

# EE 2004

## Week 13 Tutorial

Solution for this set of review questions will not be posted since answers for these questions can all be found in your lecture notes.

1. Explain why the bra instruction takes 2 instruction cycles to execute.
2. Look at the description of the bz instruction in the data sheet attached below. Can you explain why 2 instruction cycles would be taken if branching occurs and only 1 instruction cycle would be taken if branching does not occur?

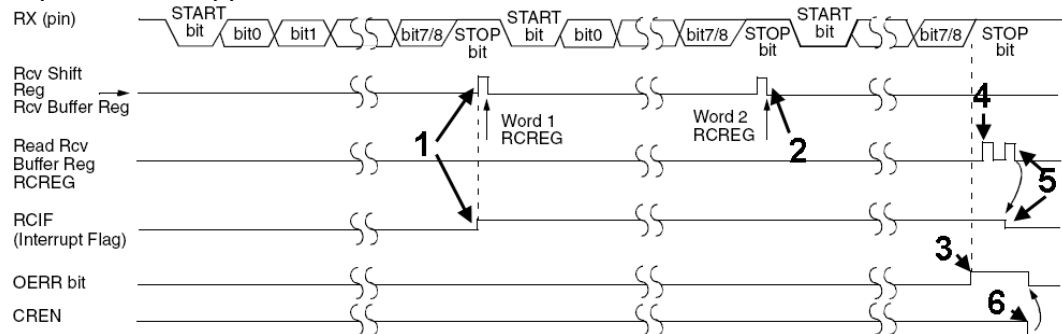
BZ		Branch If Zero			
Syntax:	[ label ] BZ n				
Operands:	$-128 \leq n \leq 127$				
Operation:	If Zero bit is '1' $(PC) + 2 + 2n \rightarrow PC$				
Status Affected:	None				
Encoding:	1110	0000	nnnn	nnnn	
Description:	If the Zero bit is '1', then the program will branch. The 2's complement number '2n' is added to the PC. Since the PC will have incremented to fetch the next instruction, the new address will be $PC+2+2n$ . This instruction is then a two-cycle instruction.				
Words:	1				
Cycles:	1(2)				
Q Cycle Activity:					
If Jump:	Q1	Q2	Q3	Q4	
	Decode	Read literal 'n'	Process Data	Write to PC	
	No operation	No operation	No operation	No operation	
If No Jump:	Q1	Q2	Q3	Q4	
	Decode	Read literal 'n'	Process Data	No operation	

3. Use examples to illustrate the behaviour of the auto-increment options: `POSTINCx`, `POSTDECx` and `PREINCx`.
4. Use examples to illustrate the behaviour of the auto-increment options used in table read operations: `tblrd*`, `tblrd*+`, `tblrd*-` and `tblrd*+`.
5. What are the advantages of interrupt over polling?
6. List three actions the microcontroller would perform after an interrupt is triggered and before the program enters the corresponding ISR.
7. Explain the difference between `return` and `retfie`.
8. Describe advantages of serial communications over parallel communications.
9. What is the difference between half duplex and full duplex modes?

10. Describe the differences between asynchronous and synchronous communications.

11. Why is a start bit required for UART communication?

12. Explain what happens in Time Point 3. How to deal with this error?



13. As a programmer, how would you initiate UART transmission? How do you know a complete byte has been shifted out?

14. How would you enable UART reception? How do you know a complete byte has been received?

15. How does a programmer initiate transmission in the I<sup>2</sup>C protocol? How does a programmer know a complete byte has been shifted out?

16. Answer the same set of questions for I<sup>2</sup>C reception.

17. Assume  $f_{OSC} = 4\text{MHz}$ , write a few instructions to turn on and configure PIC18F4520 ADC with the following requirements:

- ADC converts the analog signal fed into Channel AN3.
- ADC result is left justified.
- Select  $V_{DD}$  and  $V_{SS}$  as reference voltages.
- $T_{AD}$  must be at least  $2.5\ \mu\text{s}$ .
- $T_{ACQ}$  must be at least  $18\ \mu\text{s}$ .

18. What are some advantages of using C to program a microcontroller instead of assembly language? What are the disadvantages?