Homework #2

## Complete the assigned problems (10 Points)

**Chapter 2: 1, 2, 5, 6, 7, 13-16, 18-22, 29, 31, 38, 39c, 42, 44-47, 51-53, 57 adh, 63 ace (scanned problems are at the end of this document)**

Hint: See Chapter 2, Problem 63 Example Problem: **Chapter 2 Problem 63 Link**

Chapter 2 scanned problems

1. AVR is a(n) _____-bit microcontroller.
2. The general purpose registers are _____ bits wide.
3. The value in LDI is _____ bits wide.
4. The largest number that can be loaded into the GPRs is _____ in hex.
5. What is the result of the following code and where is it kept?

```
LDI     R20,$15
LDI     R21,$13
ADD     R20,R21
```

6. Which of the following is (are) illegal?

(a) `LDI R20,500` (b) `LDI R23,50` (c) `LDI R1,00`
(d) `LDI R16,$255` (e) `LDI R42,$25` (f) `LDI R23,0xF5`
(g) `LDI 123,0x50`

7. Which of the following is (are) illegal?

(a) `ADD R20,R11` (b) `ADD R16,R1` (c) `ADD R52,R16`

13. True or false. The I/O registers are part of the data memory space.
14. True or false. The general-purpose registers are not part of the data memory space.
15. True or false. The data memory is the same size in all members of AVR.
16. If we add the I/O registers, internal RAM, and general purpose register sizes together we should get the total space for the _____.

18. What is the difference between the EEPROM and data RAM space in the AVR?
19. Can we have an AVR chip with no EEPROM?
20. Can we have an AVR chip with no data memory?
21. What is the address range for the internal RAM?
22. What is the maximum number of bytes that the AVR can have for the data memory?

29. Show a simple code to (a) load the value $15 into location $67, and (b) add it to R19 five times and place the result in R19 as the values are added. R19 should be zero before the addition starts.

31. Write a simple code to complement the contents of location $68 and place the result in R27.

38. What is the status of the C and Z flags after the following code?

```
LDI R20,0xFF
LDI R21,1
ADD R20,R21
```

39. Find the C flag value after each of the following codes:

(a)
```
LDI R20,0x54
LDI R25,0xC4
ADD R20,R25
```

(b)
```
LDI R23,0
LDI R16,0xFF
ADD R23,R16
```

(c)
```
LDI R30,0xFF
LDI R18,0x05
ADD R30,R18
```

42. State the value (in hex) for each of the following data:

```
.EQU DAT_1 = 22
.EQU DAT_2 = $56
.EQU DAT_3 = 0b10011001
.EQU DAT_4 = 32
.EQU DAT_5 = 0xF6
.EQU DAT_6 = 0B11111011
```

44. Assembly language is a _____ (low, high)-level language while C is a _____ (low, high)-level language.
45. Of C and Assembly language, which is more efficient in terms of code generation (i.e., the amount of ROM space it uses)?
46. Which program produces the obj file?
47. True or false. The source file has the extension "asm".

51. Why are the directives also called pseudocode?
52. True or false. The .ORG directive appears in the ".lst" file.
53. The file with the _____ extension is downloaded into AVR Flash ROM.

57. Find the number of bytes each of the following instructions takes:

(a) `LDI R19,0x5`
(b) `LDI R30,$9F`
(c) `ADD R20,R21`
(d) `ADD R22,R20`
(e) `LDI R18,0x41`
(f) `LDI R28,20`
(g) `ADD R1,R3`
(h) `JMP`

63. Find the on-chip program ROM size in K for the AVR chip with the following address ranges:

(a) $0000–$1FFF
(b) $0000–$3FFF
(c) $0000–$7FFF
(d) $0000–$FFFF
(e) $0000–$1FFFF
(f) $00000–$3FFFF
(g) $00000–$FFF
(h) $00000–$1FF