code look like for a pass-by-reference call? Illustrate with an example.

Don't use the brackets around the variable (which indicate a memory lookup) in the generated setarg / getarg

```
void foo(int& arg){
    arg = 3;
}

int main(){
    int p;
    foo(p);
}
```

```
    fn_foo: enter foo
            getarg 1, arg
end_fn_foo: leave foo

   fn_main: enter main
            setarg 1, p
end_fn_main: leave main
```