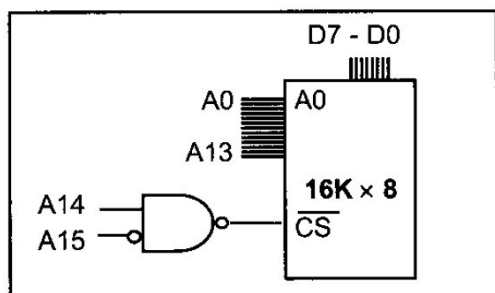


این تمرینها را دوتفره در گروههای مشخص شده تحویل دهید

AVR STRUCTURE

1. Find the organization and chip capacity of each RAM with indicated number of address and data pins.
 - a. 11 address, 1 data SRAM
 - b. 17 address, 8 data SRAM
 - c. 9 address, 1 data DRAM
2. Show the ASCII code (in hex) for the following strings:
"U.S.A. is a country in North America"
3. A given computer has a 32-bit data bus. What is the largest number that can be carried into the CPU at a time?
4. Find the address range of memory design in the diagram



5. Using the 74138, design the memory decoding circuitry in which the memory block controlled by Y0 is in the range 0000H to 1FFFH. Indicate the size of the memory block controlled by each Y.

INSTRUCTION SET

6. Which of the following is (are) illegal, and why?
 - a) ADD R20, R11
 - b) ADD R16, R1
 - c) ADD R52, R16
 - d) LDI R16, \$255
 - e) LDI R23, 0xF5
7. What is the status of the C and Z flags after the following code?

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

8. 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

9. Indicate the size (8- or 16-bit) of each of the following registers.

R0= R24= PORTA=
Data memory Location \$300= Program memory Location \$300=

10. Indicate the largest value (in decimal) that each register can contain.

R0= R24= PORTA=
Data memory Location \$300= Program memory Location \$300=

11. Who generates each of the following files and what is the use of each.

a. .asm b. .lst c. .obj d. .eep e. .hex

OPCODE

Do this exercise without using AtmelStudio program

12. Write the .hex code of this small program:

```
mov    r24,r7
cbr    r24,0b00001111    ; limit to 1 nibble
swap   r24
rcall  BCD_to_7SEG
cbr    porta,7
call   WriteDisplay
ldi    r31,200
```

BCD_to_7SEG:

```

ldi    ZL,low(table<<1)    ; load address of look-up table
ldi    ZH,high(table<<1)
clr    r1
add    ZL, r24
adc    ZH, r1
lpm    r24, Z
ret

```

13. Rewrite the code of this part of FLASH:

Memory: prog FLASH	
prog 0x0000	ff ff ff ff ff ff ff ff ff ff ff
prog 0x000C	ff ff ff ff ff ff ff ff ff ff ff
prog 0x0018	ff ff ff ff ff ff ff ff ff ff ff
prog 0x0024	ff ff ff ff ff ff ff ff ff ff ff
prog 0x0030	ff ff ff ff ff ff ff ff ff ff ff
prog 0x003C	ff ff ff ff 49 e2 54 2f 5f 70 50 63
prog 0x0048	64 2f 62 95 6f 70 60 63 0c 94 28 00
prog 0x0054	ff ff ff ff ff ff ff ff ff ff ff
prog 0x0060	ff ff ff ff ff ff ff ff ff ff ff
prog 0x006C	ff ff ff ff ff ff ff ff ff ff ff
prog 0x0078	ff ff ff ff ff ff ff ff ff ff ff
prog 0x0084	ff ff ff ff ff ff ff ff ff ff ff
prog 0x0090	ff ff ff ff ff ff ff ff ff ff ff

14. According to this code, fill the Flash of the AVR.

```

.ORG 0x25
.DB 3, 'a', 0x23
.DB 0xFF
.DB "HERE"
.DW 0x2314, 0x45

```

15. a) What are the drawbacks of this program? Correct them.
b) After executing your revised code, determine what are the contents of RAM cells of the AVR.
Suppose that "1234567890abcdefgABCDEFGH" is saved in RAM from address \$66 (not shown in this code). User inserts a number between 0 to 9 using PINB.

```

.ORG 0x23
LDI SPL,LOW(151)
LDI SPL,HIGH(151)
LDI R21,5;
MOV R20,R21
LDI R22,0x00;
OUT DDRB,R22;
CALL DELAY

```

```

IN    R3,PINB;
LDI   R30,102
LDI   YL,127
ADD   R30,R3
ADC   R31,R0
ADD   R28,R3
ADC   R29,R0
HERE: LDD R2,Z+
ROR   R2
STD   Y+,R2
DEC   R20
BRNE  HERE
OVER: JMP OVER

```

DELAY:

```

NOP
NOP
PUSH  R21
PUSH  R20
NOP
RET

```

PROGRAMMING I

16. Find the number of times the following loop is performed:

```

LDI R20,200;
BACK: LDI R21,100;
HERE: DEC R21;
BRNE HERE;
DEC R20;
BRNE BACK;

```

17. Find the time delay for the delay subroutine shown below if the system has an AVR with a clock frequency of 20 MHz.

```

DELAY: LDI R20, 200
BACK: LDI R25, 100
NOP
NOP
NOP
HERE: DEC R25
BRNE HERE
DEC R20
BRNE BACK
RET

```

PROGRAMMING II: Simulation on AtmelStudio

18. Write and assemble a program to add all the single digits of your ID number and save the result in R16. Simulate this program in AVR studio and check it.
19. Write and assemble a program to make a calculator. Suppose that R16 and R17 contain the operands and R18 contain the operation (R18=0: add, R18=1: subtraction, R18=2: multiplication, R18=3: division). Put the results in R1:R0 if necessary.