1a. The program loads the value 11 into R4, and executes the loop while R4 remains non-negative. In each execution of the loop, R4 is decremented by 3.
1b. 4 times.

2a. The program loads the value x0803 into R1, and executes the loop while R1 is positive. In each execution of the loop, 4 is added to R2. The net effect is multiplying x0803 by x0004.
2b. x200C = #8204.
2c.

// Symbol Name                  Page Address
// DONE                        3007
// LOOP                        3003
// M0                          300B
// M1                          300C
// RESULT                      3009
// ZERO                        300A

3a. The loop must terminate when R2 reaches 0. But the instruction "ADD R3,R3,R3" changes the condition code so the branch is not correctly taken.
3b. Switch the instructions in the following manner:

From:

LOOP BRz DONE
ADD R2, R2, # -1
ADD R3, R3, R3
BR LOOP
to:

LOOP BRz DONE

ADD R3, R3, R3

ADD R2, R2, #1

BR LOOP

4a.
4b.

(a) LDR R3, R1, #0
(b) NOT R4, R4
(c) ADD R4, R4, #1

4c.

R1 ← x4000
R2 ← x4100

R3 ← M[R1]

Is R3 = 0
Yes
No

R4 ← M[R2]

Is R4 = 0
Yes
No

R1 ← R1 + 1
R2 ← R2 + 1
R3 ← R3 - R4

Is R3 = 0
Yes
No

R5 ← 0
HALT
.ORIG x3000

    LD R1, FIRST
    LD R2, SECOND

LOOP      LDR R3, R1, #0
          BRz S1ZERO
          ; first string not ended
          LDR R4, R2, #0
          BRz DIFF
          ; both strings not ended
          ADD R1, R1, #1
          ADD R2, R2, #1
          NOT R4, R4
          ADD R4, R4, #1
          ADD R3, R3, R4
          BRz LOOP
          ; this is executed if both strings are different

DIFF      AND R5, R5, #0
          ADD R5, R5, #1
          BRnzp DONE

          ; this is executed if both strings are the same

SAME      AND R5, R5, #0
BRnzp DONE

; this is executed if first string has ended
S1ZERO LDR R4, R2, #0
BRz SAME
BRnzp DIFF

DONE TRAP x25
FIRST .FILL x4000
SECOND .FILL x4100
.END

5.
.orig x3000
LDI R1, X
LDI R2, Y
NOT R2, R2
ADD R2, R2, #1
AND R3, R3, #0

LOOP ADD R1, R1, R2
BRn DONE
ADD R3, R3, #1
BR LOOP
DONE  HALT

X       .fill x3200
Y       .fill x3201
.end