MICRO PROCESSORS & MICRO CONTROLLER LAB

MANUAL

DEPARTEMENT

OF

ELECTRONICS & COMMUNICATION ENGINEERING

CHIRANJEEVI REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Approved by AICTE, New Delhi & Affiliated to JNTU, Anantapuram)
BELLARY ROAD, ANANTAPUR.

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PROCEDURE OF MICRO PROCESSOR ASSEMBLE

1. **Copy downloaded assembler folder in installed OS drive**
2. **CREATE A FOLDER IN ANY DRIVE (Eg: D: Drive)**
3. **Open created folder and create a tex file document**
4. **Type programs in text files**
5. **Save text file with ".asm" extention (Eg: RSH.asm)**
6. **Text document is converted in to "asm file".**
7. **Go to start menu**
8. **Open run and type "CMD" so that command will open**
9. **Type drive extension (eg: D: press enter) so drive is opened**
10. **If created folder is present in installed OS drive (eg: C: drive) then in cmd type (eg: cd c:\ and enter)**
11. **Type cd <space> folder name enter**
12. **Type " path=c:\assembler**
13. **masm**
14. **type filename.asm {eg: rsh.asm}**
15. **press enter three times**
16. **if any errors in programs it show else continue**
17. **type "link"**
18. **type filename.obj {eg: rsh.obj}**
19. **press enter three times**
20. **type "AFDEBUG"**
21. **press enter**
22. **type L<space>filename with out .asm**
23. **inputs will display in stacks**
24. **press f1 to get input in registers**
25. **note down outputs and stacks & flags**

1.1 ADDITION OF TWO 16 BITS NUMBERS SIGNED & UN SIGNED

```
ASSUME CS:CODE,DS:DATA
DATA SEGMENT
OPR1 DW 4269H
OPR2 DW 1000H
RES DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
ADD AX,OPR2
MOV RES,AX
MOV AH,4CH
INT 21H
CODE ENDS
END START
END
```

RESULT: -

UNSIGNED:

INPUT: OPR1=4269H, OPR2= 1000H

OUTPUT:- 5269H

SIGNED :-

INPUT:- OPR1=9763H,OPR2= A973H

RES= 40D6H,CF=1

1.2. SUBTRACTION OF TWO 16 BITS NO:- SIGNED & UNSIGNED

```
ASSUME CS:CODE,DS:DATA
DATA SEGMENT
OPR1 DW 4269H
OPR2 DW 1000H
RES DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
SUB AX,OPR2
MOV RES,AX
MOV AH,4CH
INT 21H
CODE ENDS
END START
END
```

RESULT: -
UNSIGNED:
INPUT: OPR1=4269H, OPR2= 1000H
OUTPUT:- 3269H

SIGNED :-
INPUT:- OPR1=9763H,OPR2= 8973H
RES= 0DF0H,

1.3. MULTIPLICATION OF TWO 16 BITS UNSIGNED

```
ASSUME CS:CODE,DS:DATA
DATA SEGMENT
OPR1 DW 2000H
OPR2 DW 4000H
RESLW DW ?
RESHW DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
MUL OPR2
MOV RESLW,AX
MOV RESHW,DX
MOV AH,4CH
INT 21H
CODE ENDS
END START
END
```

RESULT: -
UNSIGNED:
INPUT: OPR1=2000H, OPR2= 4000H
OUTPUT:- RESLW=0000H(AX)
RESHW=0800H(DX)

1.4.MULTIPLICATION OF TWO 16 BITS SIGNED NUMBERS

```
ASSUME CS:CODE,DS:DATA
DATA SEGMENT
OPR1 DW 7593H
OPR2 DW 6845H
RESLW DW ?
RESHW DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
IMUL OPR2
MOV RESLW,AX
MOV RESHW,DX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:

CASE (1) :----TWO POSITIVE : INPUTS: OPR1: 7593H
OPR2 : 6845H

OUTPUT:

RESLW=689FH
RESHW=2FE3H

CASE(2): ----ONE POSITIVE NUMBER& ONE NEGITIVE NUMBER:

INPUTS: OPR1 = 846DH ← 2'S COMPLEMENT IS (-7593H)
OPR2 = 6845H

OUTPUTS: RESLW= 9761H <- 2'S COMPLEMENT
RESHW= D01CH ← OF (-2FE3689FH)

CASE(3):-----TWO NEGITATIVE NUMBERS

INPUTS: OPR1 = 846DH ← 2'S COMPLEMENT IS (-7593H)
OPR2 = 97BBH

OUTPUTS: RESLW= 689FH <- 2'S COMPLEMENT
RESHW= 2FE3H ← OF (-2FE3689FH)

1.5. DIVISION OF UN SIGNED NUMBERS

```
ASSUME CS: CODE, DS:DATA
DATA SEGMENT
OPR1 DW 2C58H
OPR2 DW 56H
RESQ DW ?
RESR DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
DIV OPR2
MOV RESQ,AX
MOV RESR,DX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:

CASE (1) :--- INPUTS: OPR1: 2C58H
OPR2 : 56H

OUTPUT:

RESLW=H == 0084H
RESHW=H==0000H

1.6. DIVISION OF SIGNED NUMBERS

```
ASSUME CS: CODE, DS:DATA
DATA SEGMENT
OPR1 DW 2658H
OPR2 DW 0AAH
RESQ DW ?
RESR DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
DIV OPR2
MOV RESQ,AX
MOV RESR,DX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:

CASE (1) :--- INPUTS: OPR1: 26F8H
OPR2 : 56H

OUTPUT:

RESLW=H == 0074H (AL)
RESHW=H==0000H (AH)

CASE(2):----- ONE POSITVE NUMBER & ONE NEGITIVE NUMBER
INPUT:-- OPR1 = D908H ← 2'S COMPLETE OF (-26F8H)
OPR2 = 56H
OUTPUT :---- RESQ= 8CH (AL) ← 2'S COMPLETE OF (-74H)
RESR= 00H (AH)

2.1. ASCII ADDITION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
Char  Db 8
Char1  Db 6
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AH,00H
MOV AL,CHAR
ADD AL,CHAR1
AAA
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : CHAR=8
CHAR1=6
OUTPUT:= RES= 0104(AX) ← UNPACKED BCD OF 14

2.2 ASCII SUBTRACTION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
Char  Db 9
Char1  Db  5
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AH,00H
MOV AL,CHAR
SUB AL,CHAR1
AAS
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : CHAR=9
CHAR1=5
OUTPUT:= RES= 0004(AX)

CASE(II):- CHAR=5
CHAR1=9
RES=00FC(AX) ← 2'S COMPLEMENT(-4)

2.3. ASCII MULTIPLICATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
NUM1  Db 09H
NUM2  Db  05H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AH,00H
MOV AL,NUM1
MUL NUM2
AAM
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : NUM1=09
NUM2=05
OUTPUT:= RES= 0405(AX) ← UN PACKED BCD OF 45

2.4. ASCII DIVISION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
DIVIDEND  DW 0607H
DIVISIOR   DB  09H
RESQ  DB ?
RESR DB ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,DIVIDEND
AAD
MOV CH,DIVISIOR
DIV CH
MOV RESQ,AL
MOV RESR,AH
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : DIVIDEND=0607H ← UN PACKED BCD OF 67
DIVISIOR=09H
OUTPUT:= RESQ= 07(AL)
RESR=04(AH)

3.1. LOGICAL AND OPERATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 6493H
OPR2 DW 1936H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
AND AX,OPR2
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=6493H
OPR2=1936H
OUTPUT:= RES= 0012H

3.2. LOGICAL OR OPERATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 6493H
OPR2 DW 1936H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
OR AX,OPR2
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=6493H
OPR2=1936H
OUTPUT:= RES= 7DB7H

3.3. LOGICAL XOR OPERATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 6493H
OPR2 DW 1936H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
XOR AX,OPR2
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=6493H
OPR2=1936H
OUTPUT:= RES= 7DA5H

3.4. LOGICAL NOT OPERATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 6493H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
NOT AX
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=6493H
OUTPUT:= RES= 9B6CH

4.1.SHIFT ARITHEMATIC/LOGICAL LEFT OPERATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 1639H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
SAL AX,01H--------→ (or) ←---------- SHL AX,01H
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=1639H
OUTPUT:= RES= 2C72H

4.2. SHIFT LOGICAL RIGHT OPERATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 8639H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
SHR AX,01H
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=8639H
OUTPUT:= RES= 431CH

4.3. SHIFT ARTHEMATIC RIGHT OPERATION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 8639H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
SAR AX,01H
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=8639H
OUTPUT:= RES= C31CH

4.4. ROTATE RIGHT WITH OUT CARRY

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 1639H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
ROR  AX,01H
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=1639H
OUTPUT:= RES= 8B1CH

4.5. ROTATE RIGHT WITH CARRY

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 1639H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
RCR  AX,01H
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=1639H
OUTPUT:= RES= 0B1CH

4.6. ROTATE LEFT WITH OUT CARRY

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 8097H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
ROL  AX,01H
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=8097H
OUTPUT:= RES= 012FH

4.7. ROTATE LEFT WITH CARRY

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 8097H
RES  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
RCL  AX,01H
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : OPR1=8097H
OUTPUT:= RES= 012EH

5.1. MOVE BLOCK

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
STR DB 04H,0F9H,0BCH,98H,40H
COUNT EQU 05H
DATA ENDS
EXTRA SEGMENT
ORG 0010H
STR1 DB 05H DUP(?)
EXTRA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV ES,AX
MOV SI,OFFSET  STR
MOV DI,OFFSET STR1
MOV CL,COUNT
CLD
REP MOVSB
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : STR(DS:0000H)=04H,F9H,BCH,98H,40H
OUTPUT:= STR1(DS:0010H)= 04H,F9H,BCH,98H,40H

5.2. REVERSE STRING

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
STR DB 01H,02H,03H,04H
COUNT EQU 05H
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV CI,COUNT
MOV SI,OFFSET STR
MOV DI,0003H
BACK:MOV AL,[SI]
XCHG [DI],AL
INC,SI
DEC DI
DEC CL
JNZ BACK
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : STR(DS:0000H)=01H,02H,03H,04H
OUTPUT:= STR(DS:0000H)= 04H,03H,02H,01H

5.3. LENGTH OF THE STRING

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
STR DB 01H,03H,08H,09H,05H,07H,02H
LENGTH  DB ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AL,00H
MOV CL,00H
MOV SI,OFFSET STR
BACK:CMP AL,[SI]
JNC GO
INC CL
INC SI
JNZ BACK
GO:MOV LENGTH,CL
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-
INPUT : STR(DS:0000H)=01H,03H,08H,09H,05H,07H,02H
OUTPUT:= LENGTH=07H[CL]

5.4. STRING COMPARISION

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
STR DB 04H,05H,07H,08H
COUNT EQU 04H
ORG 0010H
STR1  DB 04H,06H,07H,09H
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV SI,OFFSET STR
MOV DI,OFFSET STR1
MOV CL,COUNT
CLD
RED CMPSB
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT : STR(DS:0000H)=04H,05H,07H,08H
STR(DS:0000H)= 04H,06H,07H,09H

OUTPUT:= IF STR=STR1 THEN ZF=1
IF STR =\ STR1 THEN ZF=0

5.5. DOS/BIOS PROGRAMMING

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
MSG DB ODH,0AH,"WELCOME TO MICRO PROCESSOR LAB", 0DB,0AH,"$"
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AH,09H
MOV DX,OFFSET MSG
INT  21H
CODE ENDS
END START
END
```

RESULT:-

WELCOME TO MICRO PROCESSORS LAB

6.1. PACKED BCD TO UNPACKED BCD

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
BCD DB 48H
UBCD DB ?
UBCD2 DB ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AL,BCD
MOV BL,AL
AND AL,0FH
MOV UBCD1,AL
MOV AL,BL
AND AL,0F0H
MOV CL,04H
ROR  AL,CL
MOV UBCD2,AL
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT: 48

OUTPUT:- 0408

6.2. PACKED BCD TO ASCII

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
BCD DB 49H
ASCII1 DB ?
ASCII2 DB ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AL,BCD
MOV BL,AL
AND AL,0FH
OR AL,30H
MOV ASCII1,AL
MOV AL,BL
AND AL,0F0H
MOV CL,04H
ROR  AL,CL
MOV ASCII2,AL
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT: 49

OUTPUT:- 3439

7.1. ASCENDING ORDER

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
NUMS DW 5H,4H,3H,2H,1H
COUNT EQU 05H
DATA ENDS
CODE SEGMENT
START:
MOV AX,SEGMENT
MOV OS,AX
MOV AX,0000H
MOV DL,COUNT_1
BACK1:MOV CL,DL
MOV SI,OFFSET NUMS
BACK: MOV AX,[SI]
CMP AX,[SI+2]
MOV [SI],AX
GO:
INC SI
INC SI
LOOP BACK
DEC DL
JNZ BACK1
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT: 5H,4H,3H,2H,1H

OUTPUT:- 1H,2H,3H,4H,5H

7.2. DESCENDING ORDER

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
NUMS DW 1H,2H,3H,4H,5H
COUNT EQU 05H
DATA ENDS
CODE SEGMENT
START:
MOV AX,SEGNUMS
MOV DS,AX
MOV AX,0000H
MOV DL,COUNT_1
BACK1:
MOV CL,DL
MOV SI,OFFSET NUMS
BACK: MOV AX,[SI]
CMP AX,[SI+2]
JNC GO
XCHG AX,[SI+2]
MOV [SI],AX
GO:
INC SI
INC SI
LOOP BACK
DEC DL
JNZ BACK1
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT: 1H,2H,3H,4H,5H

OUTPUT:- 5H,4H,3H,2H,1H

8.1. MAXIMUM NUMBER

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
DLMS DW 0001H,0009H,0008H,0005H,0010H
COUNT EQU 01H
MAX DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV 01,COUNT
MOV SI,OFFSET NUMS
MOV AX,[SI]
BACK : CMP AX,[SI+2]
GO
INC SI
INC SI
LOOP BACK
MOV MAX,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT:

OUTPUT:-

8.2. MINIMUM NUMBER

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
DLMS DW 0007H,0009H,000FH,0008H,0005H,0006H
COUNT EQU 05H
MIN  DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV C1,COUNT
MOV SI,OFFSET NUMS
MOV AX,[SI]
BACK : CMP AX,[SI+2]
JC GO
XCHG AX,[SI+2]
GO: INC SI
LOOP BACK
MOV MIN,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT: 0007H,0009H,000FH,0008H,0005H,0006H

OUTPUT:- 0005H

9.1. 2'S COMPLEMENT

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
OPR1 DW 45H
RES DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,OPR1
NEG OPR1
MOV RES,AX
MOV AH,4CH
INT  21H
CODE ENDS
END START
END
```

RESULT:-

INPUT: OPR1=100101H

OUTPUT:- 011010H

9.2. AVERAGE OF TWO NUMBERS

```
ASSUME CS: CODE,DS:DATA
DATA SEGMENT
NO1 DB 0FH
NO2 DB 05H
AVG DW ?
DATA ENDS
CODE SEGMENT
START:
MOV AX,DATA
MOV DS,AX
MOV AX,00H
MOV AL,NO1
MOV AL,NO2
ADD AL,NO2
SAR AX,01H
MOV AVG,AX
CODE ENDS
END START
END
```

RESULT:-

INPUT: NO1=0FH,, NO2=05H

OUTPUT:- 0AH