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Register number: 192212149
Subject: ECA4501-Embedded C Programming

Experiment Lab Outputs:

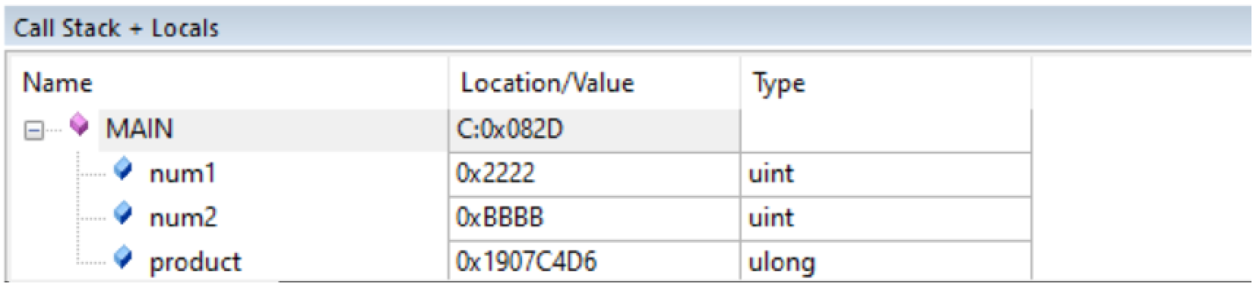
EXP 1

Aim: To Write a 8051 C program to multiply two 16 bit binary numbers.

Program:

```
#include <reg51.h>
void main ()
{
        while(1)
        {
        unsigned int num1, num2;
        unsigned long int product;
        num1=0x2222;
        num2=0xBBBB;
        product=(unsigned long int)num1*num2;
        }
}
```

Output:



Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x082D	
num1	0x2222	uint
num2	0xBBBB	uint
product	0x1907C4D6	ulong

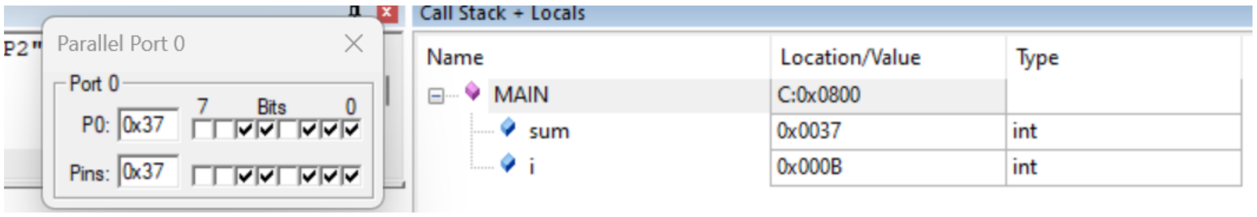
EXP 2

Aim: To Write a 8051 C program to find the sum of first 10 integer numbers.

Program:

```
#include <reg51.h>

void main() {
    int sum = 0;
    int i;

    for(i = 1; i <= 10; i++) {
        sum += i;
    }
                    P0=sum;

    while(1);
}
```

Output:



```
P0:   0x37
Pins: 0x37
```

Name	Location/Value	Type
MAIN	C:0x0800	
sum	0x0037	int
i	0x000B	int

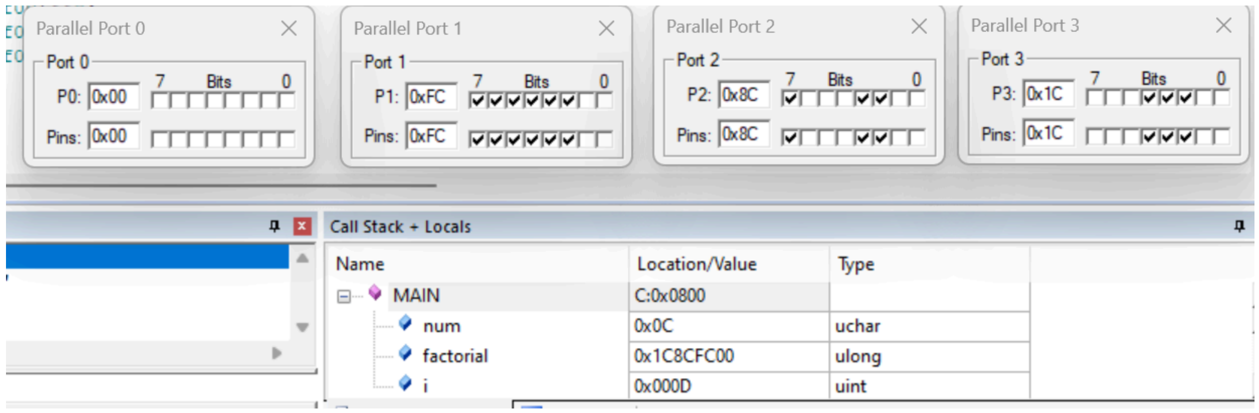
EXP 3

Aim: To write a 8051 C program to find factorials of a given number.

Program:

```
#include <reg51.h>
#include <stdio.h>

void main() {
   unsigned char num = 12;
   unsigned long factorial = 1;
   unsigned int i;

   for (i = 1; i <= num; i++) {
      factorial *= i;
   }
                  P0=factorial;
                  P1=(factorial & 0xff00)>>8;
                  P2=(factorial & 0xff0000)>>16;
                  P3=(factorial & 0xff000000)>>24;

   while (1);
}
```

Output:



```
Parallel Port 0          Parallel Port 1          Parallel Port 2          Parallel Port 3
Port 0                   Port 1                   Port 2                   Port 3
      7   Bits   0             7   Bits   0             7   Bits   0             7   Bits   0
P0:   0x00                P1:   0xFC  ✓✓✓✓✓✓        P2:   0x8C  ✓   ✓✓        P3:   0x1C     ✓✓✓
Pins: 0x00                Pins: 0xFC  ✓✓✓✓✓✓        Pins: 0x8C  ✓   ✓✓        Pins: 0x1C     ✓✓✓
```

Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x0800	
num	0x0C	uchar
factorial	0x1C8CFC00	ulong
i	0x000D	uint

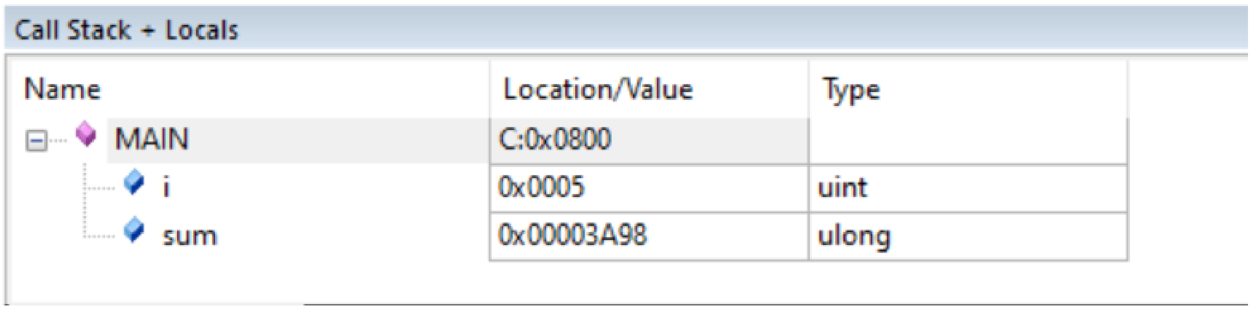
EXP 4

Aim: To write an 8051 Program to add an array of 16 bit numbers and store the 32 bit result in internal RAM.

Program:

```
#include <reg51.h>
#define ARRAY_SIZE 5

code unsigned int numbers[ARRAY_SIZE] = {1000, 2000, 3000, 4000, 5000};

unsigned long result;  // 32-bit result

void main() {
   unsigned int i;
   unsigned long sum = 0;

   for (i = 0; i < ARRAY_SIZE; i++) {
      sum += numbers[i];
   }

   result = sum;

   while (1);
}
```

Output:


Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x0800	
i	0x0005	uint
sum	0x00003A98	ulong

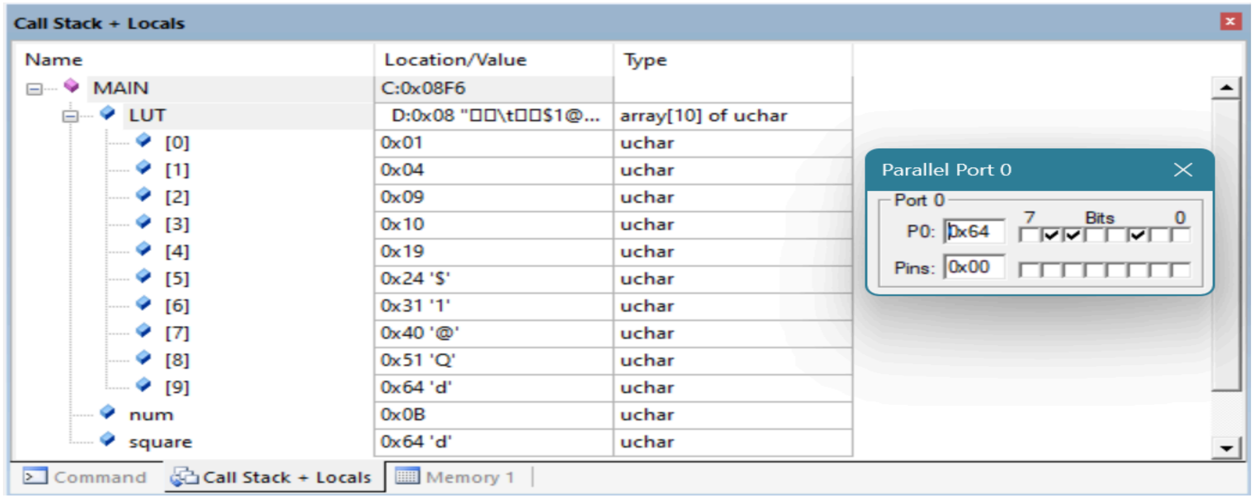
EXP 5

Aim: To write a 8051 C program to find the square of a number (1 to 10) using look-up table.

Program:

```
#include <reg51.h>
void main() {
        unsigned char LUT[]={1,4,9,16,25,36,49,64,81,100};
        unsigned char num, square;
        for(num=1; num<11; num++)
        {
        square =LUT[num-1];
        P0=square;
        }
}
```

Output:



```
Call Stack + Locals
Name            Location/Value             Type
MAIN            C:0x08F6
  LUT           D:0x08 "□□\t□□$1@...       array[10] of uchar
    [0]         0x01                       uchar
    [1]         0x04                       uchar
    [2]         0x09                       uchar
    [3]         0x10                       uchar
    [4]         0x19                       uchar
    [5]         0x24 '$'                   uchar
    [6]         0x31 '1'                   uchar
    [7]         0x40 '@'                   uchar
    [8]         0x51 'Q'                   uchar
    [9]         0x64 'd'                   uchar
  num           0x0B                       uchar
  square        0x64 'd'                   uchar

Parallel Port 0
Port 0
        7    Bits    0
P0:   0x64   [ ][✓][✓][ ][ ][✓][ ][ ]
Pins: 0x00   [ ][ ][ ][ ][ ][ ][ ][ ]
```

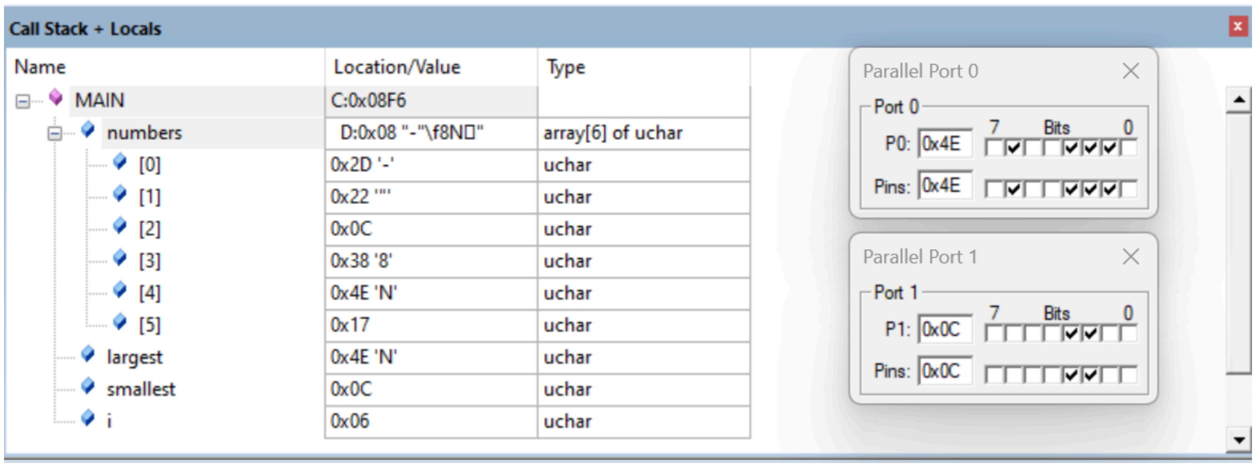
EXP 6

Aim: To write a 8051 C Program to find the Largest and Smallest numbers in an array of numbers.

Program:

```
#include <reg51.h>

void main() {
    unsigned char numbers[] = {45, 34, 12, 56, 78, 23};
    unsigned char largest = numbers[0];
    unsigned char smallest = numbers[0];
    unsigned char i;

    for (i = 1; i < sizeof(numbers); i++) {
        if (numbers[i] > largest) {
            largest = numbers[i];
        }
        if (numbers[i] < smallest) {
            smallest = numbers[i];
        }
    }

    P0 = largest;
    P1 = smallest;

    while (1);
}
```

Output:



Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x08F6	
numbers	D:0x08 "-"\f8N□"	array[6] of uchar
[0]	0x2D '-'	uchar
[1]	0x22 '"'	uchar
[2]	0x0C	uchar
[3]	0x38 '8'	uchar
[4]	0x4E 'N'	uchar
[5]	0x17	uchar
largest	0x4E 'N'	uchar
smallest	0x0C	uchar
i	0x06	uchar

Parallel Port 0

Port 0		7 Bits 0
P0:	0x4E	☐✓☐☐✓✓✓☐
Pins:	0x4E	☐✓☐☐✓✓✓☐

Parallel Port 1

Port 1		7 Bits 0
P1:	0x0C	☐☐☐☐✓✓☐☐
Pins:	0x0C	☐☐☐☐✓✓☐☐

EXP 7

Aim: To write a 8051 C Program to arrange a series of numbers in ascending and descending order locations.

Program:

(a) **Ascending Order**

```
#include<reg51.h>
void main()
{
        unsigned long array[]={0x33556666, 0xCCAADD00, 0x55998888, 0x77664444,
0x11223344};
        unsigned long temp, i, j;

        for(i=0; i<5; j++)
        {
                for(j=0; j<5; i++)
                {
                        if(array[j]>array[j+1])
                        {
                                temp=array[j+1];
                                array[j+1]=array[j];
                                array[j]=temp;
                        }
                }
        }
}
```

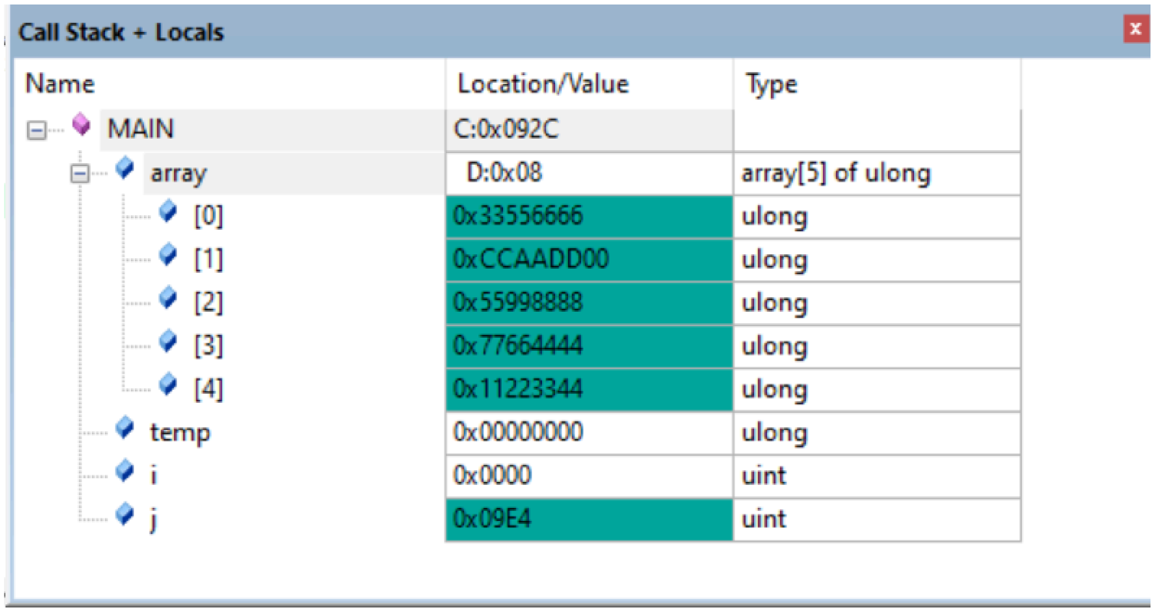
(b) **Descending Order**

```
#include <reg51.h>

void main() {
   unsigned long array[] = {0x33556666, 0xCCAADD00, 0x55998888, 0x77664444,
0x11223344};
   unsigned long temp;
   unsigned int i, j;

   for (i = 0; i < 4; i++) {
      for (j = 0; j < 4 - i; j++) {
            if (array[j] < array[j + 1]) {
                temp = array[j];
                array[j] = array[j + 1];
                array[j + 1] = temp;
            }
        }
    }

    while (1);
}
```

Output:

(a) Ascending Order:

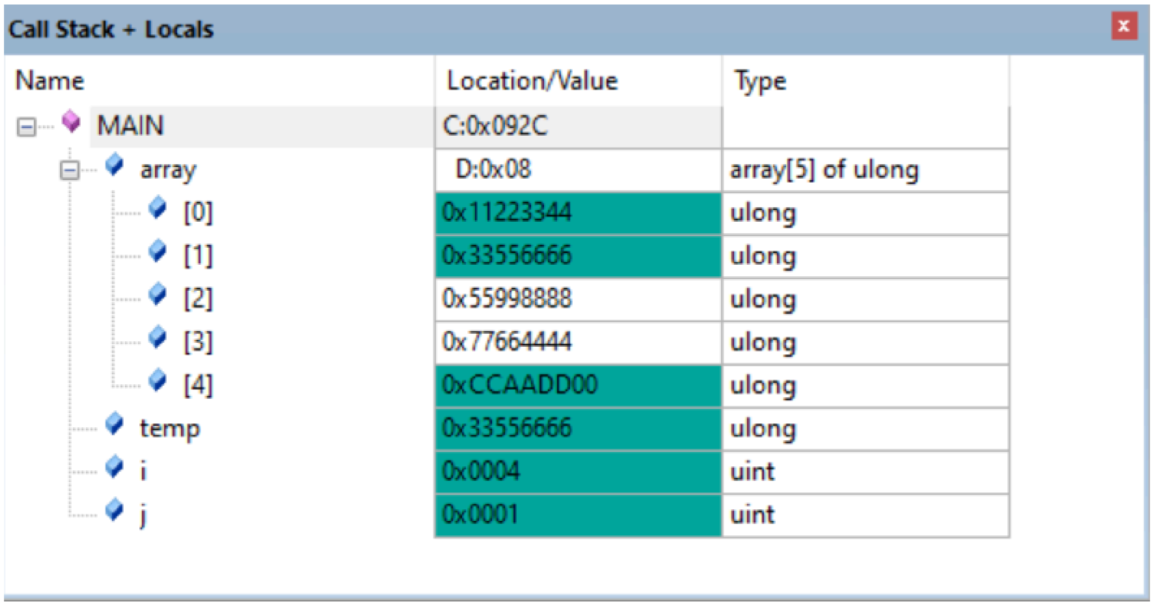
Before Execution



Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x092C	
array	D:0x08	array[5] of ulong
[0]	0x33556666	ulong
[1]	0xCCAADD00	ulong
[2]	0x55998888	ulong
[3]	0x77664444	ulong
[4]	0x11223344	ulong
temp	0x00000000	ulong
i	0x0000	uint
j	0x09E4	uint

After Execution

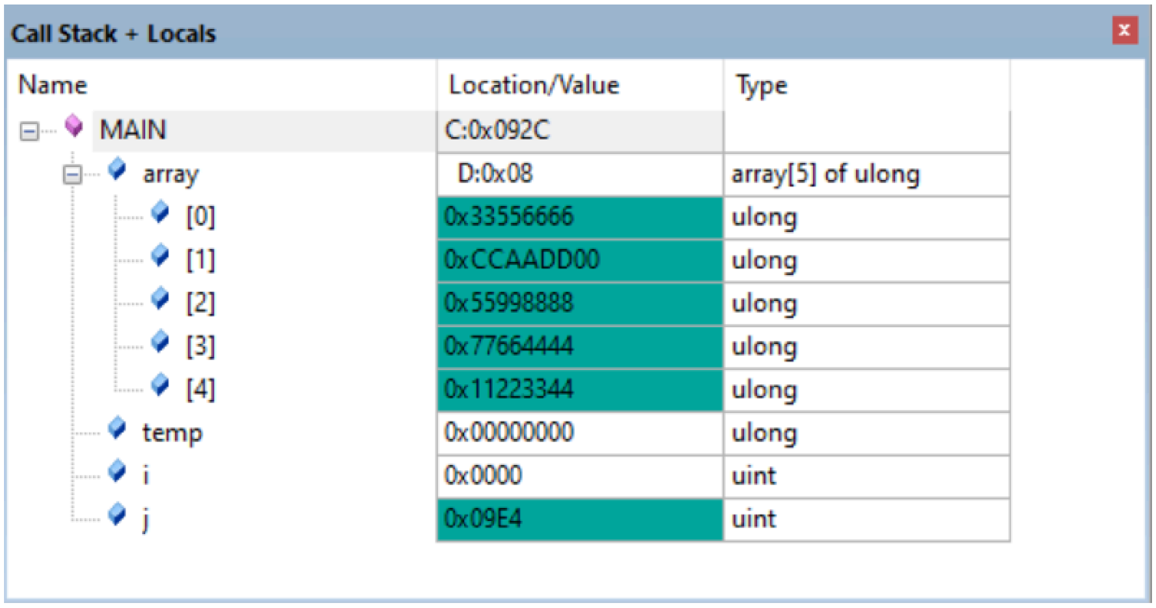


Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x092C	
array	D:0x08	array[5] of ulong
[0]	0x11223344	ulong
[1]	0x33556666	ulong
[2]	0x55998888	ulong
[3]	0x77664444	ulong
[4]	0xCCAADD00	ulong
temp	0x33556666	ulong
i	0x0004	uint
j	0x0001	uint

(b) <u>**Descending order**</u>:

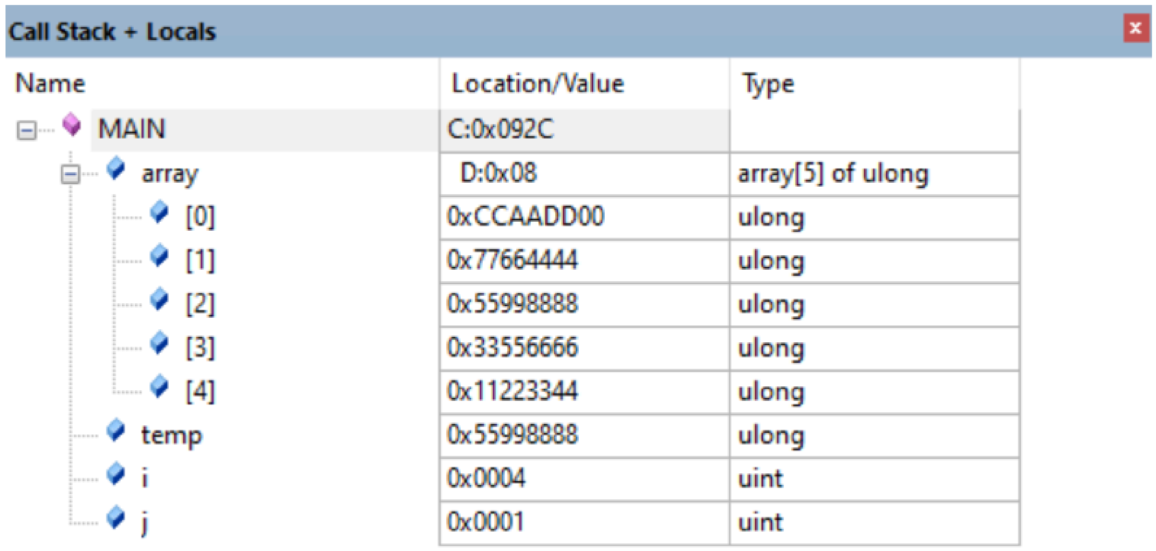
Before Execution



Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x092C	
array	D:0x08	array[5] of ulong
[0]	0x33556666	ulong
[1]	0xCCAADD00	ulong
[2]	0x55998888	ulong
[3]	0x77664444	ulong
[4]	0x11223344	ulong
temp	0x00000000	ulong
i	0x0000	uint
j	0x09E4	uint

After Execution



Name	Location/Value	Type
MAIN	C:0x092C	
array	D:0x08	array[5] of ulong
[0]	0xCCAADD00	ulong
[1]	0x77664444	ulong
[2]	0x55998888	ulong
[3]	0x33556666	ulong
[4]	0x11223344	ulong
temp	0x55998888	ulong
i	0x0004	uint
j	0x0001	uint

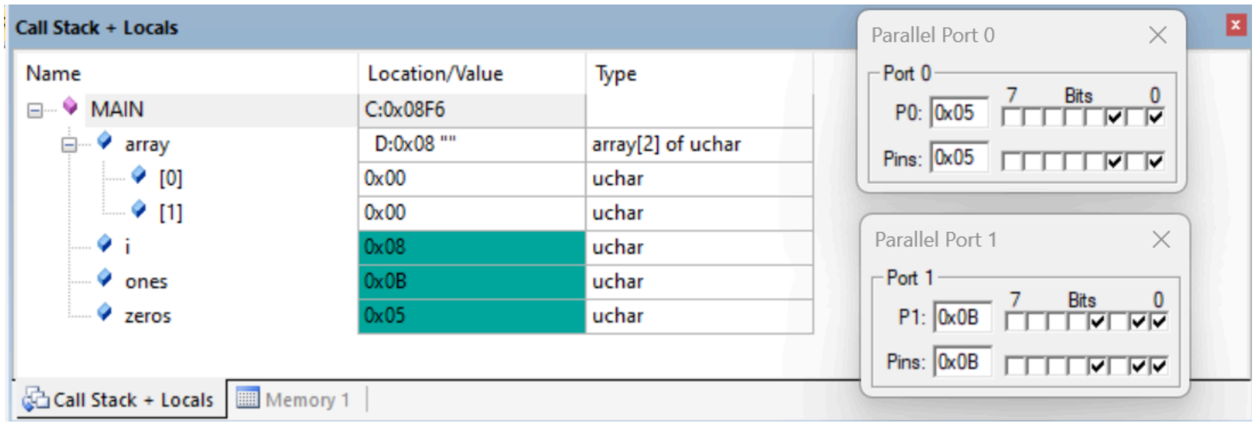
EXP 8

Aim: To write a 8051 C program to count the number of ones and zeros in two consecutive in memory locations.

Program:

```
#include<reg51.h>
void main()
{
        unsigned char array[]={0x57, 0xfc};
        unsigned char i, ones, zeros;
        CY=0;

        for(i=0; i<8; i++)
        {
                array[0]>>=1;
                if(CY==1)ones++;
                else zeros++;
        }
        for(i=0; i<8; i++)
        {
                array[1]>>=1;
                if(CY==1)ones++;
                else zeros++;
        }
        P0=zeros;
        P1=ones;
        while(1);
        }
```

Output:



Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x08F6	
array	D:0x08 ""	array[2] of uchar
[0]	0x00	uchar
[1]	0x00	uchar
i	0x08	uchar
ones	0x0B	uchar
zeros	0x05	uchar

Parallel Port 0
Port 0
P0: 0x05 7 Bits 0
Pins: 0x05

Parallel Port 1
Port 1
P1: 0x0B 7 Bits 0
Pins: 0x0B

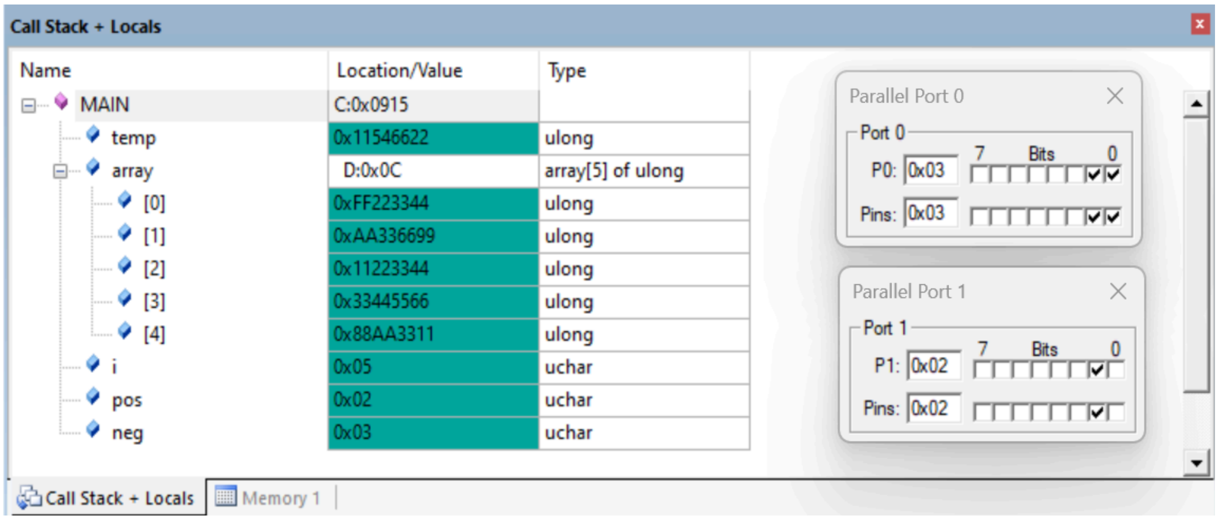
EXP 9

Aim: To write a 8051 C program to scan a series of numbers to find how many are negative.

Program:

```
#include<reg51.h>
void main()
{
        unsigned long temp,
array[]={0xff223344,0xaa336699,0x11223344,0x33445566,0x88aa3311};
        unsigned char i, pos, neg;
        CY=0;
        for(i=0; i<5; i++)
        {
                temp = array[i]<< 1;
                if(CY==1)neg++;
                else pos++;
                CY=0;
        }
        P0=neg;
        P1=pos;
        while(1);
}
```

Output:



Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x0915	
temp	0x11546622	ulong
array	D:0x0C	array[5] of ulong
[0]	0xFF223344	ulong
[1]	0xAA336699	ulong
[2]	0x11223344	ulong
[3]	0x33445566	ulong
[4]	0x88AA3311	ulong
i	0x05	uchar
pos	0x02	uchar
neg	0x03	uchar

Parallel Port 0
Port 0
P0: 0x03
Pins: 0x03

Parallel Port 1
Port 1
P1: 0x02
Pins: 0x02

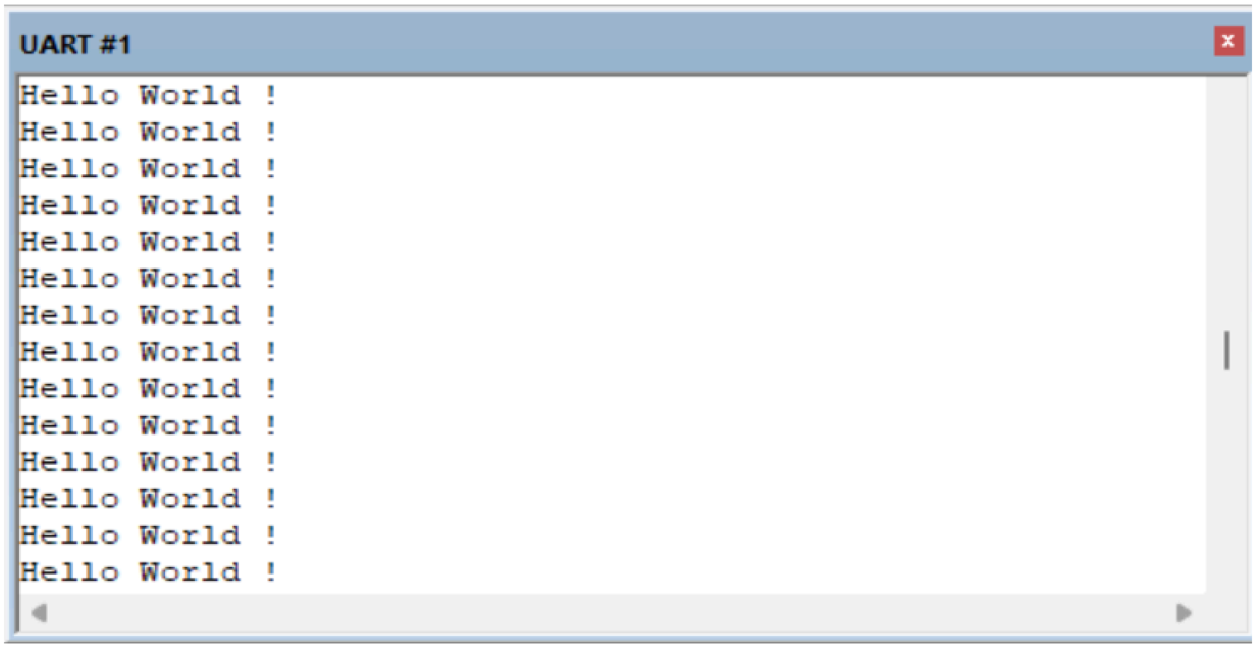
EXP 10

Aim: To write a 8051 C program to display a “Hello World” message in the UART serial window.

Program:

```
#include <reg51.h>
#include <stdio.h>

void main(void)
{
        SCON = 0x50;
        TMOD = 0x20;
        TH1 = 0xFD;
        TR1 = 1;
        TI = 1;
        while(1)
        {
                printf("Hello World !\n");
        }
}
```

Output:



UART #1

```
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
Hello World !
```

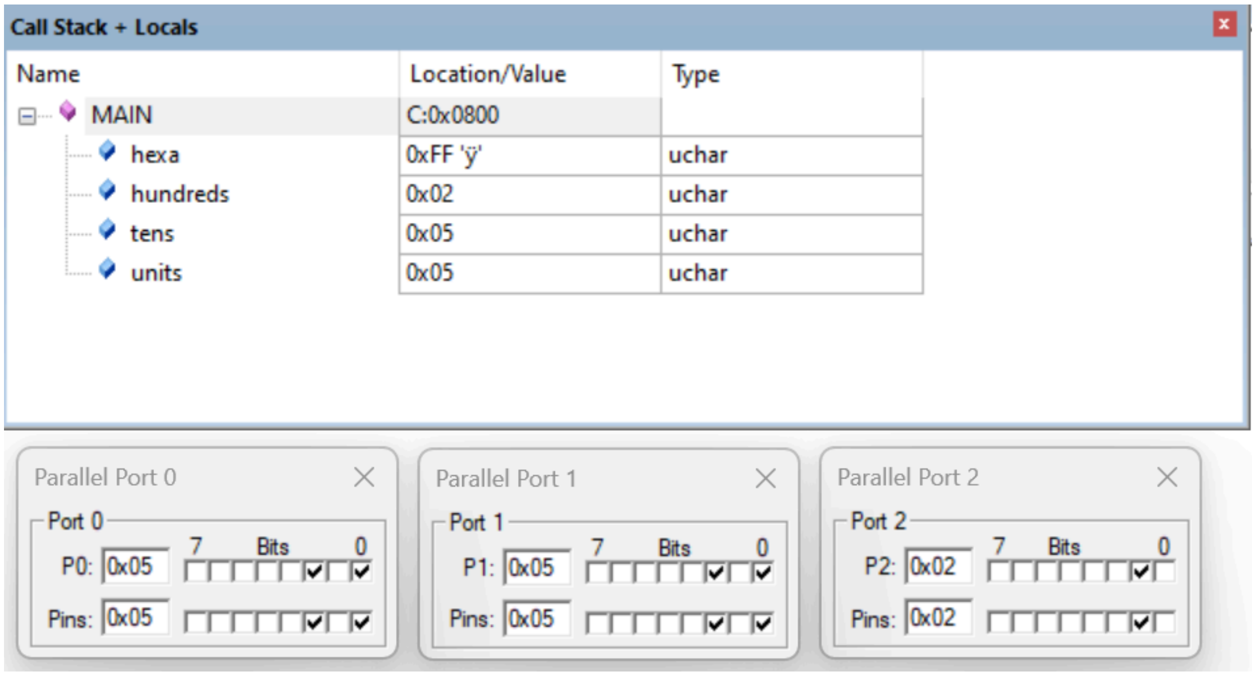
EXP 11

Aim: To write a 8051 C program to convert the hexadecimal data 0xFF to decimal and display the digits on ports P0, P1 and P2 (port window in simulator).

Program:

```
# include <reg51.h>
void main (void)
        {
                unsigned char hexa=0xFF;
                unsigned char hundreds, tens, units;

                hexa=hexa/10;
                P0=B;
                units=B;
                hexa = hexa/10;
                hundreds=ACC;
                tens=B;
                P1=B;
                P2=ACC;
                while(1);
    }
```

Output:



Call Stack + Locals

Name	Location/Value	Type
MAIN	C:0x0800	
hexa	0xFF 'ÿ'	uchar
hundreds	0x02	uchar
tens	0x05	uchar
units	0x05	uchar

```
Parallel Port 0            Parallel Port 1            Parallel Port 2
Port 0                     Port 1                     Port 2
        7   Bits   0               7   Bits   0               7   Bits   0
P0: 0x05  ☐☐☐☐☐✓☐✓        P1: 0x05  ☐☐☐☐☐✓☐✓        P2: 0x02  ☐☐☐☐☐☐✓☐
Pins: 0x05 ☐☐☐☐☐✓☐✓       Pins: 0x05 ☐☐☐☐☐✓☐✓       Pins: 0x02 ☐☐☐☐☐☐✓☐
```