

## EXPERIMENT 3

### **Aim:**

Write a program in ARM Assembly language to copy consecutive words from source to destination in memory using:

- Multiple register transfer instructions
- Load and store instructions in a loop

**Tool used:** Keil uVision4

### **Theory:**

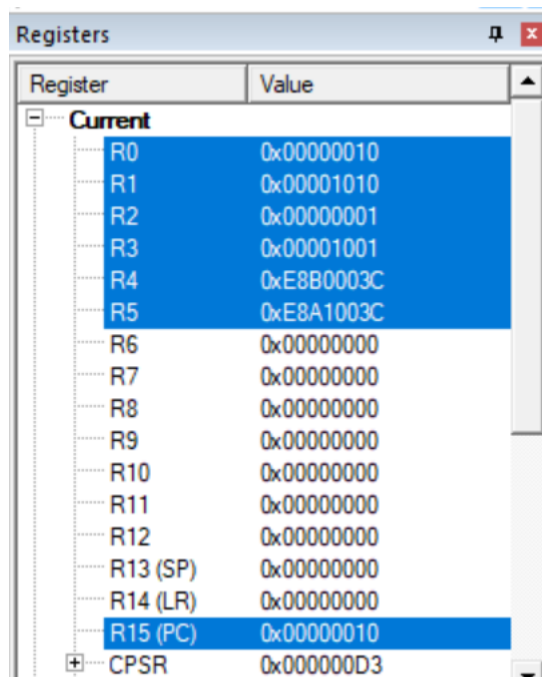
Here I have used LSL, LSR and ASR for shifting the bits. LSL is used for shifting the bits left and concatenate a 0 at the LSB. LSR is used for shifting the bits right and concatenate a 0 at the MSB. ASR is used to shift the bits right and concatenate the value of MSB at the new MSB

#### **a) Multiple register transfer instructions**

##### Code:

```
AREA PROGRAM, CODE, READONLY
ENTRY
MAIN
LDR R0,=0X00000000
LDR R1,=0X00001000
LDM R0!,{R2-R5}
STM R1!,{R2-R5}
END
```

##### Register Output:



Register	Value
<b>Current</b>	
R0	0x00000010
R1	0x00001010
R2	0x00000001
R3	0x00001001
R4	0xE8B0003C
R5	0xE8A1003C
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000010
CPSR	0x000000D3

Memory 1									
Address: 0x00000000									
0x00000000:	00	00	00	01	00	00	10	01	E8
0x00000009:	B0	00	3C	E8	A1	00	3C	00	00
0x00000012:	00	00	00	00	00	00	00	00	00
0x0000001B:	00	00	00	00	00	00	00	00	00
0x00000024:	00	00	00	00	00	00	00	00	00
0x0000002D:	00	00	00	00	00	00	00	00	00
0x00000036:	00	00	00	00	00	00	00	00	00
0x0000003F:	00	00	00	00	00	00	00	00	00

## Using IA, IB, DA, DB

### Code: IA

```

AREA PROGRAM, CODE, READONLY
ENTRY
MAIN
    LDR R0,=0x00001000
    LDR R1,=0x00001020
    LDMIA R0!,{R2-R5}
    STMIA R1!,{R2-R5}
END

```

### Register Output:

Registers	
Register	Value
<b>Current</b>	
R0	0x00001010
R1	0x00001030
R2	0x10203040
R3	0x50607080
R4	0x90000102
R5	0x03040506
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000014
CPSR	0x000000D3
SPSR	0x00000000

### Memory Mapping:

Memory 1													
Address: 0x00001000													
0x00001000:	10	20	30	40	50	60	70	80	90	00	01	02	
0x0000100C:	03	04	05	06	07	08	09	00	00	00	00	00	
0x00001018:	00	00	00	00	00	00	00	00	10	20	30	40	
0x00001024:	50	60	70	80	90	00	01	02	03	04	05	06	
0x00001030:	00	00	00	00	00	00	00	00	00	00	00	00	
0x0000103C:	00	00	00	00	00	00	00	00	00	00	00	00	
0x00001048:	00	00	00	00	00	00	00	00	00	00	00	00	
0x00001054:	00	00	00	00	00	00	00	00	00	00	00	00	
0x00001060:	00	00	00	00	00	00	00	00	00	00	00	00	

## Code: IB

AREA PROGRAM, CODE, READONLY

ENTRY

MAIN

LDR R0,=0x00001000

LDR R1,=0x00002000

LDMIB R0!,{R2-R5}

STMIB R1!,{R2-R5}

END

## Register Output:

Registers	
Register	Value
<b>Current</b>	
R0	0x00001010
R1	0x00001030
R2	0x50607080
R3	0x90000103
R4	0x02040506
R5	0x07080910
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000014
CPSR	0x000000D3
SPSR	0x00000000

Memory 1															
Address: 0X00001000															
0x00001000:	10	20	30	40	50	60	70	80	90	00	01	03			
0x0000100C:	02	04	05	06	07	08	09	10	00	00	00	00			
0x00001018:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001024:	50	60	70	80	90	00	01	03	02	04	05	06			
0x00001030:	07	08	09	10	00	00	00	00	00	00	00	00			
0x0000103C:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001048:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001054:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001060:	00	00	00	00	00	00	00	00	00	00	00	00			

## Code: DA

AREA PROGRAM, CODE, READONLY

ENTRY

MAIN

LDR R0,=0X00001000

LDR R1,=0X00001020

LDMDA R0!,{R2-R5}

STMDA R1!,{R2-R5}

END

## Register Output:

Registers	
Register	Value
<b>Current</b>	
R0	0x0000FF0
R1	0x00001010
R2	0x00000000
R3	0x00000000
R4	0x00000000
R5	0x10203040
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000014
CPSR	0x000000D3
SPSR	0x00000000

## Memory Mapping:

Memory 1															
Address: 0X00001000															
0x00001000:	10	20	30	40	50	60	70	80	90	00	01	02			
0x0000100C:	03	04	05	06	07	08	09	00	00	00	00	00			
0x00001018:	00	00	00	00	00	00	00	00	10	20	30	40			
0x00001024:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001030:	00	00	00	00	00	00	00	00	00	00	00	00			
0x0000103C:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001048:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001054:	00	00	00	00	00	00	00	00	00	00	00	00			
0x00001060:	00	00	00	00	00	00	00	00	00	00	00	00			

## Code: DB

AREA PROGRAM, CODE, READONLY

ENTRY

MAIN

LDR R0,=0X00001000

LDR R1,=0X00001020

LDMDB R0!,{R2-R5}

STMDB R1!,{R2-R5}

END

## Register Output:

Registers	
Register	Value
<b>Current</b>	
R0	0x0000FF0
R1	0x00001010
R2	0x00000000
R3	0x00000000
R4	0x00000000
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000014
CPSR	0x000000D3
SPSR	0x00000000

## Memory mapping:

Memory 1												
Address: 0X00001000												
0x00001000:	10	20	30	40	50	60	70	80	90	00	01	02
0x0000100C:	03	04	05	06	00	00	00	00	00	00	00	00
0x00001018:	00	00	00	00	00	00	00	00	00	00	00	00
0x00001024:	00	00	00	00	00	00	00	00	00	00	00	00
0x00001030:	00	00	00	00	00	00	00	00	00	00	00	00
0x0000103C:	00	00	00	00	00	00	00	00	00	00	00	00
0x00001048:	00	00	00	00	00	00	00	00	00	00	00	00
0x00001054:	00	00	00	00	00	00	00	00	00	00	00	00

## b. Load and store instructions in a loop

### Code:

```


AREA PROGRAM, CODE, READONLY
ENTRY
MAIN
    LDR R0, =0X00001000
    LDR R1, =0X00001020
    MOV R2, #10
LOOP
    LDR R3, [R0], #4
    STR R3, [R1], #4
    SUBS R2, R2, #1
    BNE LOOP
END

```

### Register output:

Registers	
Register	Value
<b>Current</b>	
R0	0x00001028
R1	0x00000000
R2	0x00000000
R3	0x00506010
R4	0x00000000
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000020
CPSR	0x600000D3
SPSR	0x00000000
+ User/System	
+ Fast Interrupt	
+ Interrupt	
+ <b>Supervisor</b>	
+ Abort	
+ Undefined	
Internal	
PC \$	0x00000020
Mode	Supervisor
States	94

## Memory mapping:

Memory 1																			
Address: 0x00001000																			
0x00001000:	01	02	03	04	00	50	60	10	20	70	00	80	90	00	11	21	31	00	00
0x00001013:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	02	03	04	00
0x00001026:	60	10	20	70	00	80	90	00	11	21	31	00	00	00	00	00	00	00	00
0x00001039:	00	00	00	00	00	00	00	00	01	02	03	04	00	50	60	10	00	00	00
0x0000104C:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x0000105F:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x00001072:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x00001085:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

## **Result:**

All the parts of the experiments are performed successfully and their results are also verified correctly.