

### Part 7.1

7.1.1/ Value "0x00000065 " appeared , this is due to the number 101 changing the memory from a decimal to a hex.

7.1.2/ Value "0x00000101" appeared, this is due to the 0x101 value is already a hex therefore no value was converted

7.1.3/ Value "0x00000005" appeared, this is due to the 0b101 changing the value from decimal to hex

The tooltip shows the binary follow by the decimal form of the value which should be default set to hex

If we change the default from hex to decimal (unsigned) , the toolship will show binary and hex.

7.1.4/ No, it will not change when you change the representation of the data.

### Part 7.2

7.2.1/ These column header memory address offsets go up in multiples of 0x4 because there are 4 bits in each memory word.

### Part 7.3.

### 7.3.1/

The screenshot displays the ARMLite Simulator V1.2.4 interface. The 'Program' pane on the left contains assembly code with line numbers 1 to 40. The 'Processor' pane in the center shows registers R0-R15, PC, SP, and status bits (NZCV). The 'Memory' pane on the right shows a hex dump of memory addresses from 0x00000000 to 0x0000001f. The 'Input/Output' pane at the bottom is empty. The status bar at the bottom indicates 'Program assembled. Run or Step to execute'.

7.3.2/ When the submit button is toggled - the code (instruction set) is executed and saved into the memory. Even though the memory has been saved - the program will not execute as the RUN button has yet to be toggled.

### 7.3.3/

The pop-up tooltip's value presents the position of each code in the memory

When attempting to modify some part of the code , these events occur after hitting the SUBMIT button

- The extra lines added disappeared
- The additional space added before instruction disappeared
- Both comment lines stayed in place and turned green
- The line with the omitted comma turned red

### Part 7.4

7.4.1/ The highlighting in both windows signifies the line code which was being executed and the location in the memory in which the instruction has been stored.

7.4.2/ Upon toggling the red button , the next set of instructions is executed in the program.

7.4.3/ The processor paused just before executing the line at breakpoint

## Part 7.5

7.5.1/ Add r1,r0,#8: it will take the decimal value 8 and add it to the value in r0 and store the result in r1

### 7.5.2/

The screenshot displays the ARMLite Simulator V1.2.4 interface, which is divided into three main sections: Program, Processor, and Memory.

**Program Window:** Shows the assembly code being executed. The code is as follows:

```
1| MOV R0,#1
2| ADD R1,R0,#8
3| ADD R2,R1,#100
4| SUB R3,R2,#25
5| HALT
```

The second line, `ADD R1,R0,#8`, is highlighted in red, indicating it is the current instruction being executed.

**Processor Window:** Displays the state of the processor. The PC (Program Counter) is 1048576. The SP (Stack Pointer) is 0. The R0 register contains the value 1. The R1 register contains the value 9. The R2 register contains the value 101. The R3 register contains the value 76. The R4 register contains the value 0. The R5 register contains the value 0. The R6 register contains the value 0. The R7 register contains the value 0. The R8 register contains the value 0. The R9 register contains the value 0. The R10 register contains the value 0. The R11 register contains the value 0. The R12 register contains the value 0. The R13 register contains the value 0. The R14 register contains the value 0. The R15 register contains the value 0. The Count register contains the value 0. The Current Instruction register contains the value 0. The Status bits register contains the value 0000.

**Memory Window:** Displays the memory contents. The memory is organized into columns for different data types: 0x0, 0x4, 0x8, and 0xc. The memory addresses range from 0x0000 to 0x001f. The memory contents are as follows:

Address	0x0	0x4	0x8	0xc
0x0000	3818913793	3800043528	3800113252	3795988505
0x0001	3774873712	0	0	0
0x0002	0	0	0	0
0x0003	0	0	0	0
0x0004	0	0	0	0
0x0005	0	0	0	0
0x0006	0	0	0	0
0x0007	0	0	0	0
0x0008	0	0	0	0
0x0009	0	0	0	0
0x000a	0	0	0	0
0x000b	0	0	0	0
0x000c	0	0	0	0
0x000d	0	0	0	0
0x000e	0	0	0	0
0x000f	0	0	0	0
0x0010	0	0	0	0
0x0011	0	0	0	0
0x0012	0	0	0	0
0x0013	0	0	0	0
0x0014	0	0	0	0
0x0015	0	0	0	0
0x0016	0	0	0	0
0x0017	0	0	0	0
0x0018	0	0	0	0
0x0019	0	0	0	0
0x001a	0	0	0	0
0x001b	0	0	0	0
0x001c	0	0	0	0
0x001d	0	0	0	0
0x001e	0	0	0	0
0x001f	0	0	0	0

The memory address 0x0001 is highlighted in red, corresponding to the instruction being executed.

**Input/Output Window:** Displays the program assembly status: "Program assembled. Run or Step to execute".

**Buttons:** The interface includes buttons for "Load", "Save", "Edit", "Run", "Step", and "Clear".

**Footer:** The footer text reads "ARMLite Simulator V1.2.4 © Peter Higginson 2020-23" and includes a link to "Documentation".

### 7.5.3/

1

MOV R2, #300

2

ADD R3, R2, #92

3

ADD R4, R3, #18

4

SUB R5, R4, #64

5

SUB R6, R5, #21

6

ADD R7, R6, #5

7

HALT

PC

0

LR

0

SP

1048576

R12

0

R11

0

R10

0

R9

0

R8

0

R7

0

R6

0

R5

0

R4

0

R3

0

R2

0

R1

0

R0

0

Count

0

Current Instruction

Status bits

NZCV  
0000

Program assembled. Run or Step to execute

000

0x0

0x4

0x8

0xc

0x0000	3818925899	3800182876	3800252434	3796127808
0x0001	3796197397	3800461317	3774873712	0
0x0002	0	0	0	0
0x0003	0	0	0	0
0x0004	0	0	0	0
0x0005	0	0	0	0
0x0006	0	0	0	0
0x0007	0	0	0	0
0x0008	0	0	0	0
0x0009	0	0	0	0
0x000a	0	0	0	0
0x000b	0	0	0	0
0x000c	0	0	0	0
0x000d	0	0	0	0
0x000e	0	0	0	0
0x000f	0	0	0	0
0x0010	0	0	0	0
0x0011	0	0	0	0
0x0012	0	0	0	0
0x0013	0	0	0	0
0x0014	0	0	0	0
0x0015	0	0	0	0
0x0016	0	0	0	0
0x0017	0	0	0	0
0x0018	0	0	0	0
0x0019	0	0	0	0
0x001a	0	0	0	0
0x001b	0	0	0	0
0x001c	0	0	0	0
0x001d	0	0	0	0
0x001e	0	0	0	0
0x001f	0	0	0	0

Decimal (unsigned) ▼

Clear

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Load

Save

Edit

### 7.5.4/

Instruction	Decimal Value of the destination register after executing this instruction	Binary value of the destination register after executing this instruction
MOV R0, #1	1	0b00000000000000000000000000000001
AND R1, R0, #3	1	0b00000000000000000000000000000001
ORR R2, R1, #6	7	0b00000000000000000000000000000111



```

4| MOV R3, #5    ; Initialize R3 with 5
5| MOV R4, #3    ; Initialize R4 with 3
6| MOV R5, #2    ; Initialize R5 with 2
7| ADD R0, R0, R1 ; Add R1 to R0 (12 + 11) and store the result in R0
8| ORR R0, R0, R2 ; Bitwise OR R2 with R0 and store the result in R0
9| AND R0, R0, R3 ; Bitwise AND R3 with R0 and store the result in R0
10| ORR R0, R0, R4 ; Bitwise OR R4 with R0 and store the result in R0
11| AND R0, R0, R5 ; Bitwise AND R5 with R0 and store the result in R0
12| ADD R0, R0, #19 ; Add 19 to R0 and store the result in R0 (bit-wise equivalent of adding 19)
13| HALT        ; Halt the program

```

## 7.5.6

The screenshot shows the ARMLite Simulator V1.2.4 interface. The main window is divided into several sections:

- Program:** A list of assembly instructions with line numbers. The current instruction is line 13: `HALT ; Halt the program`.
- Processor:** A panel showing the state of the processor. It includes a list of registers (PC, LR, SP, R12, R11, R10, R9, R8, R7, R6, R5, R4, R3, R2, R1, R0) and their values. The PC is 52, LR is 0, SP is 1048576, and R0 is 4294967229. It also shows the current instruction (e1000070) and status bits (NZCV, 0000).
- Memory:** A panel showing a memory dump. It displays addresses in hexadecimal and their corresponding values in decimal. The address 3818913891 is highlighted.
- Input/Output:** A panel showing the status of the program. It indicates that the program has halted and provides options to stop, load, or edit the program.

The code

```

1| MOV R0, #99    ; Initialize R0 with 99

```

```

2| MOV R1, #77 ; Initialize R1 with 77
3| MOV R2, #33 ; Initialize R2 with 33
4| MOV R3, #31 ; Initialize R3 with 31
5| MOV R4, #14 ; Initialize R4 with 14
6| MOV R5, #12 ; Initialize R5 with 12
7| AND R0, R0, R1 ; Bitwise AND R0 with R1 (99 & 77) and store the result in R0
8| ORR R0, R0, R2 ; Bitwise OR R0 with R2 (result from previous step) and store the result in R0
9| AND R0, R0, R3 ; Bitwise AND R0 with R3 (result from previous step) and store the result in R0
10| AND R0, R0, R4 ; Bitwise AND R0 with R4 (result from previous step) and store the result in R0
11| AND R0, R0, R5 ; Bitwise AND R0 with R5 (result from previous step) and store the result in R0
12| SUB R0, R0, #67 ; Subtract 67 from R0 and store the result in R0 (bit-wise equivalent of subtracting 67)
13| HALT ; Halt the program

```

## Part 7.6

7.6.1/ The result in R1 is R0 (in binary) moved to the left by 18 bits

7.6.2/ Binary of 1 is 0b00000000000000000000000000000001

Binary of -1 is 0 b 11111111111111111111111111111111

Binary of 2 is 0b00000000000000000000000000000010

Binary of -2 is 0b11111111111111111111111111111110

### 7.6.3/

The screenshot shows the ARMLite Simulator V1.2 interface. On the left, the assembly code is displayed:

```

1: MOV R2, #0
2: MOV R0, #6
3: SUB R1, R2, R0
4: LSR R3, R1, #32
5: HALT

```

The processor status is shown as HALT. The register window displays the following values:

Register	Value
R0	0
R1	0
R2	0
R3	0
R4	0
R5	0
R6	0
R7	0
R8	0
R9	0
R10	0
R11	0
R12	0
SP	1040576
PC	0
LR	0
Count	0
Current Instruction	00000000
Status bits	NZCV 0000

The memory window shows the following values:

Address	Value
0x0000	-62605312
0x0001	-520053504
0x0002	0
0x0003	0
0x0004	0
0x0005	0
0x0006	0
0x0007	0
0x0008	0
0x0009	0
0x000a	0
0x000b	0
0x000c	0
0x000d	0
0x000e	0
0x000f	0
0x0010	0
0x0011	0
0x0012	0
0x0013	0
0x0014	0
0x0015	0
0x0016	0
0x0017	0
0x0018	0
0x0019	0
0x001a	0
0x001b	0
0x001c	0
0x001d	0
0x001e	0
0x001f	0

The input/output window shows the program status: Program HALTED. STOP, LOAD or EDIT.

Buttons: Load, Save, Edit.

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### 7.6.4/

The screenshot shows the ARMLite Simulator V1.2.4 interface. On the left, the assembly code is displayed:

```

1: MOV R1, R0 ; Copy the positive integer from R0 to R1
2: MVN R1, R1 ; Flip all the bits in R1 to get the negative version

```

The processor status is shown as Program assembled. Run or Step to execute. The register window displays the following values:

Register	Value
R0	0
R1	0
R2	0
R3	0
R4	0
R5	0
R6	0
R7	0
R8	0
R9	0
R10	0
R11	0
R12	0
SP	1048576
PC	0
LR	0
Count	0
Current Instruction	00000000
Status bits	NZCV 0000

The memory window shows the following values:

Address	Value
0x0000	3785363456
0x0001	0
0x0002	0
0x0003	0
0x0004	0
0x0005	0
0x0006	0
0x0007	0
0x0008	0
0x0009	0
0x000a	0
0x000b	0
0x000c	0
0x000d	0
0x000e	0
0x000f	0
0x0010	0
0x0011	0
0x0012	0
0x0013	0
0x0014	0
0x0015	0
0x0016	0
0x0017	0
0x0018	0
0x0019	0
0x001a	0
0x001b	0
0x001c	0
0x001d	0
0x001e	0
0x001f	0

The input/output window shows the program status: Program assembled. Run or Step to execute.

Buttons: Load, Save, Edit.

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