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CSEN 402 Computer Organization and System Programming
Practice Assignment 4
Spring 2014

NOT to be submitted
To be discussed during tutorial sessions
The rest of the chapter's exercises are to be solved by the students for self-evaluation

Exercise 1:

A computer uses a memory unit with 256K words of 32 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers, and an address part (respectively), state:

a. How many bits are there in the operation code, the register code part, and the address part?
b. Draw the instruction word format and indicate the number of bits in each part.
c. How many bits are there in the data and address inputs of the memory?

Solution:

$256\ K = 2^8 \times 2^{10} = 2^{18}$
$64 = 2^6$

(a) Address: 18 bits
Register code: 6 bits
Indirect bit: 1 bit
32 – 25 = 7 bits for opcode.

(b) 1 7 6 18 = 32 bits

I	opcode	Register	Address

(c) Data= 32 bits
Address= 18 bits.

Exercise 2:

What are the two instructions needed in the basic computer in order to set the `E` flip-flop to 1?

Solution:

CLE Clear E
CME Complement E

Exercise 3:

Consider the instruction formats of the basic computer shown fig 5-5 and the list of instructions given in table 5-2. For each of the following 16-bit instructions, give the equivalent four-digit hexadecimal code and explain in your own words the operation of the instruction that will be performed:

a) 0001 0000 0010 0100
b) 1011 0001 0010 0100
c) 0111 0000 0010 0000

Solution:

a) 0001 0000 0010 0100
   $(1\ 0\ 2\ 4)_{16}$
   ADD $(024)_{16}$
   ADD content of `M[024]` to `AC`

b) 1011 0001 0010 0100
   $(B\ 1\ 2\ 4)_{16}$
   I STA $(124)_{16}$
   Store `AC` in `M[M[124]]`

c) 0111 0000 0010 0000
   $(7\ 0\ 2\ 0)_{16}$
   Register Increment `AC` INC

Exercice 4:

The content of AC in the basic computer is hexadecimal A937 and the initial value of E is 1. Determine the contents of AC, E, PC, AR, and IR in hexadecimal after the execution of CLA instruction. Repeat for the following instructions *(starting each instruction from the initial value)*: CLE, CMA, CIR, CIL, INC, SNA, and SZA.
The initial value of PC is hexadecimal 021.

Solution:

	E	**AC**	**PC**	**AR**	**IR**
Initial	**1**	**A937**	**021**	**---**	**---**
CLA	1	0000	022	800	7800
CLE	0	A937	022	400	7400
CMA	1	56C8	022	200	7200
CIR	1	D49B	022	080	7080
CIL	1	526F	022	040	7040
INC	1	A938	022	020	7020
SNA	1	A937	023	008	7008
SZA	1	A937	022	004	7004

Exercise 5:

Draw a timing diagram assuming that SC is cleared to 0 at time T_3 if control signal C_7 is active.

$$C_7T_3: SC \leftarrow 0$$

C_7 is activated with the positive clock transition associated with T_1.

Solution: