Exercise 6

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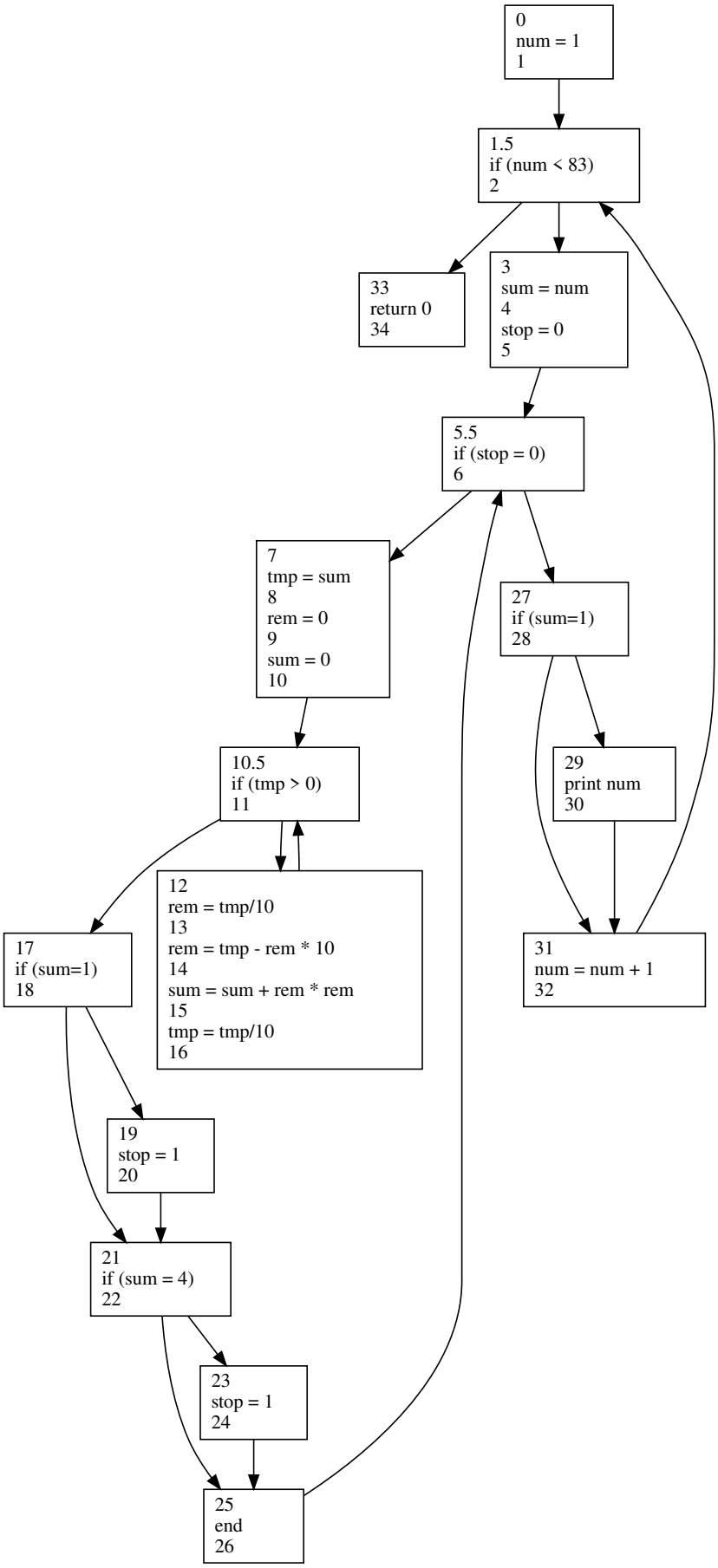
1.1 Control flow graph



1.2 Reaching definitions

Let

d1: num = 1
d2: sum = num
d3: stop = 0
d4: tmp = sum
d5: rem = 0
d6: sum = 0
d7: rem = tmp/10
d8: rem = tmp - rem * 10
d9: sum = sum + rem * rem
d10: tmp = tmp/10
d11: stop = 1
d12: num = num + 1

Then the data flow equations are given by:

L0 = {}
L1 = L0 - d12 + d1
L1.5 = L1 U L32
L2 = L1.5
L3 = L2
L4 = L3 - (d6, d9) + d2
L5 = L4 - d11 + d3
L5.5 = L5 U L26
L6 = L5.5
L7 = L6
L8 = L7 - d10 + d4
L9 = L8 - (d7, d8) + d5
L10 = L9 - (d2, d9) + d6
L10.5 = L10 U L16
L11 = L10.5
L12 = L11
L13 = L12 - (d5, d8) + d7
L14 = L13 - (d5, d7) + d8
L15 = L14 - (d2, d6) + d9
L16 = l15 - d4 + d10
L17 = L11
L18 = L17
L19 = L18
L20 = L19 - d3 + d11
L21 = L18 U L20
L22 = L21
L23 = L22
L24 = L23 - d3 + d11
L25 = L22 U L24
L26 = L25
L27 = L6
L28 = L27
L29 = L28
L30 = L29
L31 = L28 U L30
L32 = L31 - d1 + d12
L33 = L2
L34 = L33

The solutions to the equations are:

L0 = {}
L1 = {d1}
L1.5 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L2 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L3 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L4 = {d1,d2,d3,d4,d5,d8,d10,d11,d12}
L5 = {d1,d2,d3,d4,d5,d8,d10,d12}
L5.5 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L6 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L7 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L8 = {d1,d2,d3,d4,d5,d6,d8,d9,d11,d12}
L9 = {d1,d2,d3,d4,d5,d6,d9,d11,d12}
L10 = {d1,d3,d4,d5,d6,d11,d12}
L10.5 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L11 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L12 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L13 = {d1,d3,d4,d6,d7,d9,d10,d11,d12}
L14 = {d1,d3,d4,d6,d8,d9,d10,d11,d12}
L15 = {d1,d3,d4,d8,d9,d10,d11,d12}
L16 = {d1,d3,d8,d9,d10,d11,d12}
L17 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L18 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L19 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L20 = {d1,d4,d5,d6,d8,d9,d10,d11,d12}
L21 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L22 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L23 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L24 = {d1,d4,d5,d6,d8,d9,d10,d11,d12}
L25 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L26 = {d1,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L27 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L28 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L29 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L30 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L31 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L32 = {d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L33 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}
L34 = {d1,d2,d3,d4,d5,d6,d8,d9,d10,d11,d12}

(Maybe a smaller graph would've been sufficient for this exercise)