1. When this program finally halts, R1 will have the value of $2^x$

2. Program:
   1: Load R1 ← N
   2: Load R2 ← 0000
   3: Load R0 ← 0002
   4: Add R2 ← R2 + R1
   5: Sub R1 ← R1 - R0
   6: Jump to 4 if (R1 > 0)
   7: halt

3. a) 1: Load R1 ← N
   2: Load R2 ← K
   3: Add R2 ← R2 + R1
   4: If (R1 > 0), Jump to 3 and decrease R1
   5: halt

   b) 10 load R1 = 6
   11 load R2 = 1
   12 load R3 = 0  (will be answer)
   13 add R3 ← R3 + R1
   14 sub R1 ← R1 - R2
   15 jump 19 if R1 > 0
   16 halt
   17 mul R3 ← R3 * R1
   18 jump 14

   c) same as b) but ...

   "10 load R1 = N"
3) d) insert some code to check before the loop really gets going.

13 Load R4 = 8
14 Load RS = 0
15 Sub RS ← R4 - R1
16 Temp 18 if RS > 0
17 Load R1 = 8
18 (rest of original program here)
sub Sum(H, A, N, S)
Dim X as Integer
X = 1
S = H
Do while (N > 1)
S = S + (H + X * A)
X = X + 1
N = N - 1
Loop
4a)

Sub SeqSum(K, A, N, S)
    Dim i as Integer
    If N == 0 then S = 0
    Else
        S = K
        i = 0
        While (i < n) Do
            S = S + (K + i*A)
            i = i + 1
        End While
    End If
End sub

Note: There is also a better way of doing this. If you notice, the series you are trying to add up is a arithmetic series and we know the sum of the series is given by:

S = N*K + (N*(N-1)*A)/2

In this case, the procedure will look like –

Sub SeqSum(K,A,N,S)
    S = N*K + (N*(N-1)*A)/2
End Sub
4b) // program declarations
   Dim N, S as interger
   // code here to get input from user for N and S
   SeqSum(2,2,N,S)
   Print(s)

   Similarly, the program for 3a part will involve taking input from
   user for K and N and then calling:
   SeqSum(K,1,N,S)

4c) Some of the possibilities (taken from submissions):

   If the machine code is generated while the program is running,
   the corrected load instructions can be generated with the correct
   parameters.

   The code can be generated so that the parameter values are
   always loaded using load reg ← mem[fixed_location] and the
   parameters values are placed in the fixed_location memory
   location before the procedure gets called.

Note: In real systems, neither of these schemes are used.

Note2: Some of the submissions were very vague but were still
given full credit.