

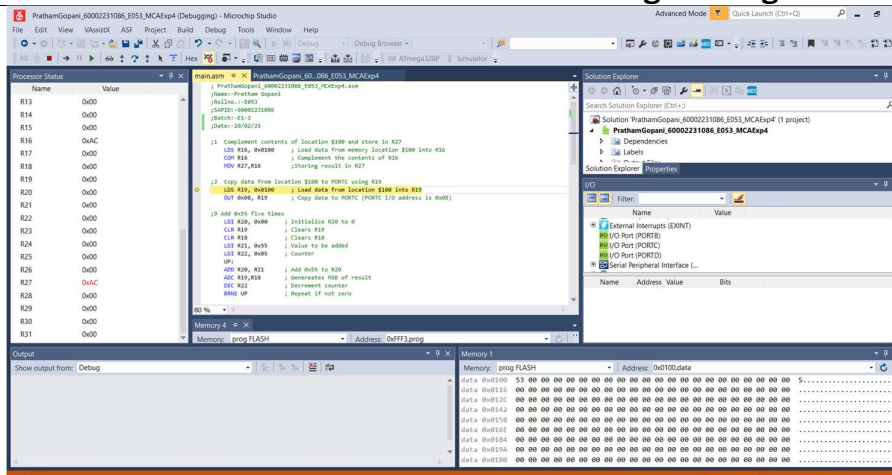
**Department of Electronics & Telecommunication Engineering****Experiment No.: FOUR****Microcontroller & Applications****Name:****Batch/Rollno:****SAP ID:****Date:**

<b>Objective:</b>	Assembly language programming in simulation environment for AVR's microcontroller ATmega328p
<b>Outcome:</b>	Programs that demonstrate the understanding and use of instructions like: LDI, ADD, CPI, LDS in light of status register - SREG
<b>Tasks/Problem Statement:</b>	<ol style="list-style-type: none"> <li>1. Write a simple code to complement the contents of location \$100 and place the result in R27.</li> <li>2. Write a simple code to copy data from location \$100 to PORTC using R19.</li> <li>3. The status register is a(n) ____ -bit register.</li> <li>4. Which bits of the status register are used for the C and H flag bits, respectively?</li> <li>5. Which bits of the status register are used for the V and N flag bits, respectively?</li> <li>6. In the ADD instruction, when is H raised?</li> <li>7. What is the status of the C and Z flags after the following code LDI R20,0xFF LDI R21,1 ADD R20,R21</li> <li>8. Find the C flag value after each of the following codes: (a)LDI R20,0x54      (b)LDI R23,0 (      c)LDI R30,0xFF LDI R25,0xC4      LDI R16,0xFF      LDI R18,0x05 ADD R20,R25      ADD R23,R16      ADD R30,R18</li> <li>9. Write a simple program in which the value 0x55 is added 5 times.</li> <li>10. Write a simple program to transfer the contents of source data block to destination data block. Both the source and destination data blocks are of 10 bytes. The memory location of the source data block start from memory location 0X0100 onwards. The memory location of the destination data block start from memory location 0X0200 onwards.</li> <li>11. Write a simple program to exchange the contents of source data block and destination data block. Both the source and destination data blocks are of 10 bytes. The memory location of the source data block start from memory location 0X0100 onwards. The memory location of the destination data block start from memory location 0X0200 onwards.</li> </ol>
<b>Programs,</b>	<ol style="list-style-type: none"> <li>1. Write a simple code to complement the contents of location \$100 and place the result in R27.</li> </ol>

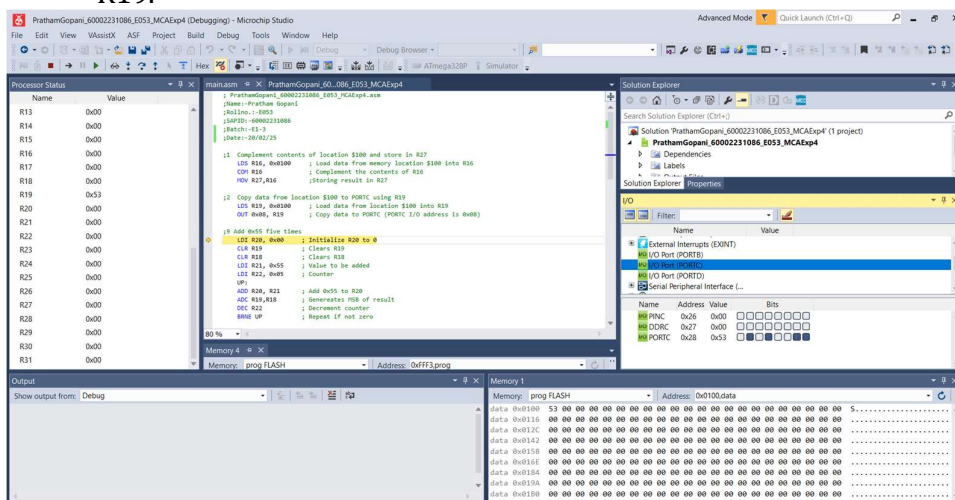


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**comments,  
 brief  
 explanation  
 and output:**



2. Write a simple code to copy data from location \$100 to PORTC using R19.



3. The status register is an 8-bit register.

4. Which bits of the status register are used for the C and H flag bits, respectively?

**C (Carry Flag): Bit 0.**

**H (Half Carry Flag): Bit 5.**

5. Which bits of the status register are used for the V and N flag bits, respectively?

**V (Overflow Flag): Bit 3.**

**N (Negative Flag): Bit 2.**

6. In the ADD instruction, when is H raised?

**The H (Half Carry) flag is raised when there is a carry from bit 3 to bit 4 during the addition of two 8-bit numbers. This is useful for BCD (Binary-Coded Decimal) arithmetic.**

7. What is the status of the C and Z flags after the following code  
 LDI R20,0xFF

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LDI R21,1

ADD R20,R21

**0xFF + 0x01 = 0x100, but since R20 is an 8-bit register, the result is 0x00 (256 - 256 = 0).**

**C (Carry Flag): Set to 1 (because there's a carry out of bit 7).**

**Z (Zero Flag): Set to 1 (because the result in R20 is 0x00).**

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

(a) LDI R20,0x54

(b) LDI R23,0

(c) LDI R30,0xFF

LDI R25,0xC4

LDI R16,0xFF

LDI R18,0x05

ADD R20,R25

ADD R23,R16

ADD R30,R18

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**0x54 + 0xC4 = 0x118 (280 in decimal).**

**Result in R20 = 0x18 (24 in decimal, truncated to 8 bits).**

**Carry Flag: 1 (carry out of bit 7).**

**0x00 + 0xFF = 0xFF (255 in decimal). Result in R23 = 0xFF.**

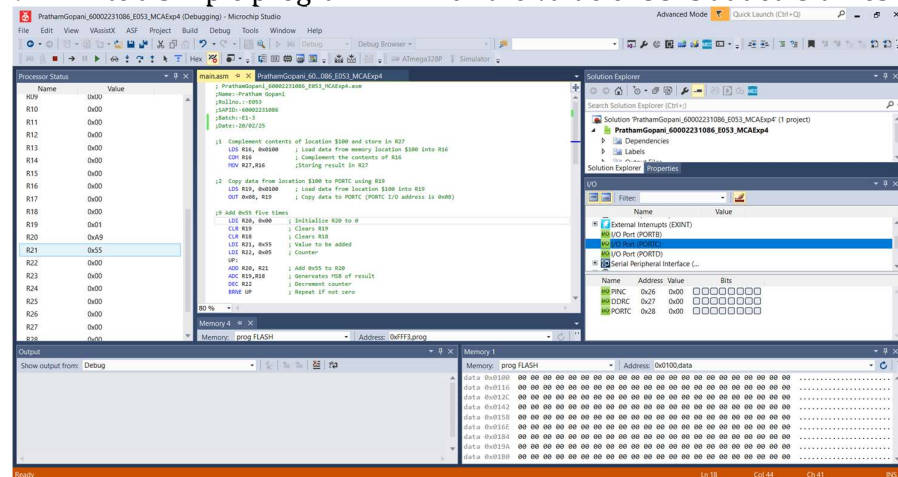
**Carry Flag: 0 (no carry out of bit 7).**

**0xFF + 0x05 = 0x104 (260 in decimal).**

**Result in R30 = 0x04 (4 in decimal, truncated to 8 bits).**

**Carry Flag: 1 (carry out of bit 7)**

9. Write a simple program in which the value 0x55 is added 5 times.

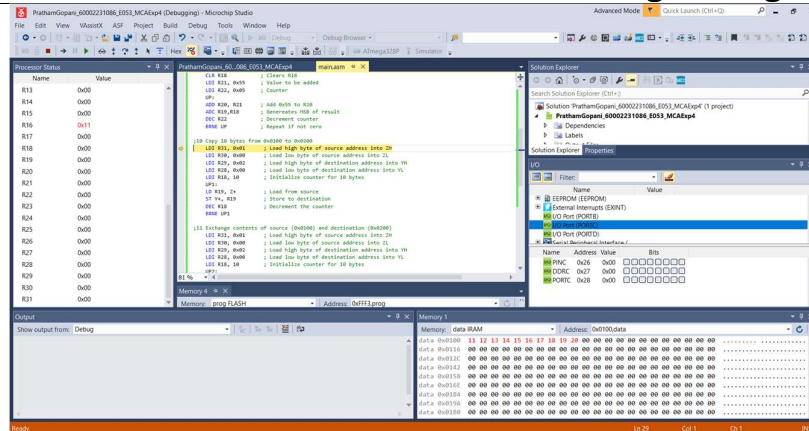


10. Write a simple program to transfer the contents of source data block to destination data block. Both the source and destination data blocks are of 10 bytes. The memory location of the source data block start from memory location 0X0100 onwards. The memory location of the destination data block start from memory location 0X0200 onwards.

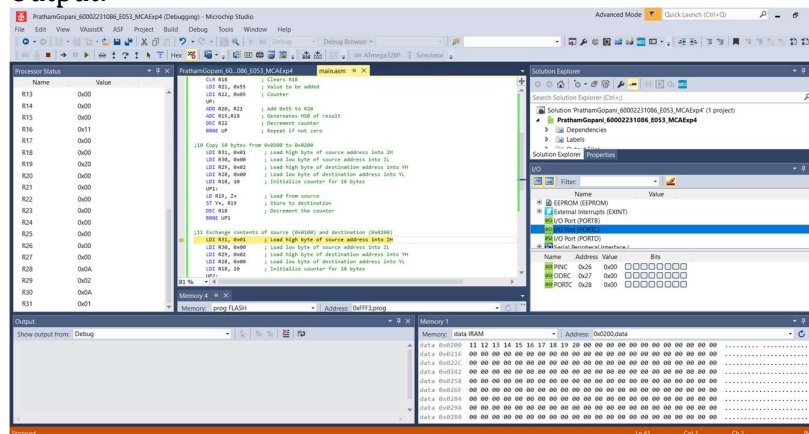
Input:-



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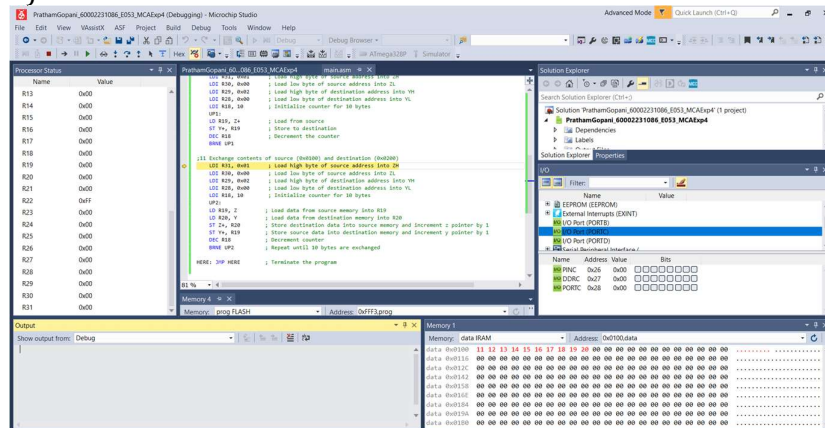
Output:-



11. Write a simple program to exchange the contents of source data block and destination data block. Both the source and destination data blocks are of 10 bytes. The memory location of the source data block start from memory location 0X0100 onwards. The memory location of the destination data block start from memory location 0X0200 onwards

Input:-

1)

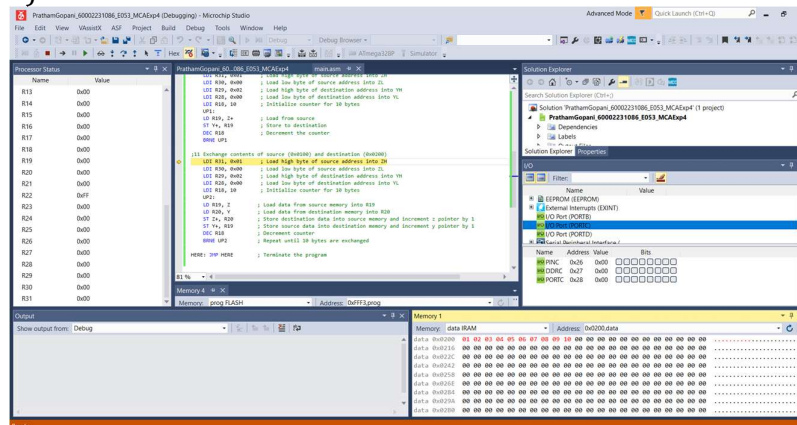






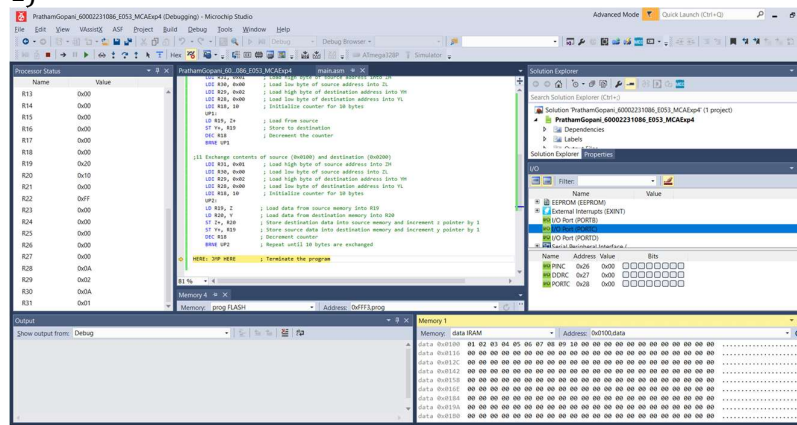
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2)

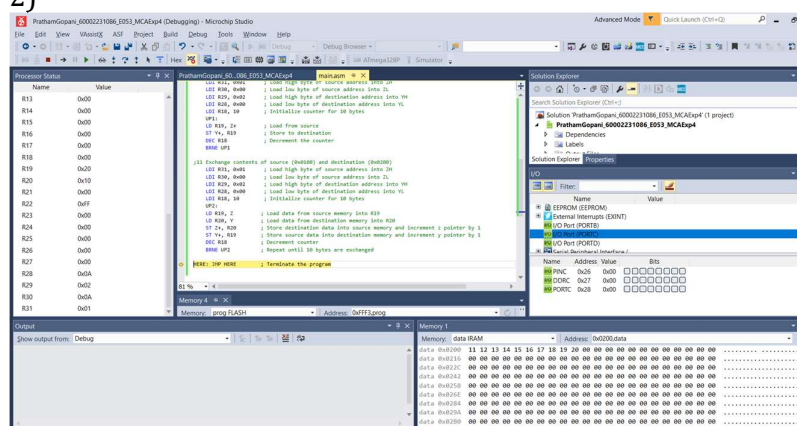


Output:-

1)



2)



Attach screen shots of the output

**NOTE:** Each code output should display student SAP id as well as Name of student along with date of performance.

### Conclusion :

This experiment provides hands-on understanding of key AVR instructions (LDI, LDS, ADD, CPI, COM) and their interaction with the Status Register (SREG). It strengthens practical knowledge of memory access, arithmetic operations, flag updates, and data manipulation critical for embedded system development.



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Assessment for Laboratory sessions  
Academic Year 2024 - 2025

Laboratory

SAP ID: 60002231061  
Course Code: DJ23ELPC403  
Batch: E2-4

(4)

Write a program to transfer a source data block of 10 bytes. Start from address  $0 \times 0100$ . Destination data block, start from memory address  $0 \times 0200$ .

LDI R26,  $0 \times 00$   
LDI R27,  $0 \times 01$   
LDI R28,  $0 \times 00$   
LDI R29,  $0 \times 02$   
LDI R16,  $0 \times 0A$   
UP: LD R20, X+

ST Y+, R20

DEC R16

BRNE UP

here : jmp here.

\* Write a program to exchange the contents of 2 data blocks of 10 bytes.

Data block 1 starts from  $0 \times 0100$

Data block 2 starts from  $0 \times 0200$