Course Overview

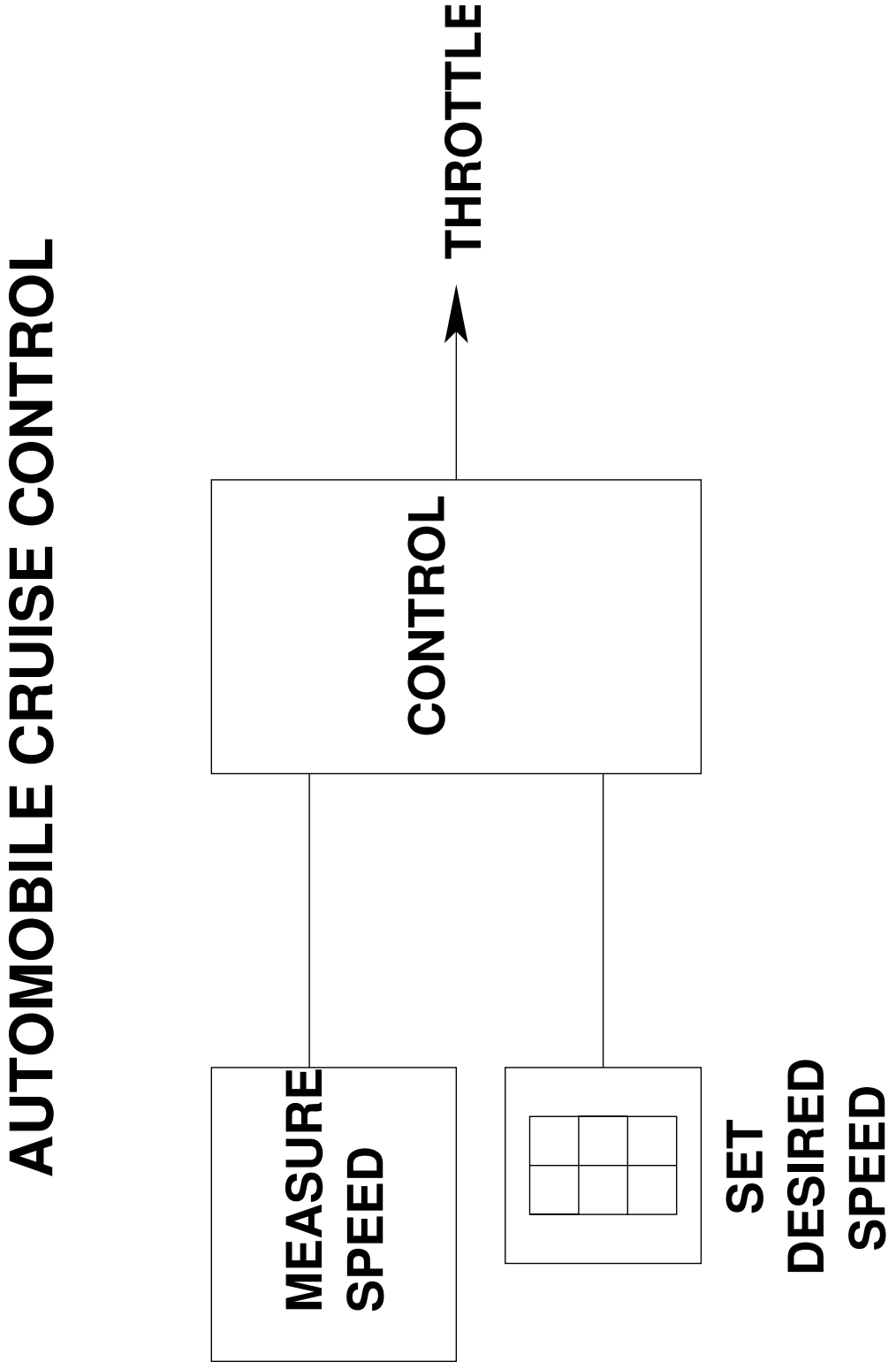
`http://www.ee.nmt.edu/~rison/ee308`

Texts: **Freescale Databooks on the MC9S12**
You can pick up the Freescale data sheets at the end of class today
The HCS12/9S12: An Introduction to Software and Interfacing
(Recommended)

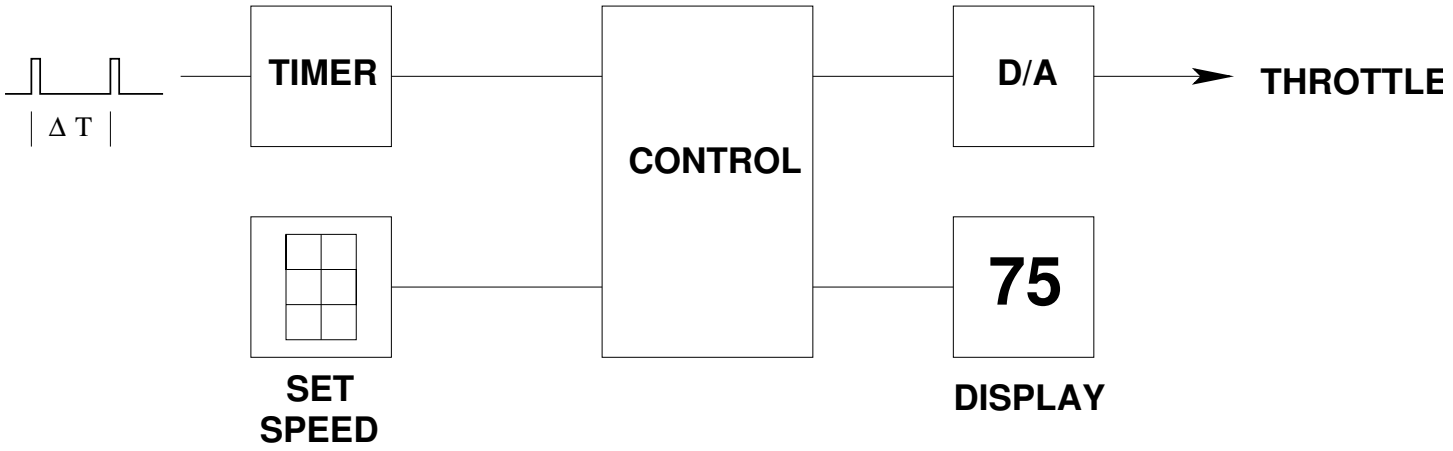
- Introduction to the MC9S12 Microcontroller
- Binary and Hexadecimal Numbers
- Assembly Language Programming
- C Language Programming
- Introduction to MC9S12 Internal Peripherals
  - The MC9S12 Timer Subsystem
  - Interrupts using the Timer Subsystem
  - The MC9S12 Pulse Width Modulator Subsystem
- The MC9S12 Expanded Mode
  - Address and Data Buses and Timing
  - Adding Memory and External Peripherals
  - Interfacing to the MC9S12
- More MC9S12 Internal Peripherals
  - The A/D Converter Subsystem
  - The Serial Peripheral Interface
  - The Serial Communications Interface
- Using the MC9S12 in a Control Application

Lab Overview

- The lab instructor is Dr. Hector Erives. The lab meets Monday and Wednesday afternoons. **No labs this week.**
- Lab handouts will be posted on the EE 308 website: http://www.ee.nmt.edu/~rison/ee308
- The 9S12 evaluation kits will be passed out in lab next week.
- You need to bring a bound lab notebook to the first lab.
- There will be a prelab for each lab. This must be done and turned in at the start of your lab section. The lab TA will verify that you have completed the prelab.
- There will be a short quiz covering the prelab material at the start of the lab. To get credit for the prelab, you must take the quiz.
- If you do not complete the prelab before coming to lab, you will lose 40% of the points for that lab.

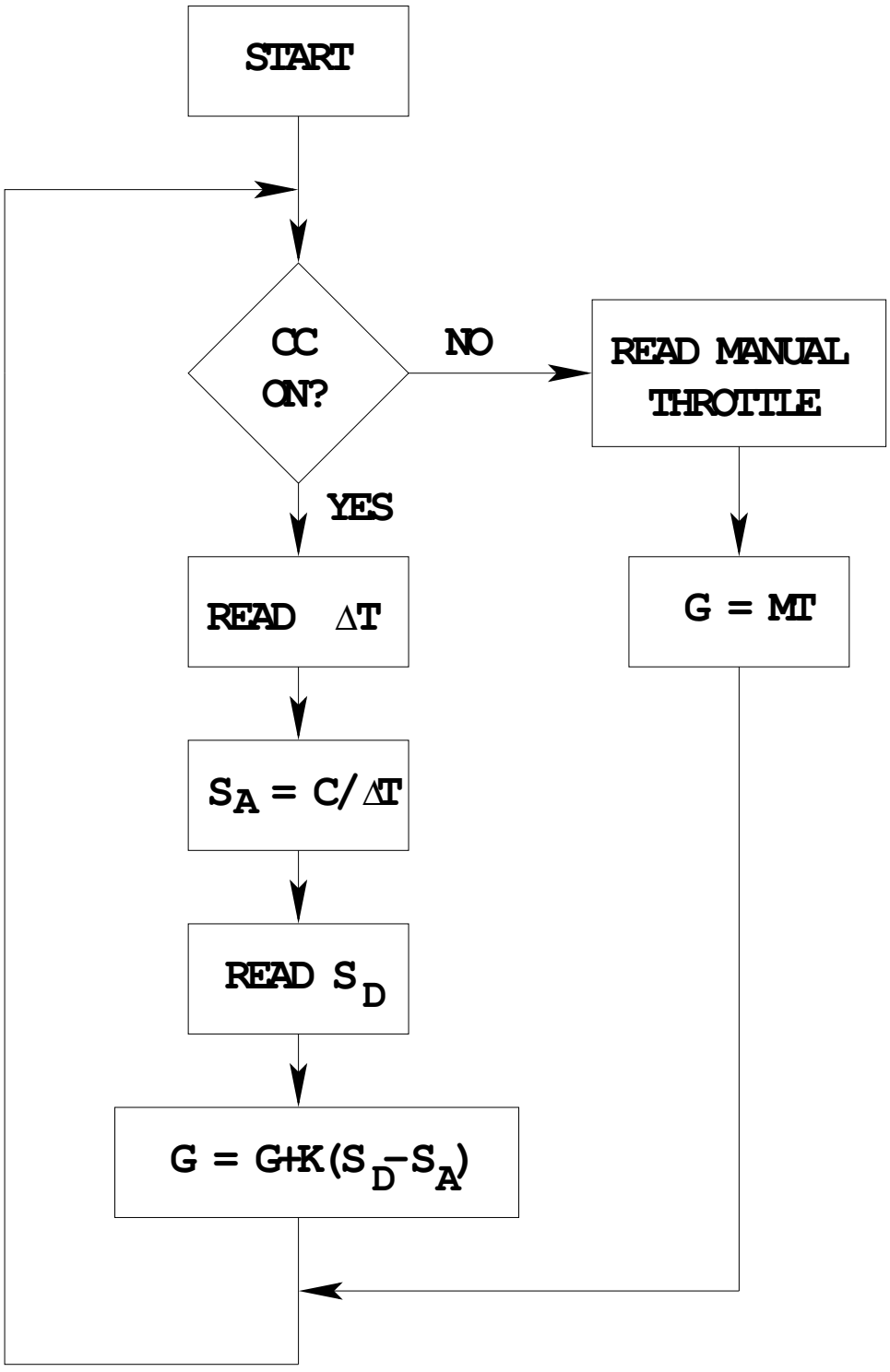

AUTOMOBILE CRUISE CONTROL
THROTTLE
CONTROL
MEASURE SPEED
SET DESIRED SPEED

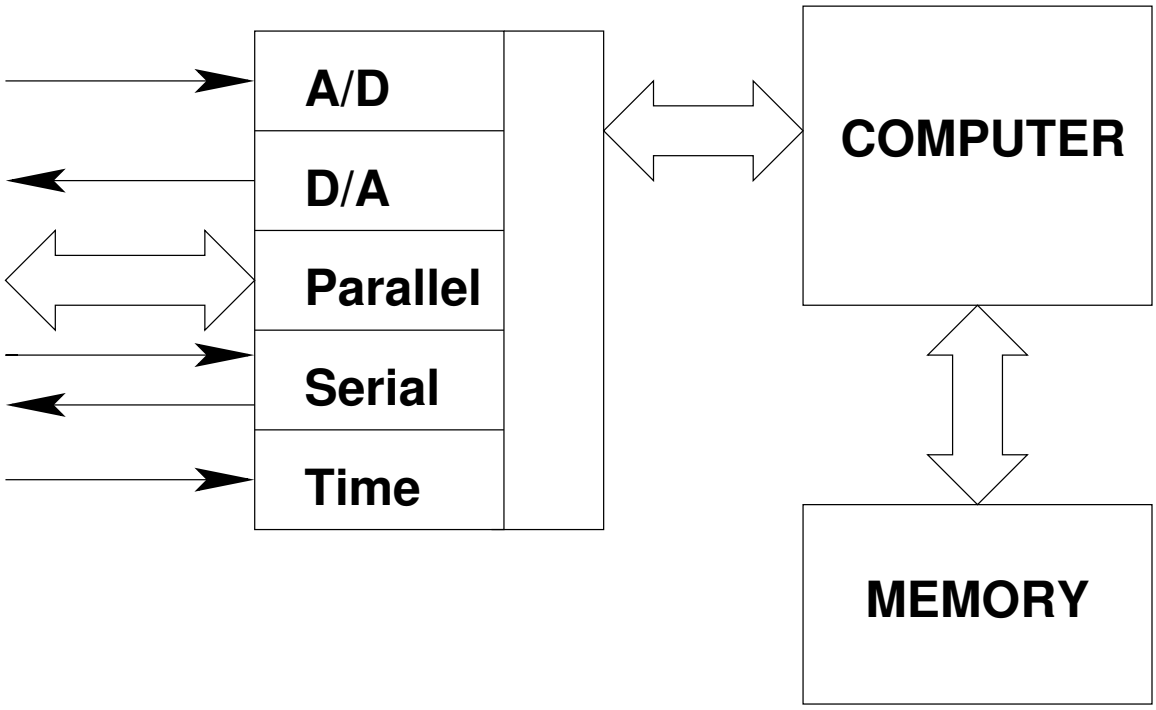
AUTOMOBILE CRUISE CONTROL



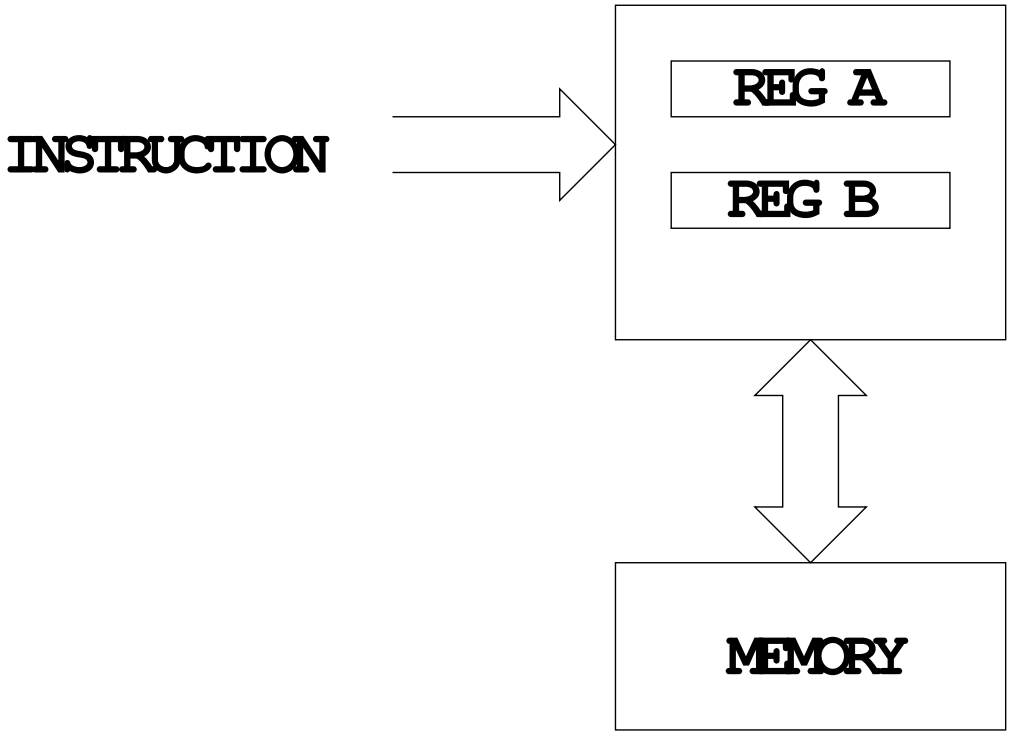
ΔT = time for one revolution of wheel.

Speed = $C/\Delta T$, where C is the circumference of the wheel

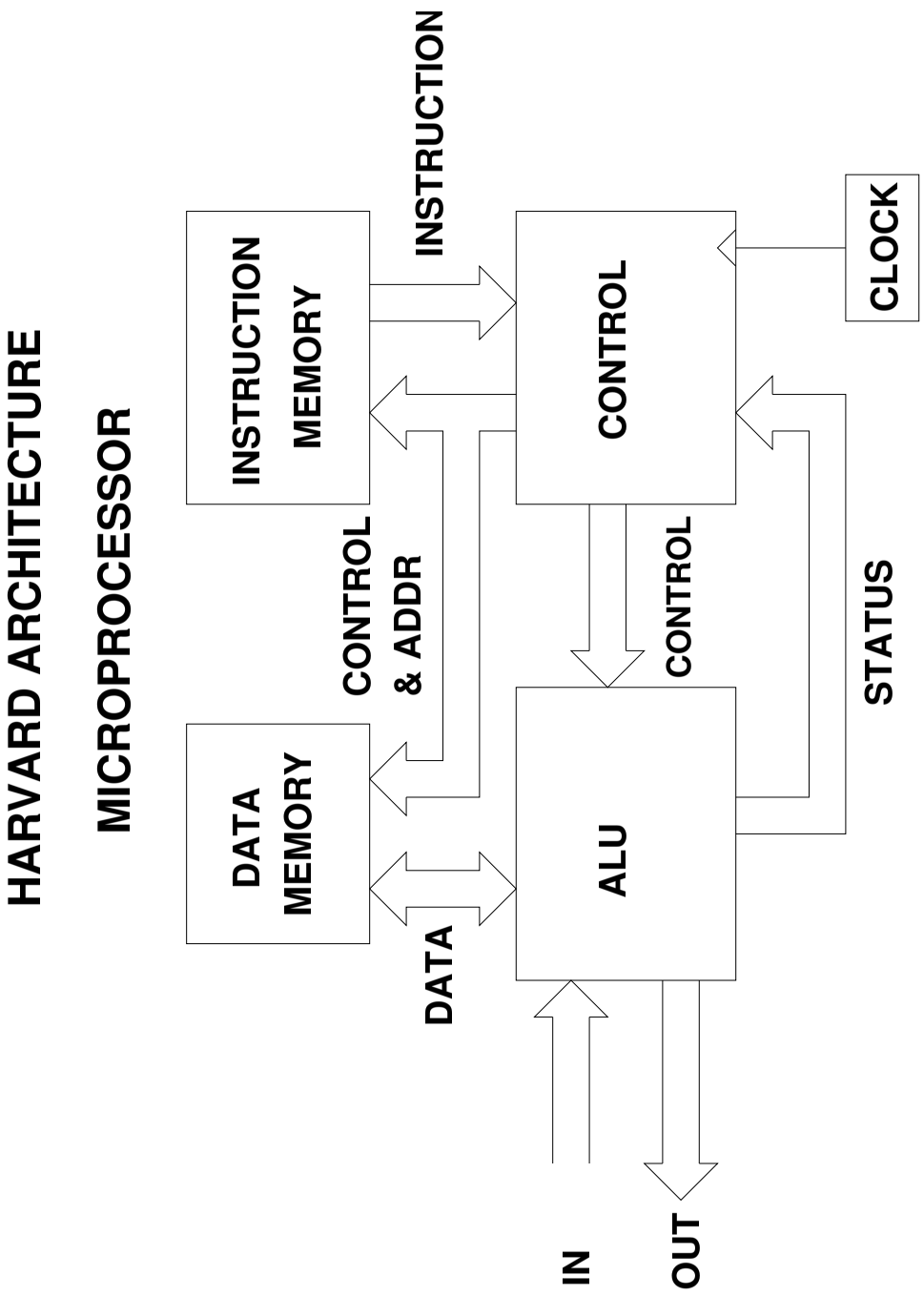

START
CC ON?
NO
READ MANUAL THROTTLE
YES
READ ΔT
G = MT
S_A = C/ΔT
READ S_D
G = G+K(S_D−S_A)

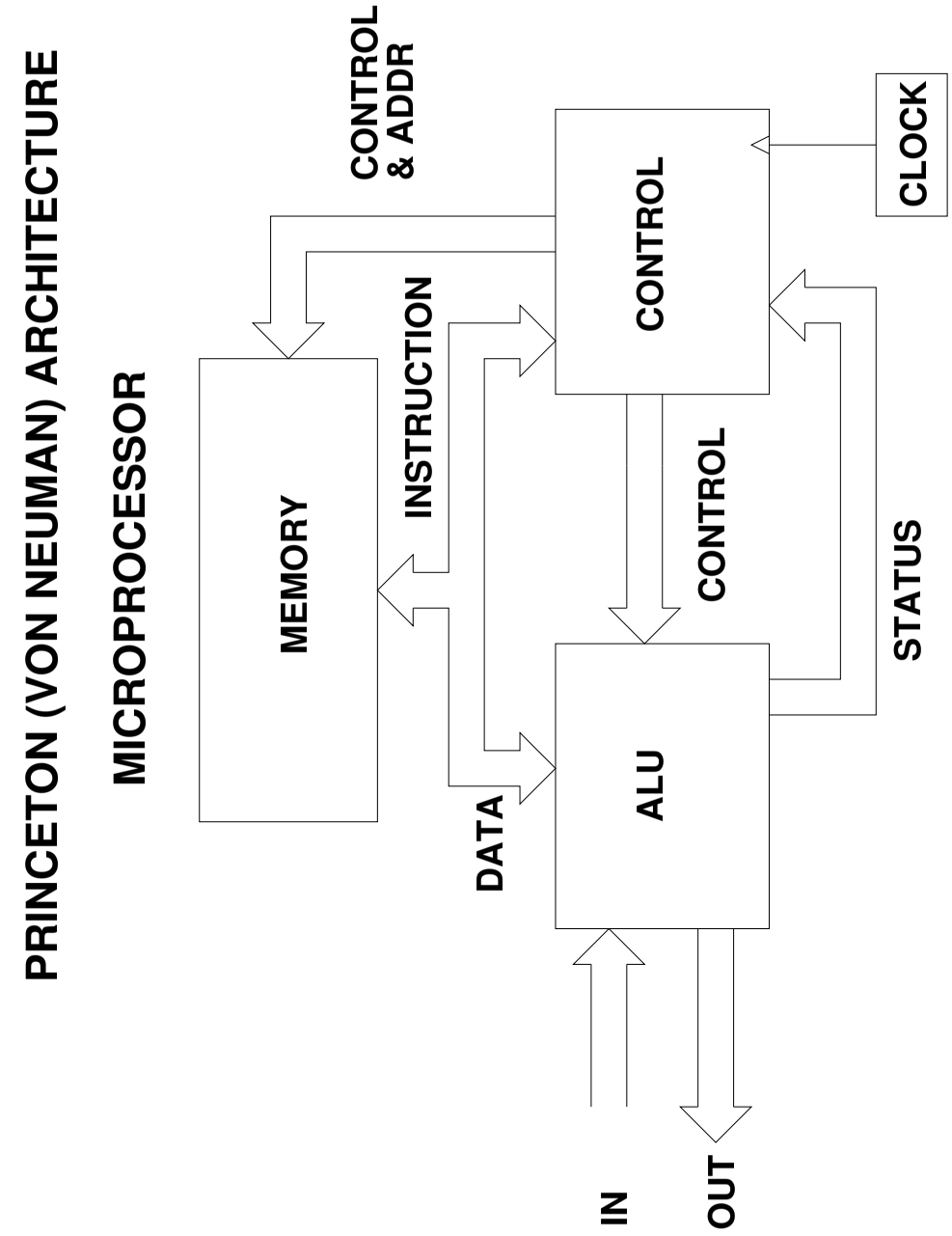

MICROCONTROLLER
A/D
D/A
Parallel
Serial
Time
COMPUTER
MEMORY

SIMPLE MICROPROCESSOR



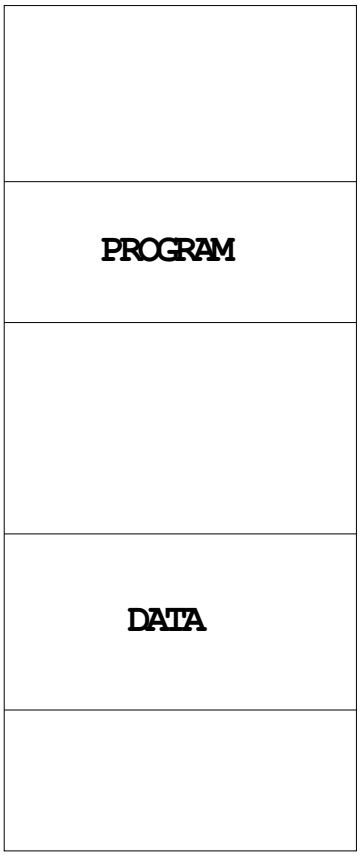
INSTRUCTION	ACTION
18 06	(A) + (B) => A
87	0 => A
5A 05	(A) => Address 5


HARVARD ARCHITECTURE
MICROPROCESSOR
INSTRUCTION MEMORY
INSTRUCTION
CONTROL
CLOCK
DATA MEMORY
CONTROL & ADDR
CONTROL
STATUS
ALU
DATA
IN
OUT


PRINCETON (VON NEUMAN) ARCHITECTURE
MICROPROCESSOR
CONTROL & ADDR
CONTROL
CLOCK
MEMORY
INSTRUCTION
CONTROL
STATUS
DATA
ALU
IN
OUT

MEMORY MAP

(Princeton Architecture)



Function of memory determined by programmer

Binary	Hex	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

Convert Binary to Decimal

1111011_2

$1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$1 \times 64 + 1 \times 32 + 1 \times 16 + 1 \times 8 + 0 \times 4 + 1 \times 2 + 1 \times$

123_{10}

Convert Hex to Decimal

$82D6_{16}$

$8 \times 16^3 + 2 \times 16^2 + 13 \times 16^1 + 6 \times 16^0$

$8 \times 4096 + 2 \times 256 + 13 \times 16 + 6 \times 1$

33494_{10}