Tutorial

- What do you mean by sequential circuits ?

Difference between the combinational circuits and sequential circuits are given below

	Combinational Circuits	Sequential Circuits
1)	The outputs of the combinational circuit depend only on the present inputs.	The outputs of the sequential circuits depend on both present inputs and present state(previous output).
2)	The feedback path is not present in the combinational circuit.	The feedback path is present in the sequential circuits.
3)	In combinational circuits, memory elements are not required.	In the sequential circuit, memory elements play an important role and require.
4)	The clock signal is not required for combinational circuits.	The clock signal is required for sequential circuits.

Tutorial

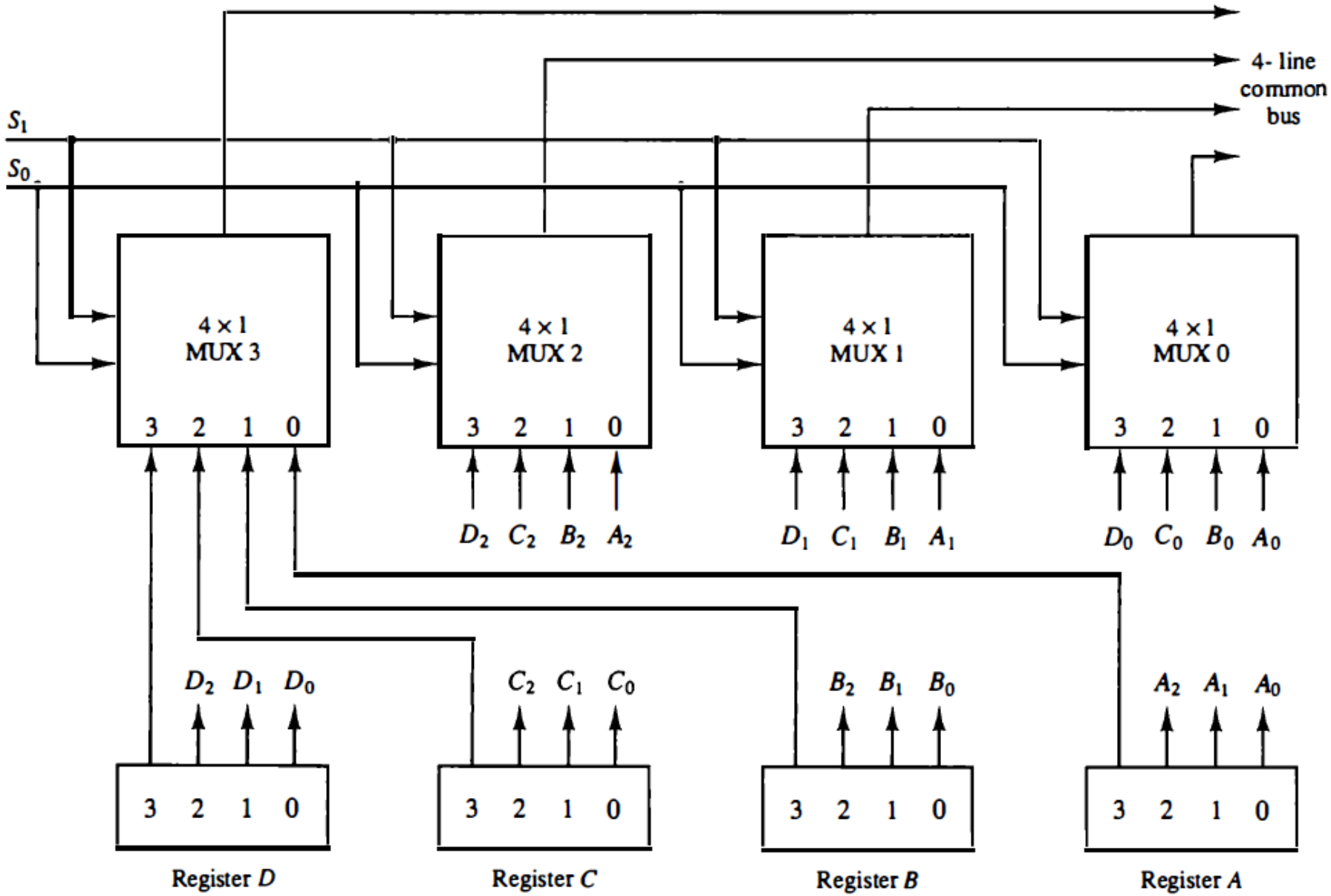
- What is bus system with 4 registers and 4 mux ?

Bus and Memory transfer

- A typical digital computer has many registers, and paths must be provided to transfer information from one register to another.
- The number of wires will be excessive if separate lines are used between each register and all other registers in the system.
- A more efficient scheme for transferring information between registers in a multiple-register configuration is a common bus system.

- BUS STRUCTURE CONSISTS OF SET OF COMMON LINES, ONE FOR EACH BIT OF A REGISTER THROUGH WHICH BINARY INFORMATION IS TRANSFERRED ONE AT A TIME
- Have control circuits to select which register is the source, and which is the destination

Figure 4-3 Bus system for four registers.



S1	S0	Register selected
0	0	A
0	1	B
1	0	C
1	1	D

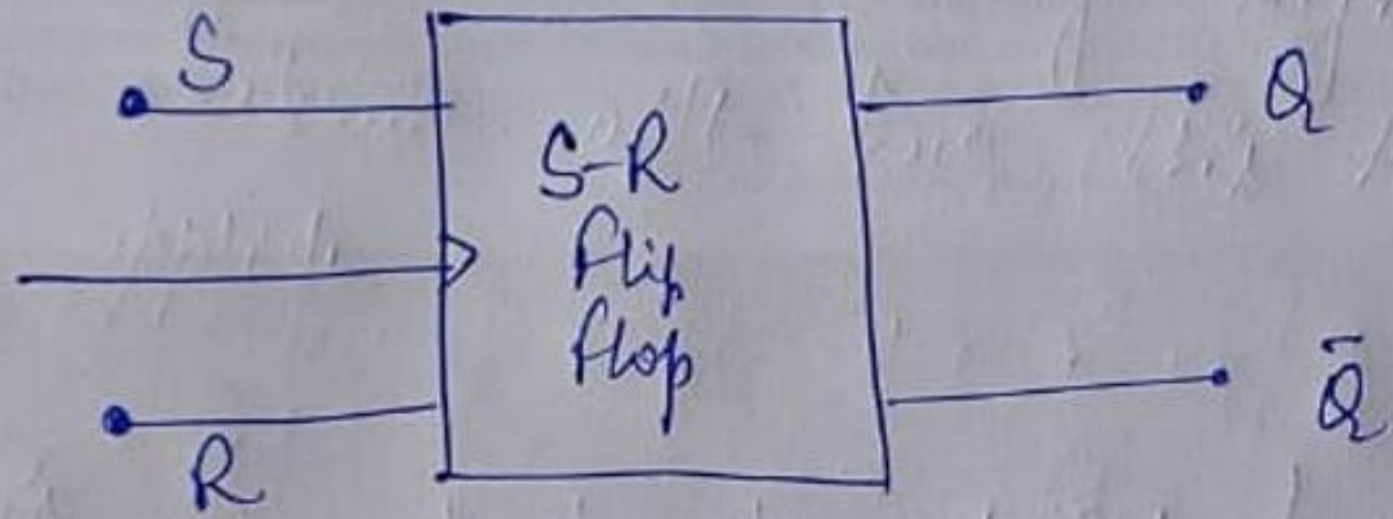
Tutorial

- What is SR Flip flop ? Explain with truth table ?

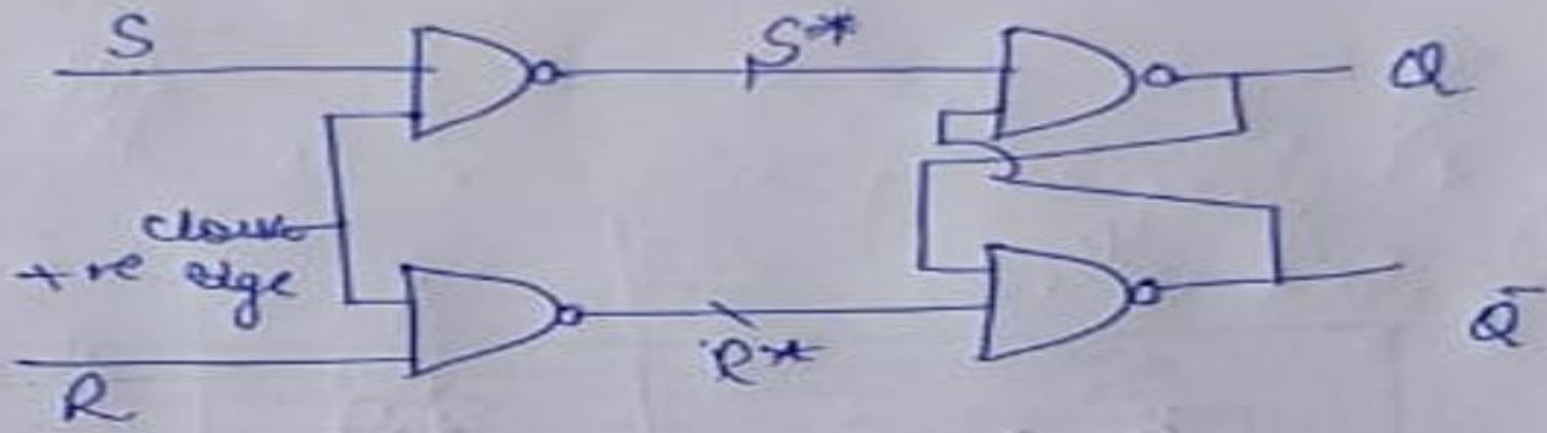
SR FLIP FLOP

- SR Flip Flop is the set reset flip flop. It consist of SR latch with clock circuit.
- It may be positive edge triggered or negative edge triggered.
- Triggering is the process of change of state of flop by applying input signal.

(1) S-R flip flop



positive edge triggered



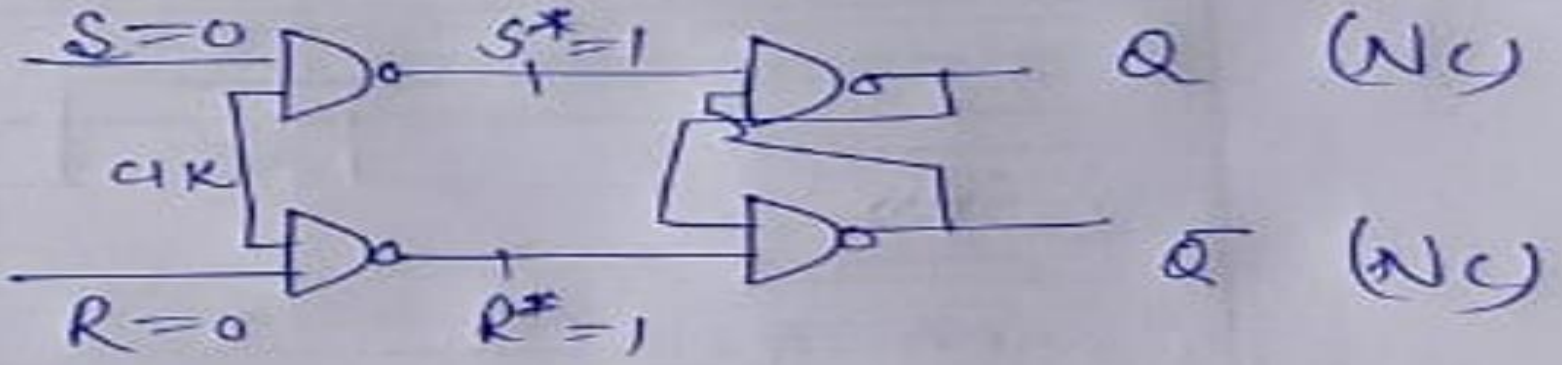
(SR NAND Latch)

S*	R*	Q $\bar{Q}$
0	0	Invalid
0	1	1 0
1	0	0 1
1	1	NC

No change

Case I :-

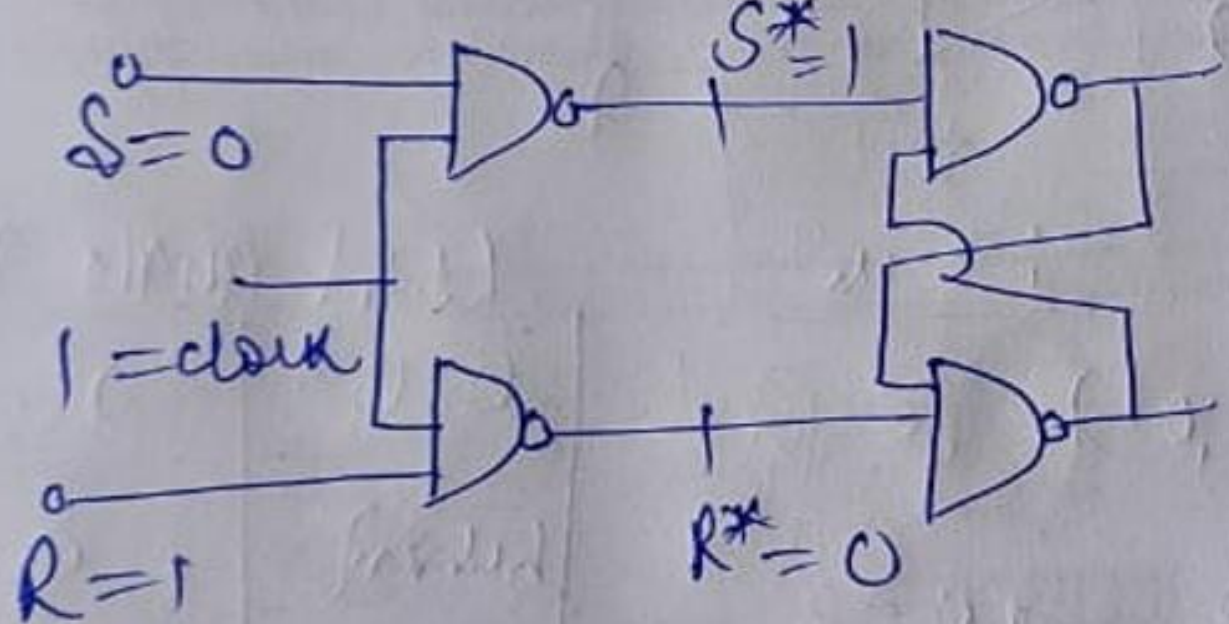
S=0, R=0, clock = ↑



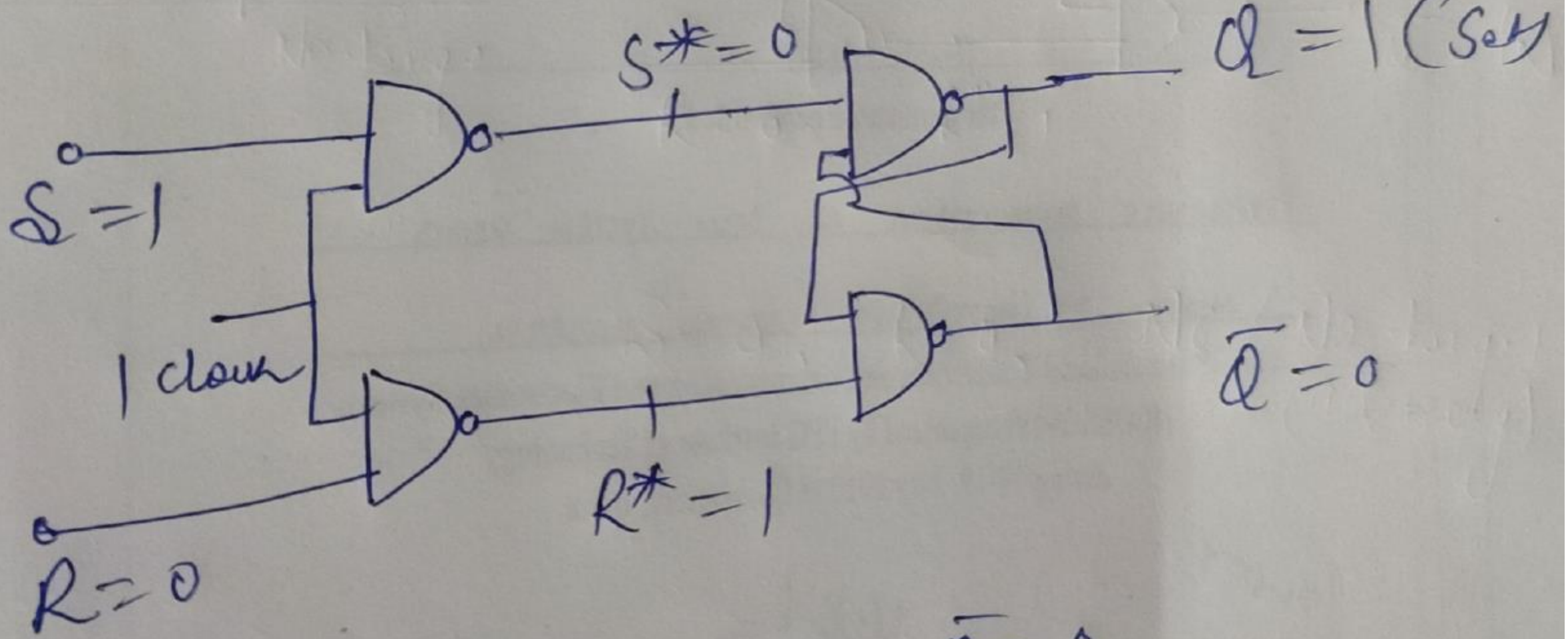
S=0, R=0, NC (No change)
(Memory)

Case II :-

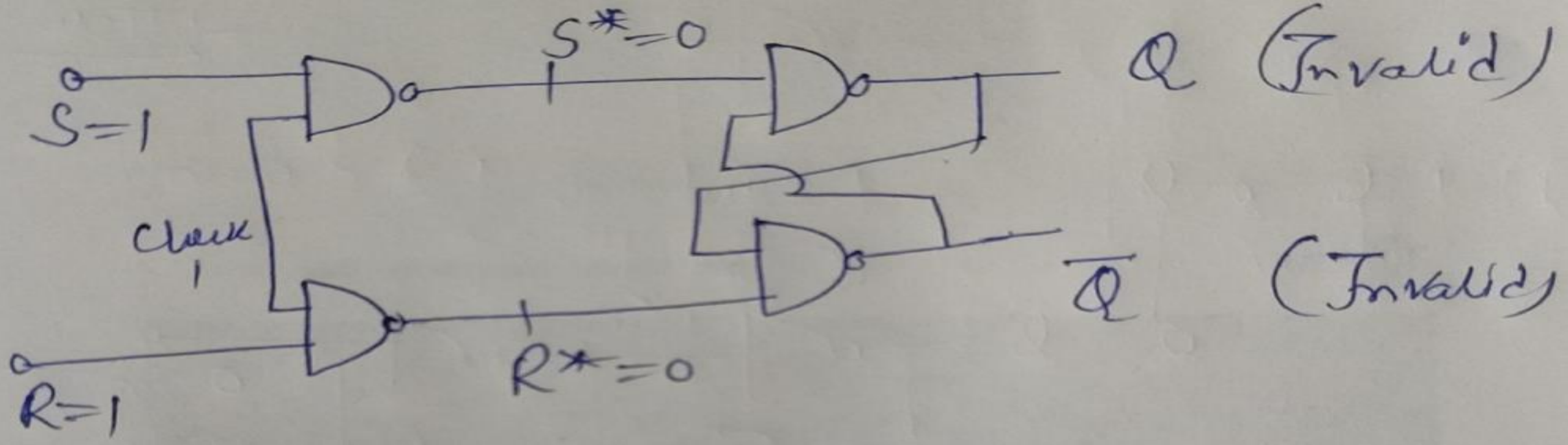
S=0 & R=1 , clock = 1 Q=0, $\bar{Q}$=1 (Reset)



Case III :-



S = 1; R = 0 Q = 1; $\bar{Q}$ = 0



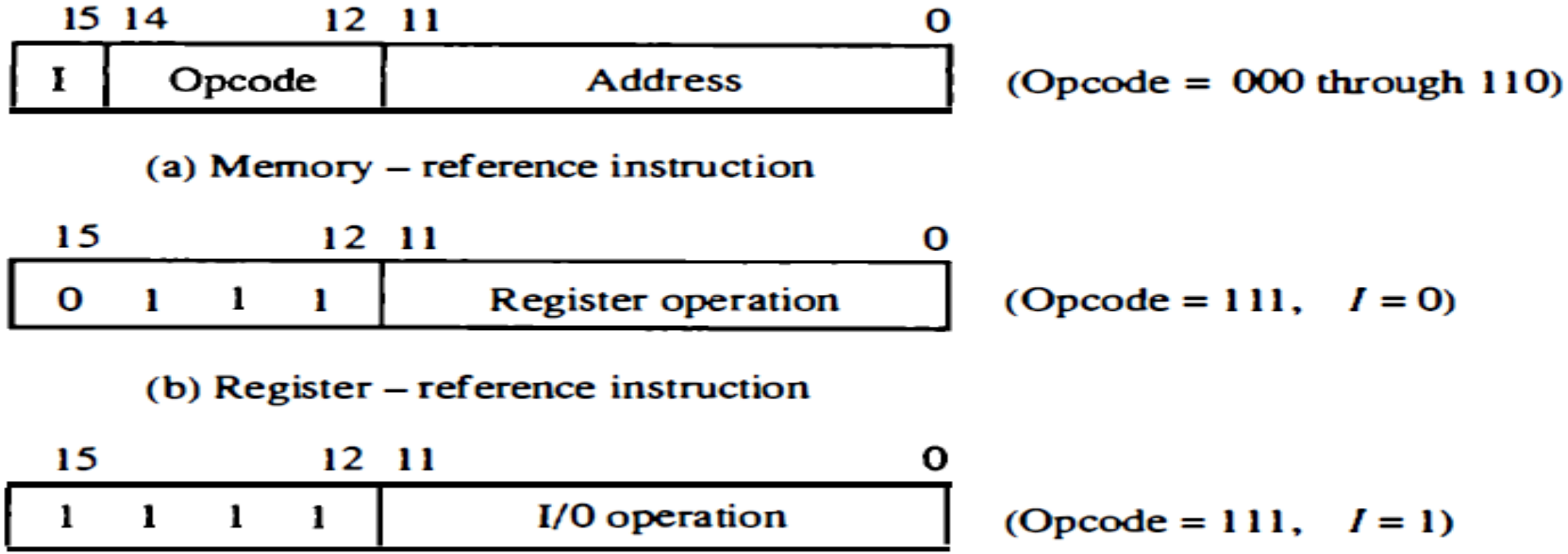
Clock	S	R	Q	$\overline{Q}$	
↑	0	0	NC	NC	
↑	0	1	0	1	Reset
↑	1	0	1	0	Set
↑	1	1	Invalid		

Tutorial

- What is the format of register reference instructions ?

Computer Instructions

Figure 5-5 Basic computer instruction formats.



Tutorial

- Define
- direct address
- indirect address

Computer Organization

- One bit of the instruction code can be used to distinguish between a direct and an indirect address.
- As an illustration of this configuration, consider the instruction code format shown in Fig. 5-2(a). It consists of a 3-bit operation code, a 12-bit address, and an address mode bit designated by I.
- The mode bit is 0 for a direct address and 1 for an indirect address.
- A direct address instruction is shown in Fig. 5-2(b).

Computer Organization

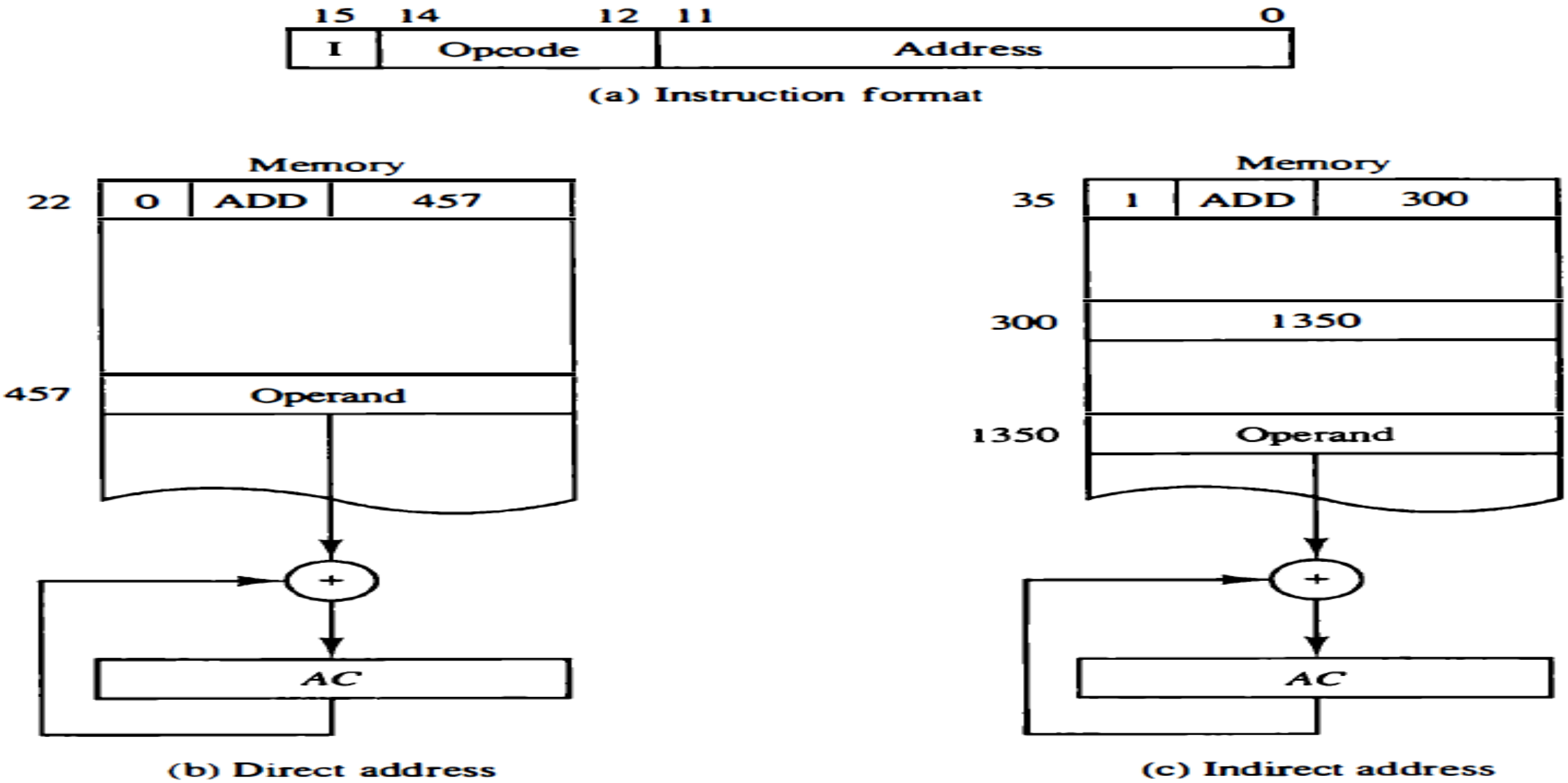


Figure 5.2 Demonstration of direct and indirect address

Computer Organization

- The I bit is 0, so the instruction is recognized as a direct address instruction. The opcode specifies an ADD instruction, and the address part is the binary equivalent of 457.

- The control finds the operand in memory at address 457 and adds it to the content of AC .

- Fig. 5-2(c) has a mode bit I = 1. Therefore, it is recognized as an indirect address instruction.

Computer Organization

- Fig. 5-2(c) has a mode bit I = 1. Therefore, it is recognized as an indirect address instruction. The address part is the binary equivalent of 300.
- The control goes to address 300 to find the address of the operand. The address of the operand in this case is 1350.
- The operand found in address 1350 is then added to the content of AC .
- The indirect address instruction needs two references to memory to fetch an operand.
- The first reference is needed to read the address of the operand; the second is for the operand itself.
- Thus the effective address in the instruction of Fig. 5-2(b) is 457 and in the instruction of Fig 5-2(c) is 1350.

Tutorial

- Define

❑Hardwired organization

❑Microprogrammed organization

Timing and Control

- There are two major types of control organization: hardwired control and microprogrammed control.
- In the hardwired organization, the control logic is implemented with gates, flip-flops, decoders, and other digital circuits.
- It has the advantage that it can be optimized to produce a fast mode of operation.
- In the microprogrammed organization, the control information is stored in a control memory.
- The control memory is programmed to initiate the required sequence of microoperations.

Timing and Control

- A hardwired control, as the name implies, requires changes in the wiring among the various components if the design has to be modified or changed.

- In the microprogrammed control, any required changes or modifications can be done by updating the microprogram in control memory.