CS222: Computer Organization & Assembly Language

Lecture 26:

Programming the Basic Computer

Assembly language programs

Translation to Binary

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Reading Sections: Computer System Architecture, 3rd Edition by Morris Mano, Sections 6.1 & 6.2

Video Lecture: Available at this link

BASIC COMPUTER INSTRUCTION SET

Symbol	Hex Code I = 0	Hex Code I = 1	Description
AND	0xxx	8xxx	AND memory word to AC
ADD	1xxx	9xxx	Add memory word to AC
LDA	2xxx	Axxx	Load AC from memory
STA	3xxx	Bxxx	Store content of AC into memory
BUN	4xxx	Cxxx	Branch unconditionally
BSA	5xxx	Dxxx	Branch and save return address
ISZ	6xxx	Exxx	Increment and skip if zero
CLA	7800		Clear AC
CLE	7400		Clear E
CMA	7200		Complement AC
CME	7100		Complement E
CIR	7080		Circulate right AC and E
CIL	7040		Circulate left AC and E
INC	7020		Increment AC
SPA	7010		Skip next instr. if AC is positive
SNA	7008		Skip next instr. if AC is negative
SZA	7004		Skip next instr. if AC is zero
SZE	7002		Skip next instr. if E is zero
HLT	7001		Halt computer
INP	F800		Input character to AC
OUT	F400		Output character from AC
SKI	F200		Skip on input flag
SKO	F100		Skip on output flag
ION	F080		Interrupt on
IOF	F040		Interrupt off

Q. There is no instruction available in the Basic Computer for subtraction, so how are we going to perform subtraction?

A. Through a program

SUBTRACT USING ASSEMBLY LANGUAGE

- **Assembly language program of the Basic Computer to subtract two numbers**

```
        ORG  100        / Origin of program is location 100
        LDA  SUB        / Load subtrahend to AC
        CMA             / Complement AC
        INC             / Increment AC
        ADD  MIN        / Add minuend to AC
        STA  DIF        / Store difference
        HLT             / Halt computer
MIN,    DEC  5          / Minuend
SUB,    DEC  3          / Subtrahend
DIF,    DEC  0          / Difference stored here
        END             / End of symbolic program
```

TRANSLATION TO BINARY

Hexadecimal Code		Assembly Language Program	
Location	Content		
			ORG 100
100	2107		LDA SUB
101	7200		CMA
102	7020		INC
103	1106		ADD MIN
104	3108		STA DIF
105	7001		HLT
106	0005	MIN,	DEC 5
107	0003	SUB,	DEC 3
108	0000	DIF,	HEX 0
			END

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