16.317: Microprocessor Systems Design I

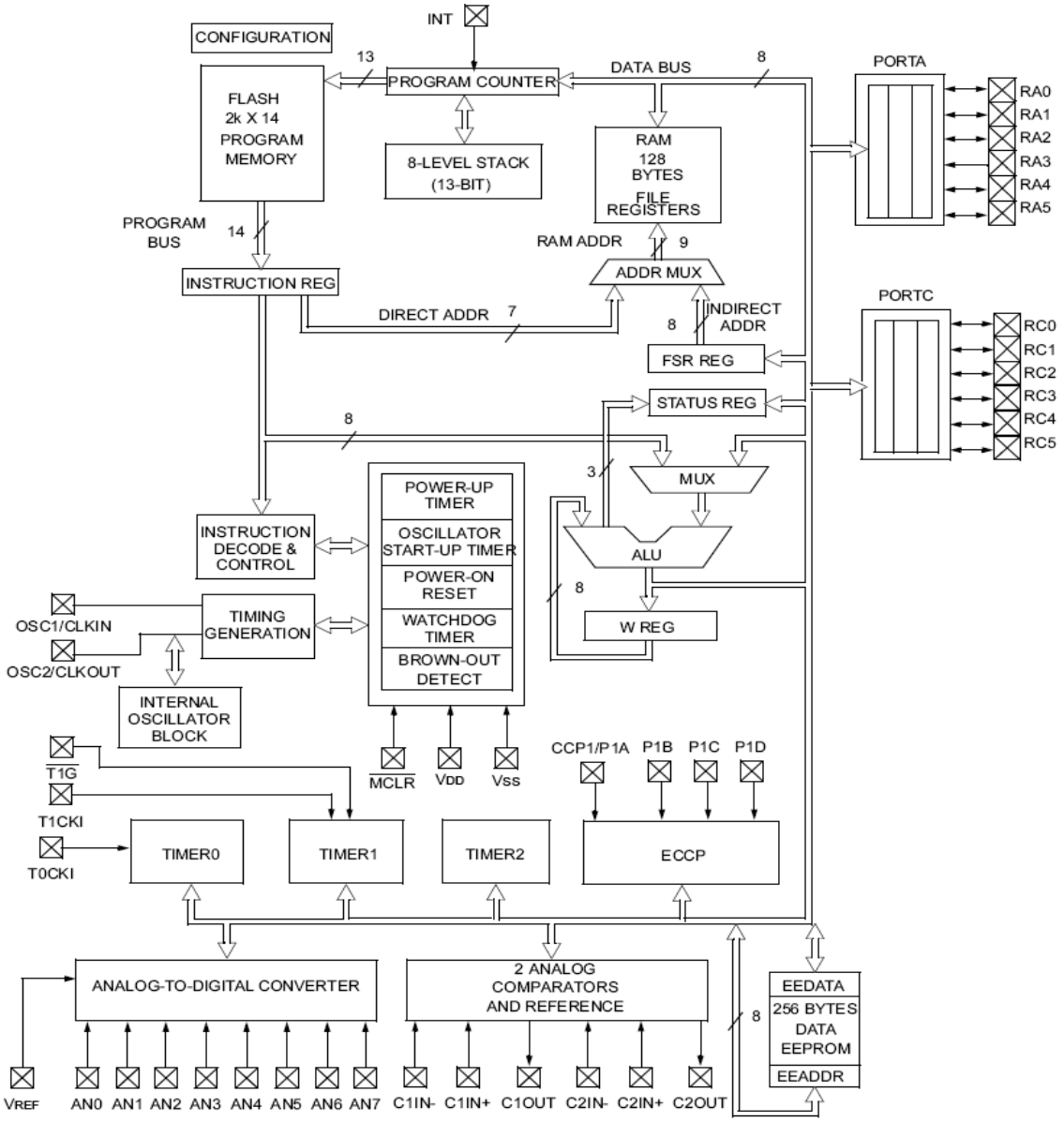
Summer 2013

Lecture 8: Key Questions
August 6, 2013

1. Explain the major differences between a microprocessor and a microcontroller, including the typical features of a microcontroller.

2. Explain the major benefits and limitations of using a microcontroller.

3. Explain the general components of the PIC 16F684 block diagram shown below.



4. Briefly explain why the PIC 16F684 has so few pins and how they can be used to access all of the components shown above.

5. What is the difference between Harvard and von Neumann memory architectures?

6. Explain the basic organization of the PIC data memory.

7. Explain the purpose of the PCL and PCLATH registers.

8. Briefly describe the contents of the STATUS register.

9. Explain the basic organization of the PIC stack.

10. Explain how different memory banks are accessed in PIC microcontrollers, and what the general function of each bank is.

11. Explain direct addressing on the PIC microcontrollers.

12. Example: What address on the PIC16F684, which has 2 banks, is being accessed if:

- STATUS = 60h, instruction = 031Fh?

- STATUS = 40h, instruction = 1F02h?

- STATUS = 13h, instruction = 0793h?

- STATUS = EEh, instruction = 03F1h?

13. Explain indirect addressing on the PIC microcontrollers.

14. Explain how I/O ports are managed through special function registers. In the example below, what bits of PORTA are inputs? What bits are outputs?

```
bcf         STATUS, RP0   ; bank0
bcf         STATUS, RP1
clrf        PORTA         ; initializing PORTA by
                          ; clearing output data latches
 bsf        STATUS, RP0   ; select bank1
 movlw      0xCF          ; value used to initialize
                          ; data direction
 movwf      TRISA
```

15. Describe the instruction formats of the PIC 16F684.

16. Describe how variables can be declared in PIC assembly language.

17. Describe the PIC instructions for clearing or moving registers.

18. Describe the PIC instructions for manipulating a single bit.

19. **Example:** Show the values of all changed registers after the following sequence

```
cblock    0x30
     x
     y
endc
clrw
movwf     x
movlw     0xFE
movwf     y
swapf     y, F
bcf       y, 3
bsf       x, 3
movf      y, W
```

20. Describe the PIC instructions for increment, decrement, and complement operations.

21. Describe the PIC instructions for addition and subtraction.

22. **Example**: Show the values of all changed registers after the following sequence

```
cblock    0x20
     varA
     varB
     varC
endc
clrf      varA
clrf      varB
clrf      varC
incf      varA, W
sublw     0x0F
addwf     varB, F
decf      varB, F
comf      varB, W
subwf     varC, F
```

23. Describe the PIC instructions used for multi-bit bitwise operations.

24. Describe the PIC rotate instructions.

25. **Example:** Show the values of all changed registers after the following sequence. Assume the carry bit is initially 0

```
cblock    0x40
     z
endc

clrf      z
movlw     0xF0
iorwf     z, F
xorlw     0xFF
rrf       z, F
andwf     z, W
rlf       z, F
```