

Processor Register

- A processor has many registers to hold instructions, addresses, data, etc
- The processor has a register, the Program Counter (PC) that holds the memory address of the next instruction to be executed

Since the memory in the Basic Computer only has 4096 locations, the PC only needs 12 bits

- In a direct or indirect addressing, the processor needs to keep track of what locations in memory it is addressing: The Address Register (AR) is used for this

The AR is a 12 bit register in the Basic Computer

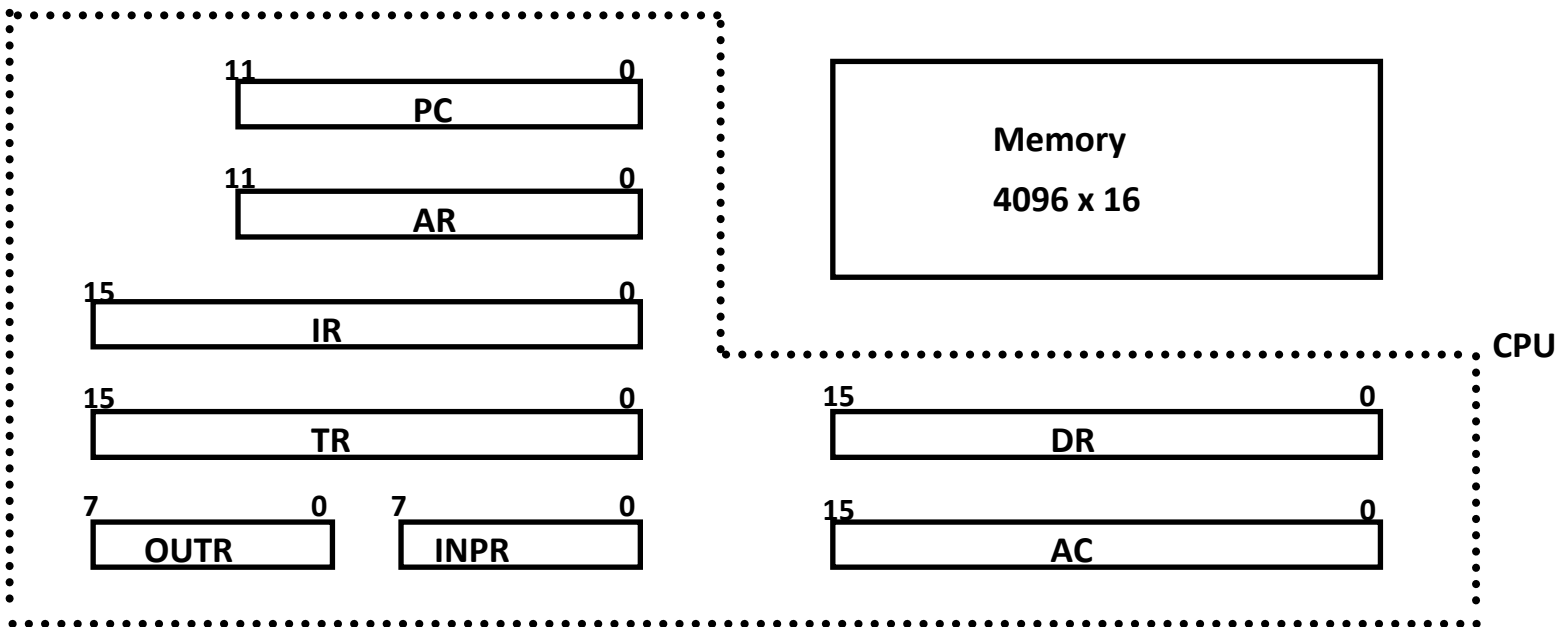
- When an operand is found, using either direct or indirect addressing, it is placed in the Data Register (DR). The processor then uses this value as data for its operation
- The Basic Computer has a single general purpose register – the Accumulator (AC)

Processor Register

- The significance of a general purpose register is that it can be referred to in instructions
 - e.g. load AC with the contents of a specific memory location; store the contents of AC into a specified memory location
- Often a processor will need a scratch register to store intermediate results or other temporary data; in the Basic Computer this is the Temporary Register (TR)
- The Basic Computer uses a very simple model of input/output (I/O) operations
 - Input devices are considered to send 8 bits of character data to the processor
 - The processor can send 8 bits of character data to output devices
- The Input Register (INPR) holds an 8 bit character gotten from an input device
- The Output Register (OUTR) holds an 8 bit character to be send to an output device

Processor Register

Registers in the Basic Computer



List of BC Registers

DR	16	Data Register	Holds memory operand
AR	12	Address Register	Holds address for memory
AC	16	Accumulator	Processor register
IR	16	Instruction Register	Holds instruction code
PC	12	Program Counter	Holds address of instruction
TR	16	Temporary Register	Holds temporary data
INPR	8	Input Register	Holds input character
OUTR	8	Output Register	Holds output character

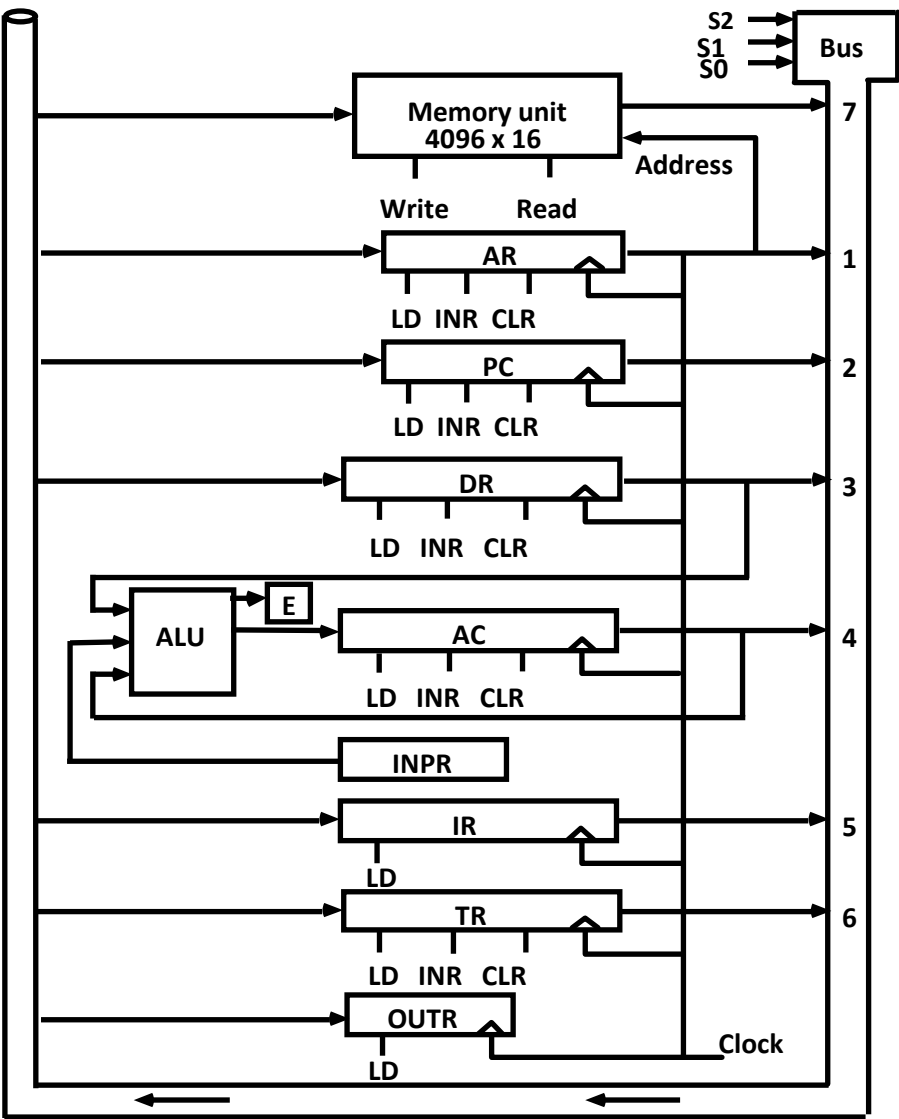
In basic computer, which of the following register is called as a General Purpose Register ?

- a) PC
- b) IR
- c) TR
- d) AC

Common Bus System

- **Basic computer : 8 register, a memory unit and a control unit**
- **The registers in the Basic Computer are connected using a bus**
- **This gives a savings in circuitry over complete connections between registers**
- **Output of 7 register and memory connected to input of bus**
- **Specific output that is selected for bus lines will be determined by selection variables S_2 , S_1 , S_0**

Common Bus System



Common Bus System

- Three control lines, S_2 , S_1 , and S_0 control which register the bus selects as its input

S_2 S_1 S_0	Register
0 0 0	x
0 0 1	AR
0 1 0	PC
0 1 1	DR
1 0 0	AC
1 0 1	IR
1 1 0	TR
1 1 1	Memory

- Either one of the registers will have its load signal activated, or the memory will have its write signal activated
Will determine where the data from the bus gets loaded
- Memory places its 16 bit output on bus when read input is activated and $S_2S_1S_0=111$

Common Bus System

- 4 register DR, AC, IR, TR is 16 bit. The 12-bit registers, AR and PC, have 0's loaded onto the bus in the high order 4 bit positions
- When the 8-bit register OUTR is loaded from the bus, the data comes from the low order 8 bits on the bus
- INPR – connected to provide information to bus
 - receives character from input device and transfer to AC
- OUTR – can only receive information from bus
 - receives a character from AC and delivers to Output device
- Three types of input to AC :
 - from AC : complement AC, Shift AC
 - from DR : arithmetic and logic microoperation
 - from INPR

Common Bus System

- **Bus lines connected to inputs of 6 registers and memory**
- **Input/output data connected to common bus but memory address connected to AR**

- What is the size of memory in basic computer?
 - a) 4096 x 12
 - b) 4096 x 12
 - c) 4095 x 16
 - d) 4096 x 16

CSE211

Computer Organization and Design

- ✿ *Computer Instructions*
- ✿ *Timing and Control*
- ✿ *Instruction Cycles*
- ✿ *Memory Reference Instructions*
- ✿ *Input Output and Interrupts*
- ✿ *Complete Computer Description*

Overview

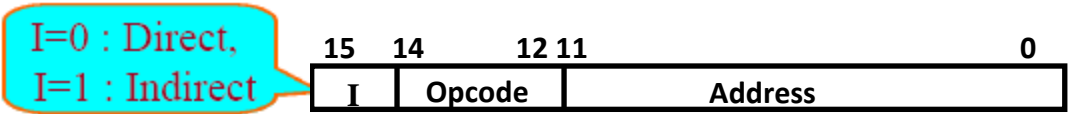
- Instruction Codes
- Computer Registers
- **Computer Instructions**
- **Timing and Control**
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Basic Computer Instructions

Basic Computer Instruction Format

1. Memory-Reference Instructions

(OP-code = 000 ~ 110)



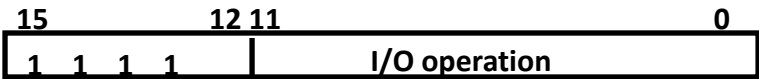
2. Register-Reference Instructions

(OP-code = 111, I = 0)



3. Input-Output Instructions

(OP-code =111, I = 1)



- In basic computer, which of the following flip flops is used to hold the addressing mode information?

a) E

b) I

c) A

d) T