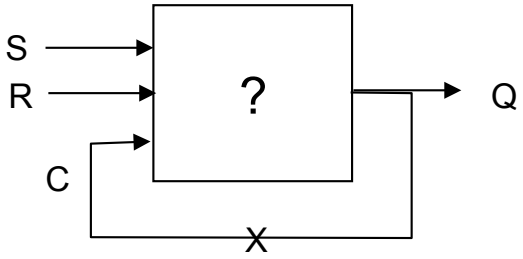
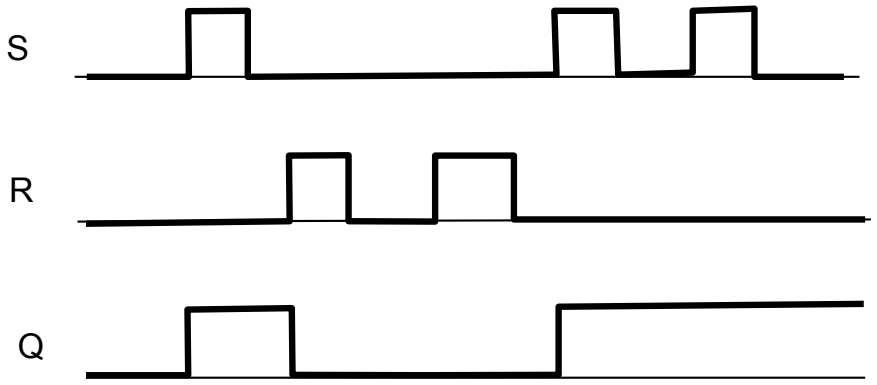
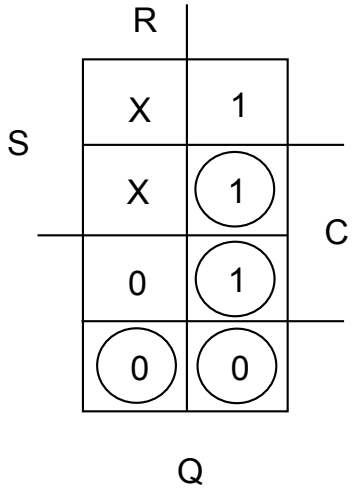
In Memoriam

Dr. A. van Weel

Dr. C.G.H. Scholten: RS flip-flop design

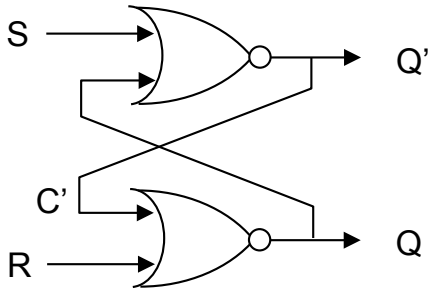






Q = S + CR'

CR' = (C' + R)'



Implementation with NORs

This was 1968 and earlier. The only book that describes Asynchronous Sequential Circuits is Charles Roth: Fundamentals of Logic Design, UT Austin, 1975/79/85/92 ch. 23.

Dr. C.G.H. Scholten: Computer Concept

- **Instruction Set**

- **00 – read memory: ACC <- DR <- (M)**
- **01 – add: ACC <- ACC + DR**
- **02 – subtract: ACC <- ACC – DR**
- **03 – store to memory: (M) <- ACC**

- **Number a is stored in memory 04, (04) = a.**
- **Number b is stored in memory 05: (05) = b.**

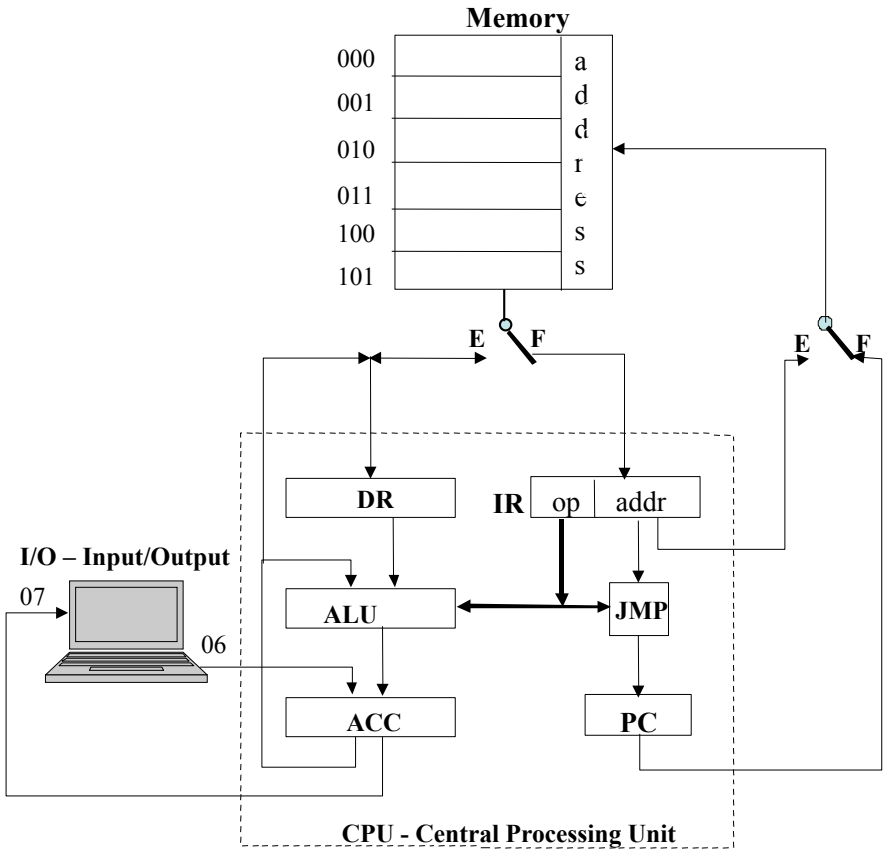
- **Program:**

Mnemonic	Memory Addr.	Machine Code
Read a	00	00 100
Add b	01	01 101
Store result in 04	02	03 100
Data:		
Operand a	04	a
Operand b	05	b

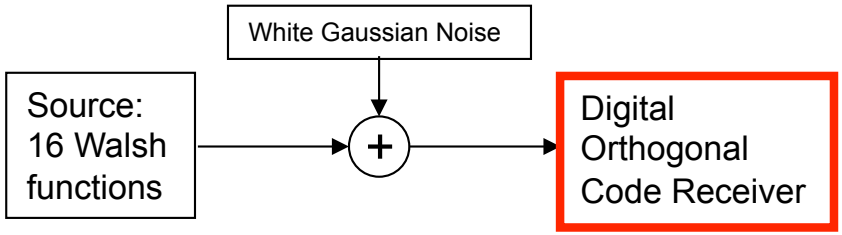
- **I/O device is treated as memory. In our case keyboard buffer has address 06, and screen buffer 07.**

- **I/O program:**

- **00 110 // ACC <- keyboard buff.**
- **03 100 // store input into mem 04.**
- **03 111 // echo ACC onto screen.**



Dr. J.B.H. Peck: Information Theory I and II



- J.B.H. Peck for his Ph.D. built analog correlator (sonar).
- He taught us from Wozencraft and Jacobs: Principles of Communication Engineering, MIT 1965.
- The book offers “analog” theory for the Orthogonal Receivers resulting in Figure 4.37.
- For my Master Thesis I have built (in Philips Nat. Lab.) entirely digital receiver, developed “digital” theory and obtained exactly the same results as Figure 4.37 by my theory as well as by receiver measurements.
- This was late 1969 and if followed up could be considered the first rudimentary CDMA receiver that appeared 16+ years later from Qualcomm (established 1985 by Jacobs, Viterbi, and others).

Design Real-Time Computer Systems

- IBM 360 Mainframe Systems used Queuing Theory for provisioning (late 1969).
- Much later Leonard Kleinrock: Queuing Systems I and II, 1975/76 UCLA gave the comprehensive texts and is considered the single main contributor to the Network Engineering and the Internet.
- Although the IBM 360 was very advanced “computer” network, the course stop short of elaborating on use of modeling tools in the Network Engineering. It went up to the Khinchin-Pollaczeck average formula (M/G/1), Kleinrock (5.63).
- However, this course made me aware of the significance of mathematical performance modeling that I have grossly exploited in my subsequent 20 years career with Bell Northern Research and Nortel Networks.
- Surely I have added much more including Markov Chains, Petri Nets and Discrete Simulation and learned how it all came together.

Post PII Life

- After the MEE graduation from NUFFIC Jan 1970, I came back to Sarajevo Energoinvest Institute for Automatic Control. However, they were aware of the state-of-the-art knowledge that I have acquired at PII and allowed me to teach as an Assistant Prof. at Sarajevo University.
- I have used Dr. Scholten's courses as the basis for my course Digital Computer Fundamentals, and expanded the Real-Time course for my Queuing Systems course. Both areas were growing very rapidly: computers toward mini/microprocessors, and mathematical modeling toward Stochastic Petri Nets (Ramchandani MIT 1974) and Queuing Networks (BCMP 1975) which feel off you will get in my second presentation.
- By 1971 in Yugoslavia they brought a law that Assistant Profs should have Ph.D. degree. And for the Ph.D. degree you have to have world wide contribution in the area of interest. Very few in Yugoslavia had the later, and very few (politically appropriate) defended Ph.D. in the country.
- My master thesis had all necessary ingredients, however, I was not politically suitable. So I was told to use my MEE thesis to rehabilitate, meaning I can continue teaching after I defend my MEE thesis in front of examination committee, which I did, and surrender my chance to use it towards the Ph.D.
- It took me 6 years to find doctor-able topic, write a thesis (while working full time) and to defend it (there was a substantial artificially injected delay). I have combined my microprocessor and queuing systems knowledge to make a thesis: Multiprocessor-Multimemory Computer Systems with Microprocessors, which discusses the architectures of multiprocessor system, its microprocessor implementation, and its performance evaluation. There are several world-wide novelties here the most notable being the most accurate closed-form performance model. That was June 1981*.

*to this day you cannot buy such system on the market.

THE next door

Studying for my Ph.D. thesis I have learned that:

- Dutch mathematician Th. J. Dekker was the first to resolve mutual exclusion problem in concurrent programming.
- Edsger Dijkstra THE Mathematical Department (1930-2002):
  - Replaced Dekker's Algorithm by read/modify/write
  - Invented semaphores (critical sections)*
  - THE Multiprogramming Operating System (layered approach, 1968)
  - Banker's Algorithm (deadlock prevention)
  - Open Shortest Path First (OSPF)**

*solved the problem of airplane reservation tickets.
**the Internet routing algorithm.

Bell Northern Research (BNR)

- Most of the PII graduates from the non-Western countries either didn't go back or they shortly did before going to work to the West, mostly Canada and the US.
- I have exchanged Christmas greetings with the most graduates of my generation +/-1 year of overlap. That's how I met Mr. Cho-Lun Wong, who was instrumental for my employment with BNR 1981 (Cho-Lun big thank you).
- BNR not only offered me a job but they relocated me from Sarajevo to Ottawa. My starting salary was 34 k which they increased to 45 k half a year later.
- Shortly after I came, June 1981, the Apple company made their first PC, the Apple II. BNR got one, and since didn't know how to operate it nor what to use it for they put it in the cafeteria cubicle opposite of the coffee machine so that anybody can use it.
- One Turkish fellow new to run spread sheet, and I was the only one that knew to run it from the operating system on (write/compile/run programs).
- Apple II had two operating systems: DOS and Pascal. I was running ISDN subscriber loop simulation on it for weeks (to get more accurate results) printing * characters on the screen as a sign that it is running.

Story about my thesis

- BNR/Nortel telephone switch DMS was distributed architecture except the CM (Central Module) which became the bottleneck.
- They wanted to use Multiprocessor-multimemory to make CM more powerful. The new CM was named XA-core (2 bil.$ investment)
- It was never completed and finally abandoned 2001.

Success means

- **fulfilling your own dreams,**
- **singing your own song,**
- **dancing your own dance,**
- **creating from your heart**
  and enjoying the journey,
- **trusting that whatever happens**
  it will be OK,
- **creating your own adventure.**

Elana Lindquist