1.   The following is an incomplete MARIE program for summing the integer sequence 1 to 100 (similar to what is done in assignment 3). Three   of   the instructions (shown in underline) are missing.

```
        S1,     Load    Count
                Add     One
                Store   Count
                Subt    N
                Skipcond 800
                Jump    S2
                Load    Sum
                Add     Count
                Store   Sum
                Jump    S1
        S2,     Halt
        N,      Dec     100
        One,    Dec     1
        Count,  Dec     0
        Sum,    Dec     0
```

[4 marks] (a)   Fill in the three missing instructions in the underlined space in the above program.

[2 marks] (b)   The total number of symbolic addresses in the given program is ___6____. If S1 corresponds to memory location 0, then S2 will correspond to memory location _____10____.

[4 marks] (c)   Fill in the missing information (shown in shaded entries) in the following fetch-decode-execute cycle of the instruction Load Count in the program (when the program starts execution). Contents of register are expressed in hexadecimal. [Hint: the opcode of Load is equal to 1.]

Step	RTN	PC	IR	MAR	MBR	AC
initial value		000	----	---	----	----
Fetch	MAR ← PC			000		
	IR ← M[MAR]		100D			
	PC ← PC+1	001				
Decode	(Decode IR[15-12])					
	MAR ← IR[11-0]			00D		
Get operand	MBR ← M[MAR]				0000	
Execute	AC ← MBR					0000

[2 marks] (d)   The instruction jumpI in MARIE is useful in programming in situations such as when the target address of the jump instruction will be changed during program execution, for example, in subroutine calls via the JNS instruction.