# Peripheral Interface Device 8155 (I/O Interface & Timer)

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# Outline

- Programmable Interface device  (Introduction)
- Requirement for programmable interface device
- Simple example configurable device
- Programmable Interface device 8155
  - Block diagram
  - Address diagram
  - Interfacing LED using 8155
- 8155 Timer
  - Modes of timer
  - Square wave generation using 8155 interfaced timer
- Next class (8055 Handshake & Interrupt mode)

# Programmable Interface Device

- Designed to perform various I/O functions
- Device can be setup to perform specific functions
  - By writing instruction to a internal register
- Can be changed during execution of the program
- Devices are flexible, versatile & economical

# Programmable Interface Device

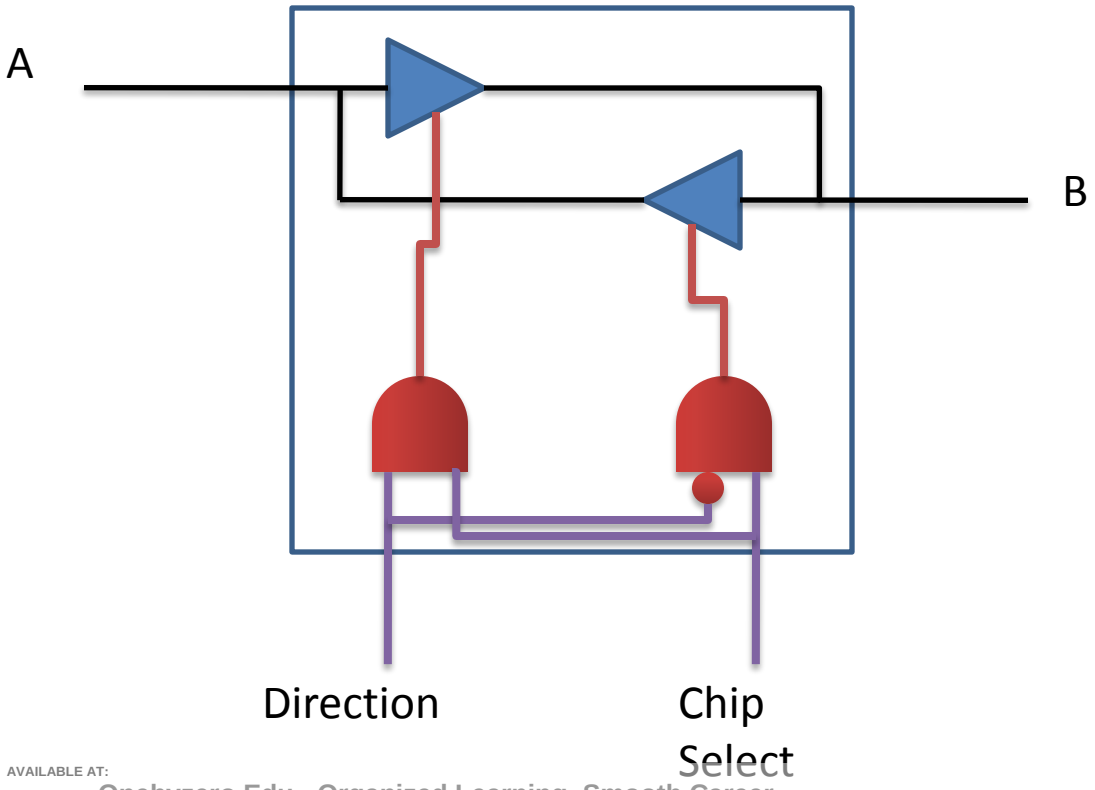
- Functions are determined by software instructions
- Can be viewed as multiple I/O device
- Perform many functions
  - Time delay, counting, interrupts
- Consists of many devices on a chip, interconnect through a common Bus
- Software programmable approach of I/O reduce design time

# Requirement for a programmable Interface Device

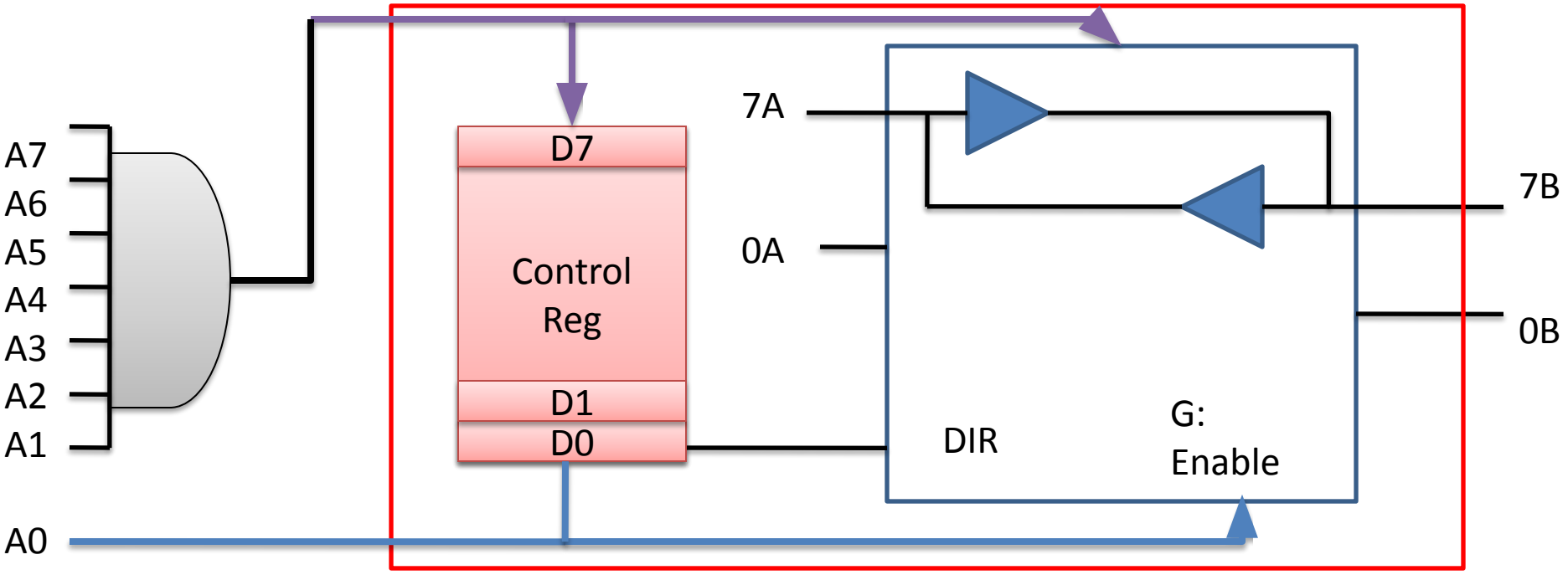
- I/P & O/P Regs: A group of latches to hold data
- Tri-State Buffer
- Capability of Bidirectional data flow
- Handshake & Interrupt signal
- Control Logic
- Chip Select Logic
- Interrupt control logic

# Programmable interface Device

- Configurable Device Example
- Latch Direction



# Making latches programmable



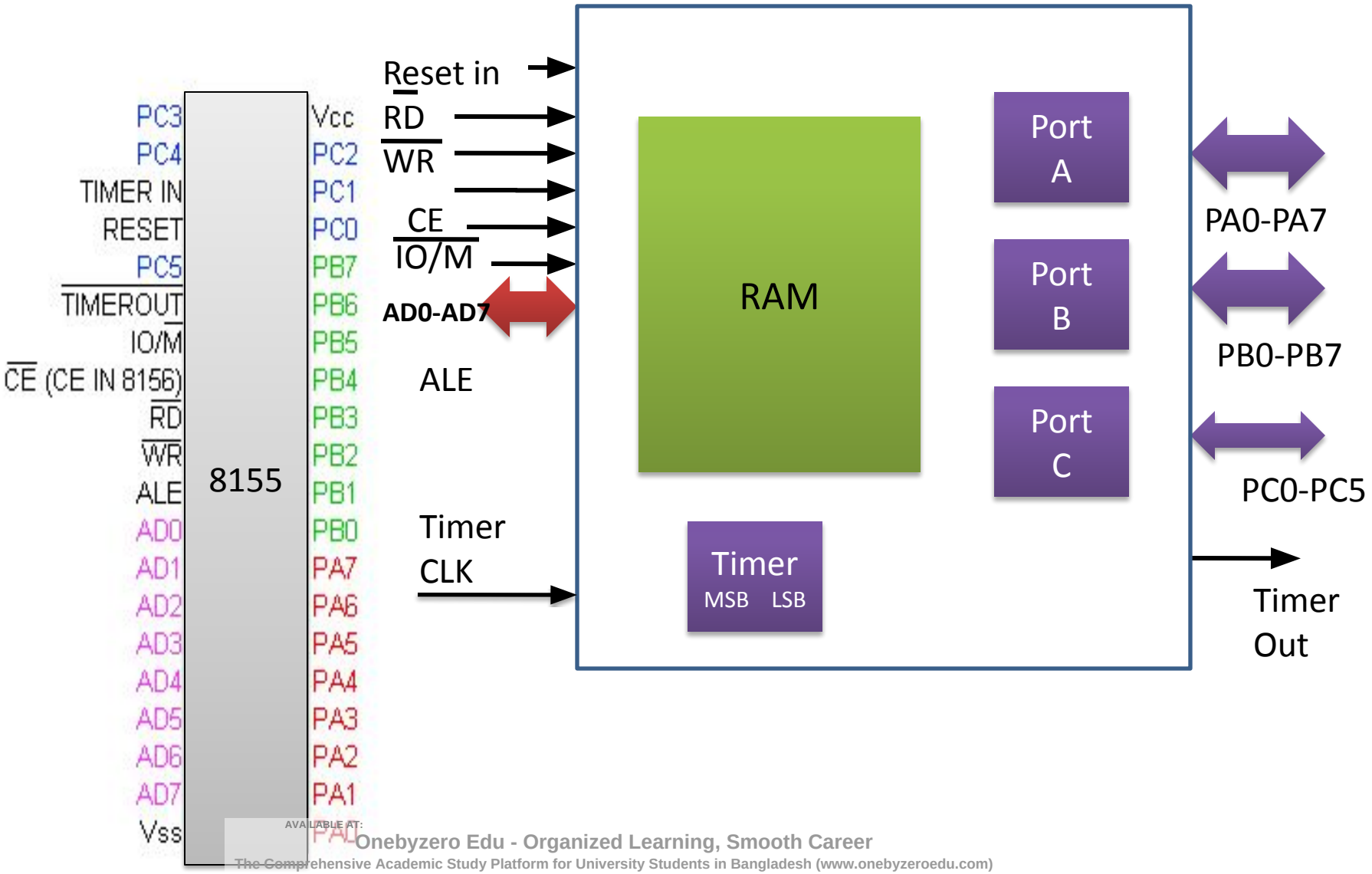

- Program

```
MVI     A,01 H   ; Set Do=1, D1-D7==0
OUT     FFH      ;Write in control register
MVI     A,BYTE1      ;Load data bye
OUT     FEH      ; Send Data out
```

# 8155 Features

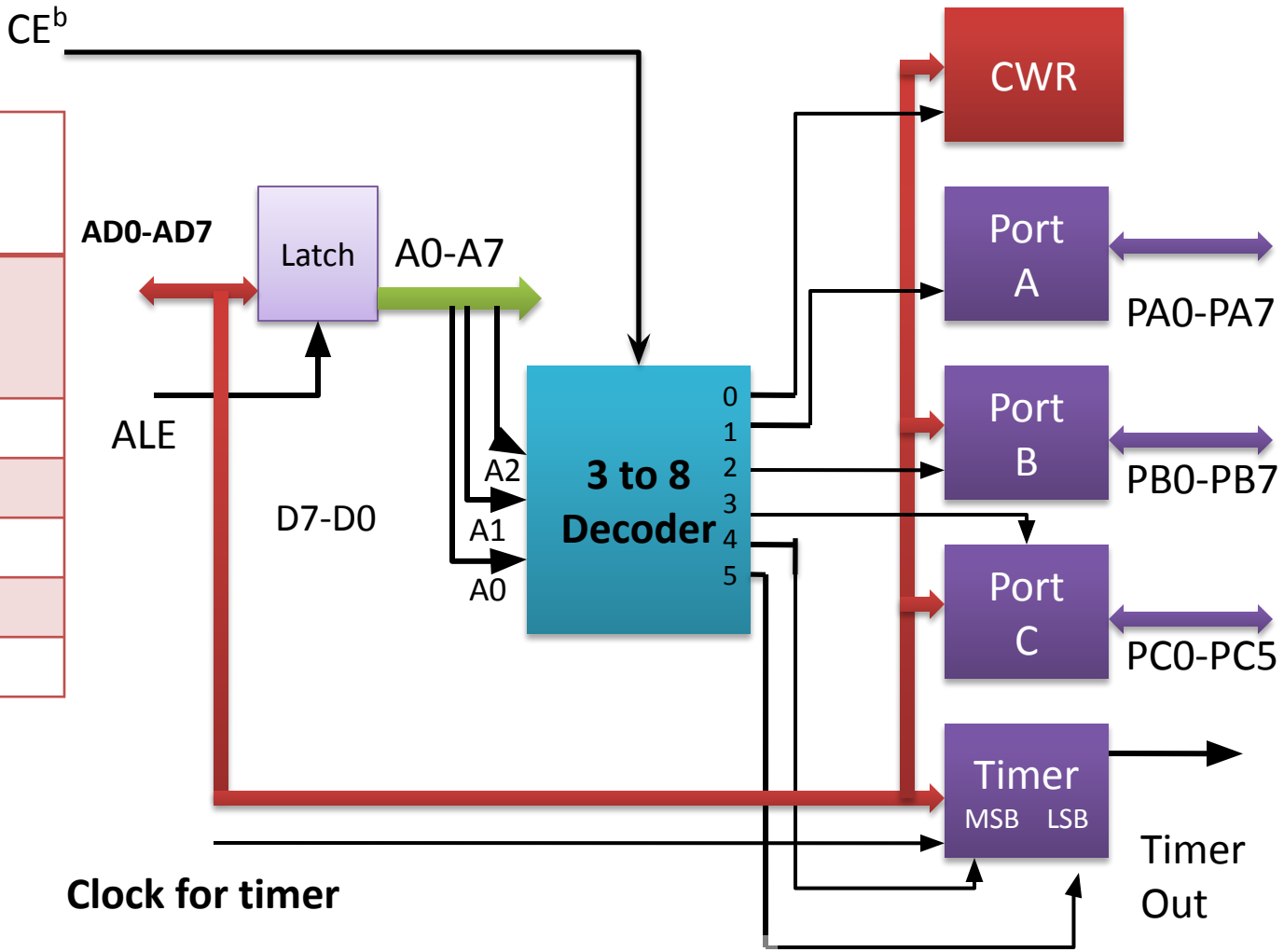
- 2kbits static RAM 256x8
- 2 programmable 8 bit I/O ports
- 1 programmable 6 bit I/O port
- 1 programmable 14 bit binary counter/timer
- Internal address latch to Demux AD0-AD7, using ALE line

# 8155 Block Diagram

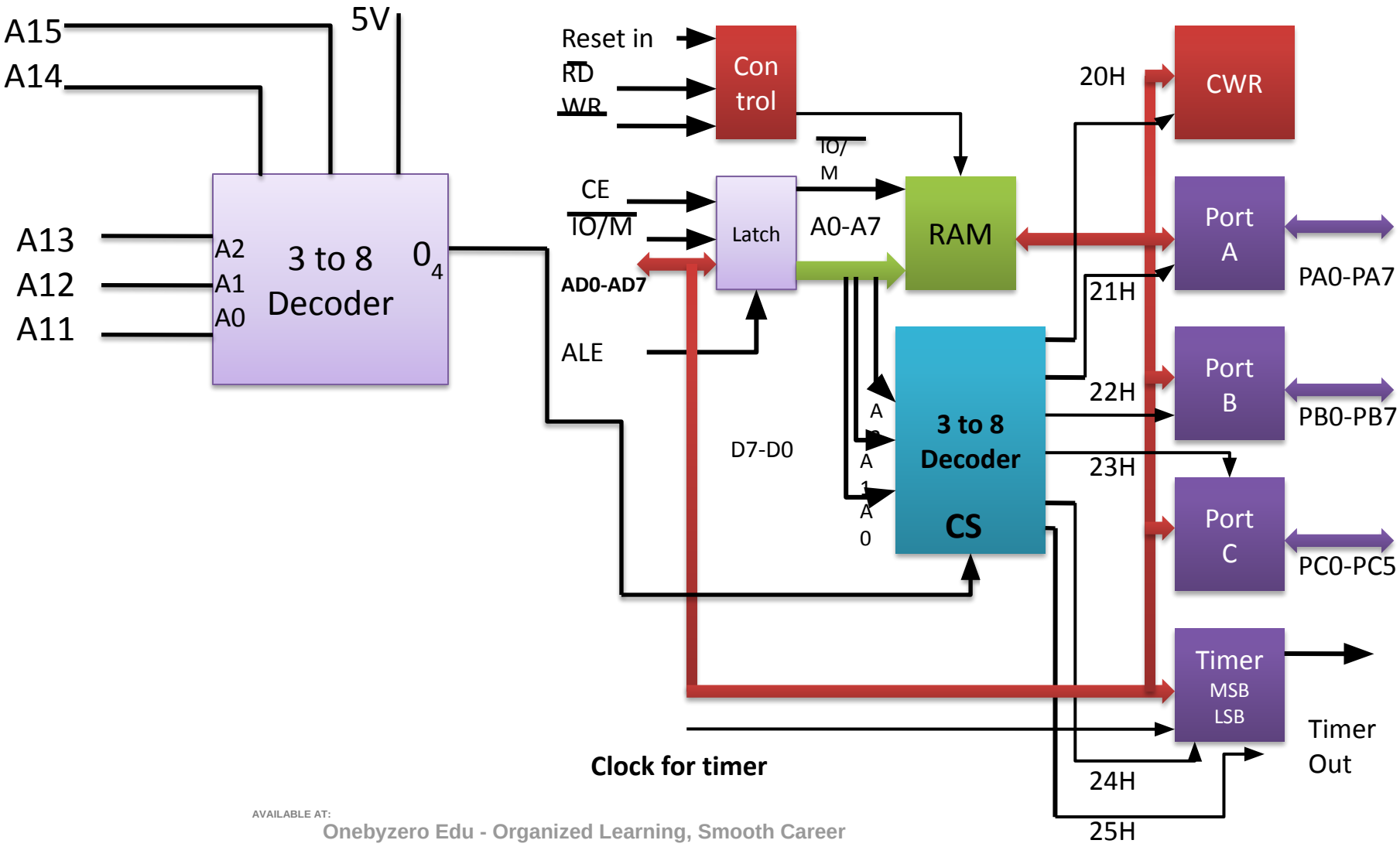


# Expanded Block Diagram

| A2 | A1 | A0 | Port (ALE high, AD0=A0) |
|---|---|---|---|
| 0 | 0 | 0 | Command /Status Register |
| 0 | 0 | 1 | PA |
| 0 | 1 | 0 | PB |
| 0 | 1 | 1 | PC |
| 1 | 0 | 0 | Timer LSB |
| 1 | 0 | 1 | Timer MSB |



# Calculate Address of Port of 8155



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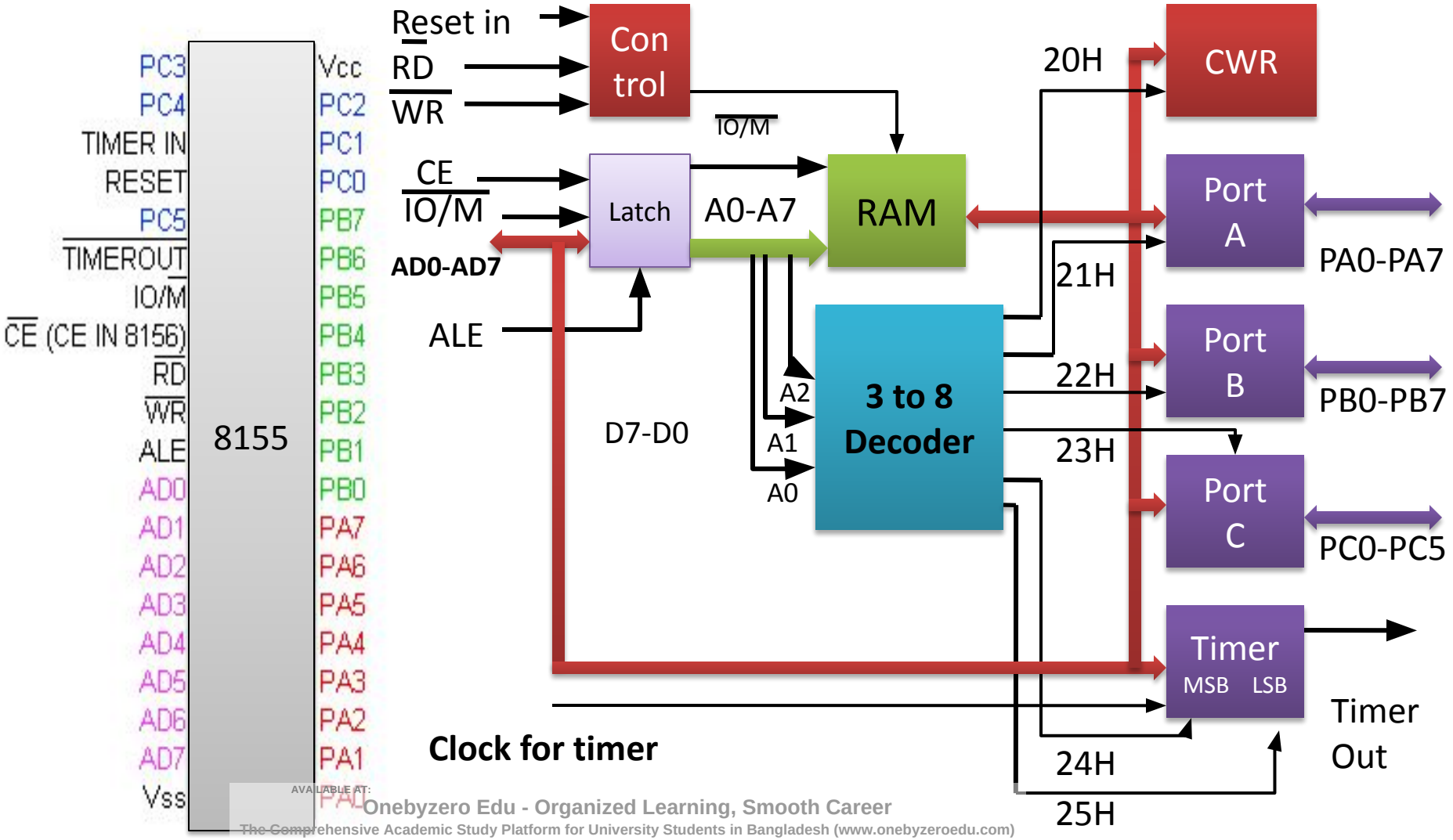


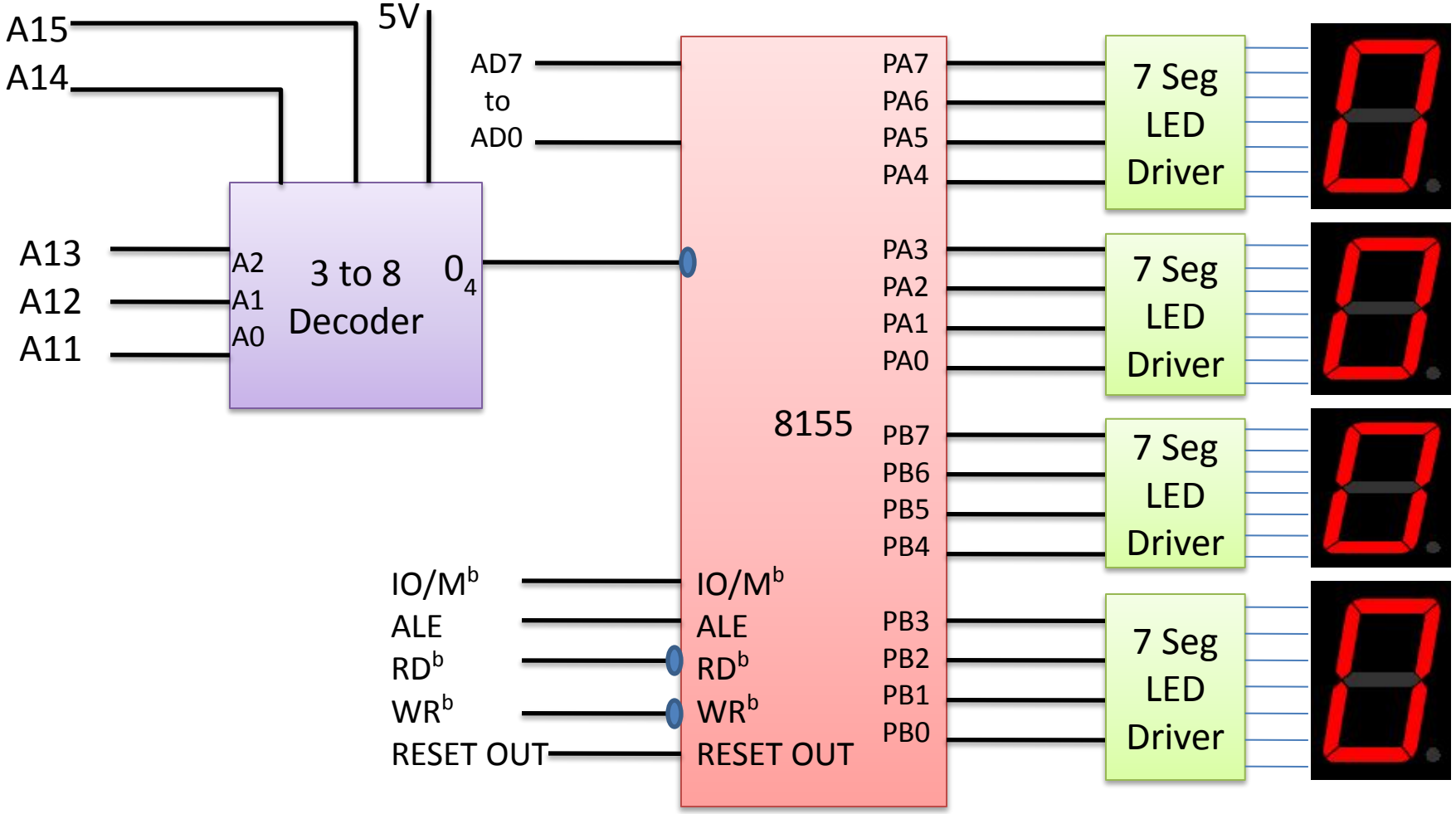
# Control word (command reg) format

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|
| Timer Command | | IEB | IEA | PC | | PB | PA |

- D0, D1: mode for PA and PB, 0=IN, 1=OUT
- D2, D3: mode for PC
- D4, D5: interrupt EN for PA and PB, 0=disable 1=enable
- D6, D7: Timer command:
  - 00: No effect
  - 01: Stop if running else no effect
  - 10: Stop after terminal count (TC) if running, else no effect
  - 11: Start if not running, reload at TC if running.
- Port C bits (D2, D3)

| ALT | D3 | D2 | PC5 | PC4 | PC3 | PC2 | PC1 | PC0 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | IN | IN | IN | IN | IN | IN |
| 2 | 0 | 1 | OUT | OUT | OUT | OUT | OUT | OUT |
| 3 | 1 | 0 | OUT | OUT | OUT | $STB_A$ | $BF_A$ | $INTR_A$ |
| 4 | 1 | 1 | $STB_B$ | $BF_B$ | $INTR_B$ | $STB_A$ | $BF_A$ | $INTR_A$ |

# Interfacing 7 Segment LEDs to output port using 8155



# Interfacing LEDs Cntd..

- Port Address
  - Control Register=20H, Port A= 21H, Port B= 22H
- Control word:

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Timer | | Not Applicable | | Use for Port C | | Port B Output | Port A Output |

- Program
  - MVI A,03 ; initialize Port A &B for O/P
  - OUT 20H
  - MVI A, BYTE1 ; Display BYTE1 at port A
  - OUT 21H
  - MVI A, BYTE2 ; Display BYTE2 at port B
  - OUT 22H

# Reference

- R S Gaonkar, “Microprocessor Architecture”, Chapter 14

# Thanks