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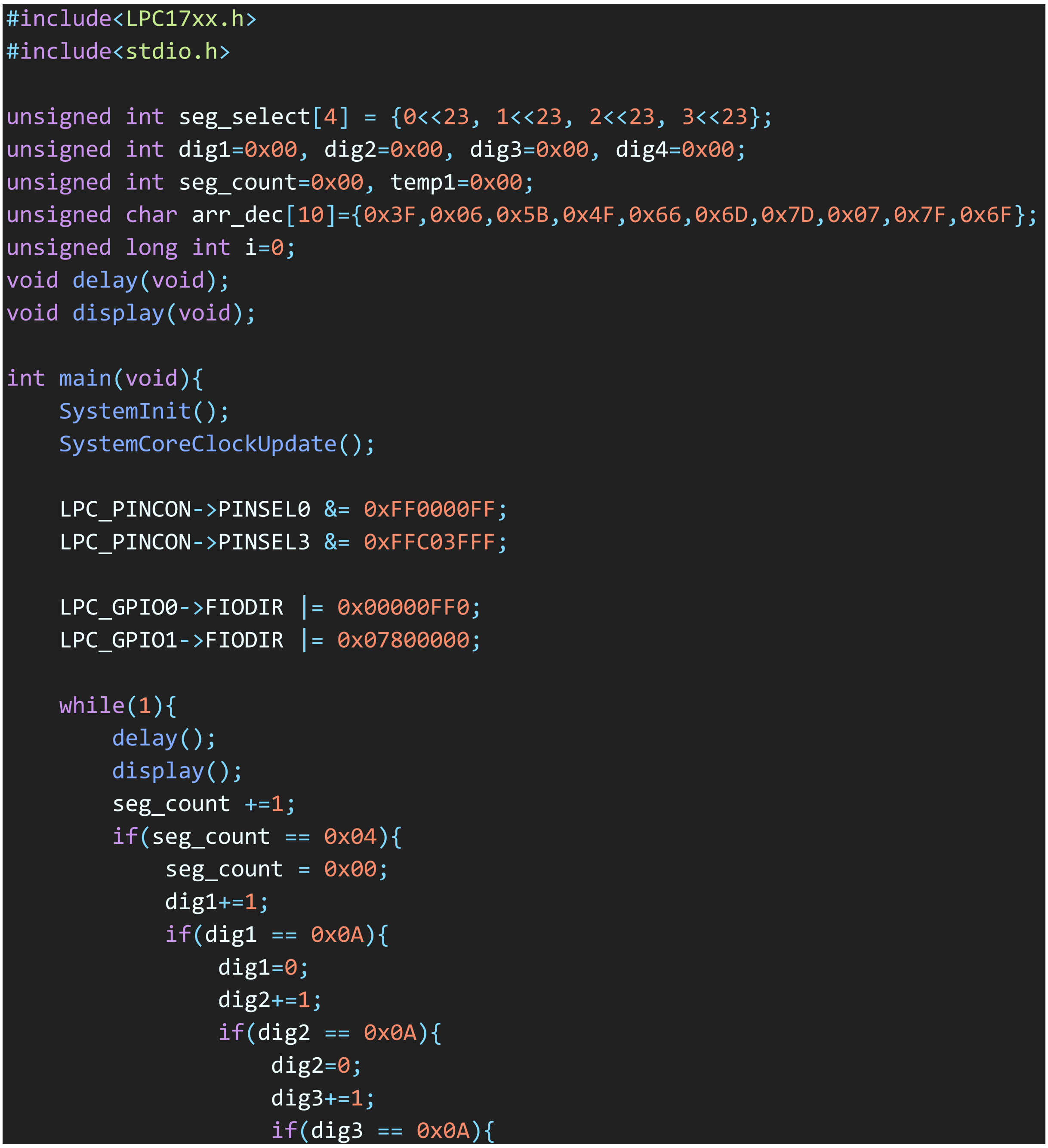
190905522 CSE D 62

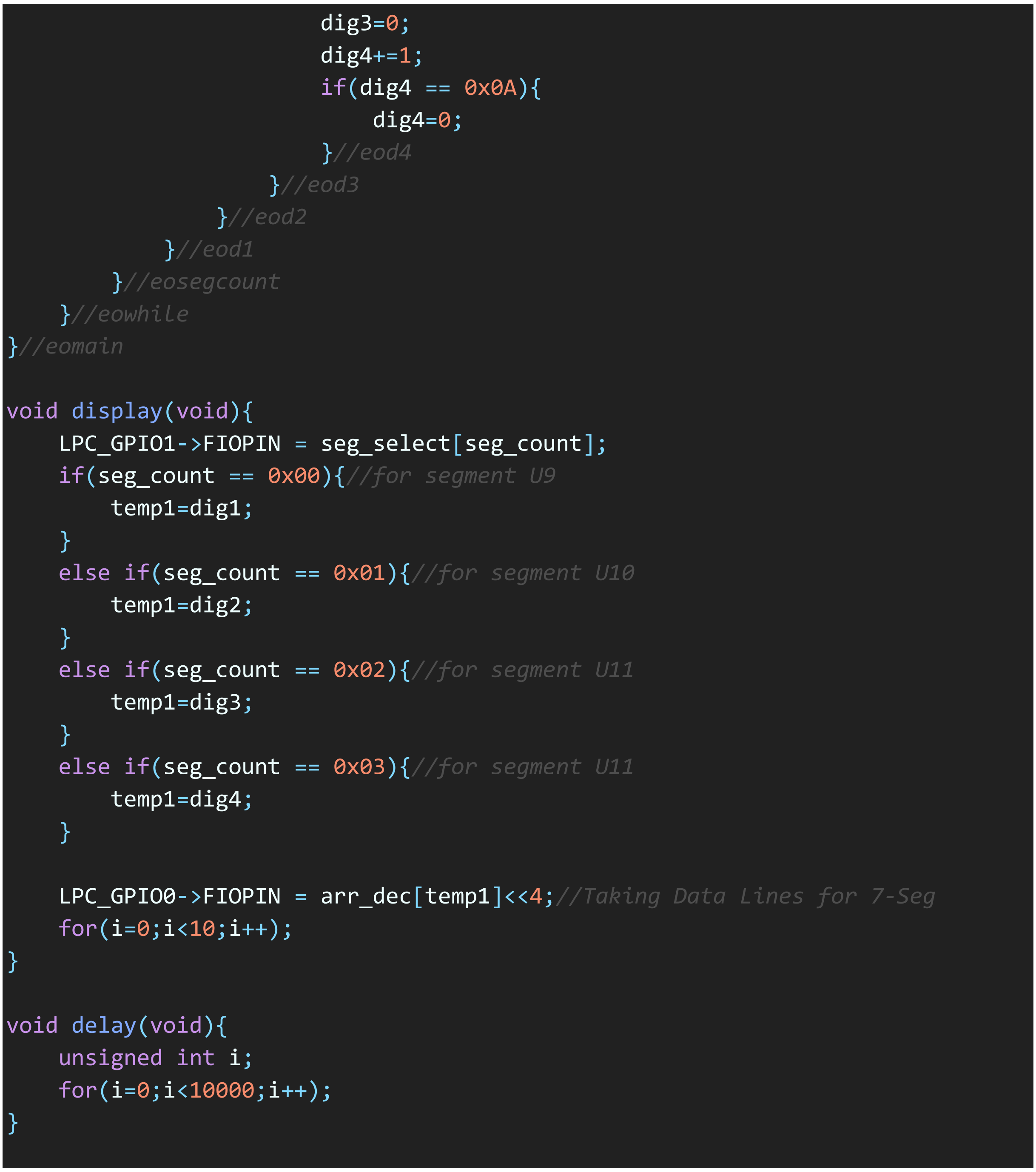
## ES Lab 7 (Week 7) – Programs on Multiplexed Seven Segment Display

**Solved Exercise: Write a program to simulate 4-digit BCD up counter on the multiplexed seven-segment display. (0000-9999)**

**CODE:**



```
#include<LPC17xx.h>
#include<stdio.h>

unsigned int seg_select[4] = {0<<23, 1<<23, 2<<23, 3<<23};
unsigned int dig1=0x00, dig2=0x00, dig3=0x00, dig4=0x00;
unsigned int seg_count=0x00, temp1=0x00;
unsigned char arr_dec[10]={0x3F,0x06,0x5B,0x4F,0x66,0x6D,0x7D,0x07,0x7F,0x6F};
unsigned long int i=0;
void delay(void);
void display(void);

int main(void){
    SystemInit();
    SystemCoreClockUpdate();

    LPC_PINCON->PINSEL0 &= 0xFF0000FF;
    LPC_PINCON->PINSEL3 &= 0xFFC03FFF;

    LPC_GPIO0->FIODIR |= 0x00000FF0;
    LPC_GPIO1->FIODIR |= 0x07800000;

    while(1){
        delay();
        display();
        seg_count +=1;
        if(seg_count == 0x04){
            seg_count = 0x00;
            dig1+=1;
            if(dig1 == 0x0A){
                dig1=0;
                dig2+=1;
                if(dig2 == 0x0A){
                    dig2=0;
                    dig3+=1;
                    if(dig3 == 0x0A){
```

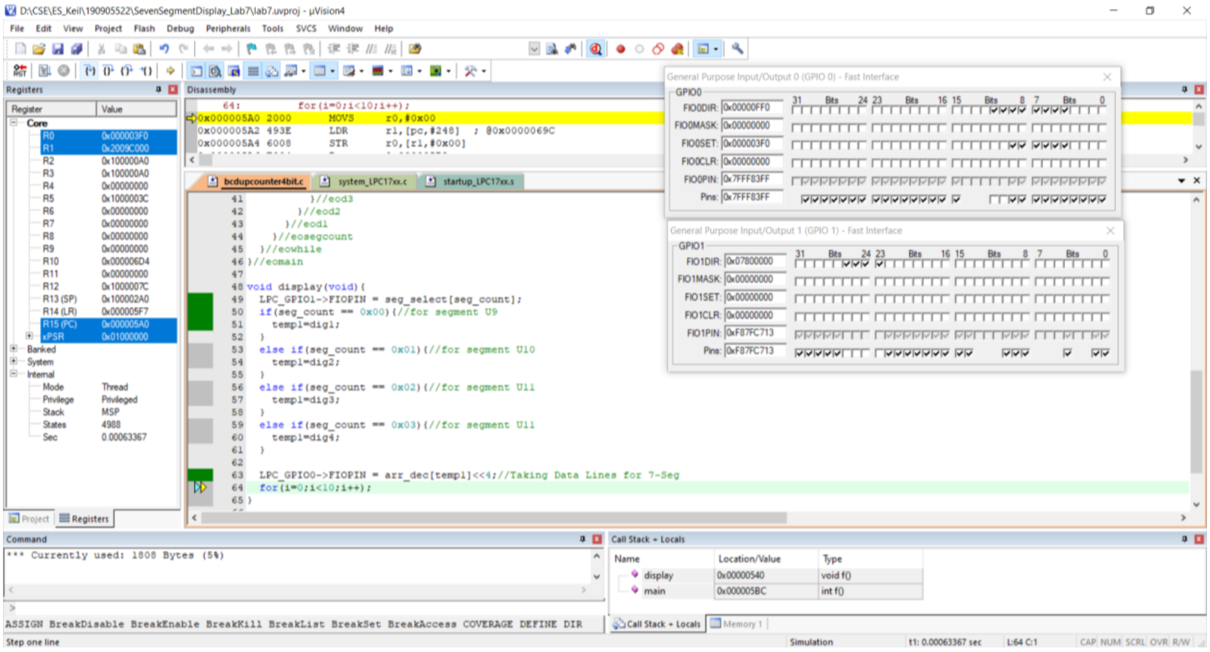


```
                        dig3=0;
                        dig4+=1;
                        if(dig4 == 0x0A){
                            dig4=0;
                        }//eod4
                    }//eod3
                }//eod2
            }//eod1
        }//eosegcount
    }//eowhile
}//eomain

void display(void){
    LPC_GPIO1->FIOPIN = seg_select[seg_count];
    if(seg_count == 0x00){//for segment U9
        temp1=dig1;
    }
    else if(seg_count == 0x01){//for segment U10
        temp1=dig2;
    }
    else if(seg_count == 0x02){//for segment U11
        temp1=dig3;
    }
    else if(seg_count == 0x03){//for segment U11
        temp1=dig4;
    }

    LPC_GPIO0->FIOPIN = arr_dec[temp1]<<4;//Taking Data Lines for 7-Seg
    for(i=0;i<10;i++);
}

void delay(void){
    unsigned int i;
    for(i=0;i<10000;i++);
}
```

**OUTPUT:**

In the first iteration of the program the BCD number to be displayed will be 0000 then 0001 and so on and so forth till 9999. So, we can see that for 0000 the bits made 0 will be bits 0, 1, 2 and 3:

In the first position, the 0th bit shown in GPIO1 we can see output of seven segment display of the digit 0 in GPIO0 which is of value 0011 1111 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000003F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 4988 |
| Sec | 0.00063367 |

Disassembly

```
    64:         for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

bcdupcounter4bit.c

```
          }//eod3
        }//eod2
      }//eod1
    }//eosegcount
  }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=digl;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

| GPIO0 | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000003F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF83FF |
| Pins: | 0x7FFF83FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

| GPIO1 | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x00000000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF87FC713 |
| Pins: | 0xF87FC713 |

Command

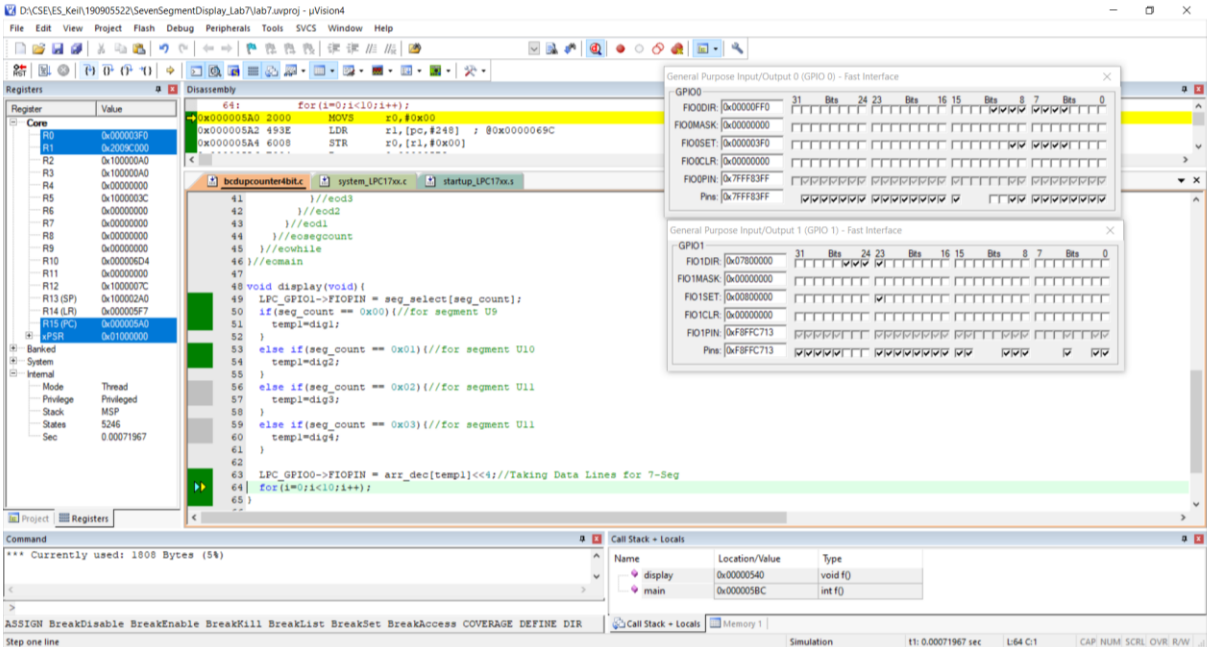
```
*** Currently used: 1808 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

Call Stack + Locals

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Step one line    Simulation    t1: 0.00063367 sec    L:64 C:1

In the second position, the 1st bit shown in GPIO1 we can see output of seven segment display of the digit 0 in GPIO0 which is of value 0011 1111 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000003F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 5246 |
| Sec | 0.00071967 |

Disassembly

```
    64:         for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

bcdupcounter4bit.c

```
          }//eod3
        }//eod2
      }//eod1
    }//eosegcount
  }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=digl;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

| GPIO0 | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000003F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF83FF |
| Pins: | 0x7FFF83FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

| GPIO1 | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x00800000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF8FFC713 |
| Pins: | 0xF8FFC713 |

Command

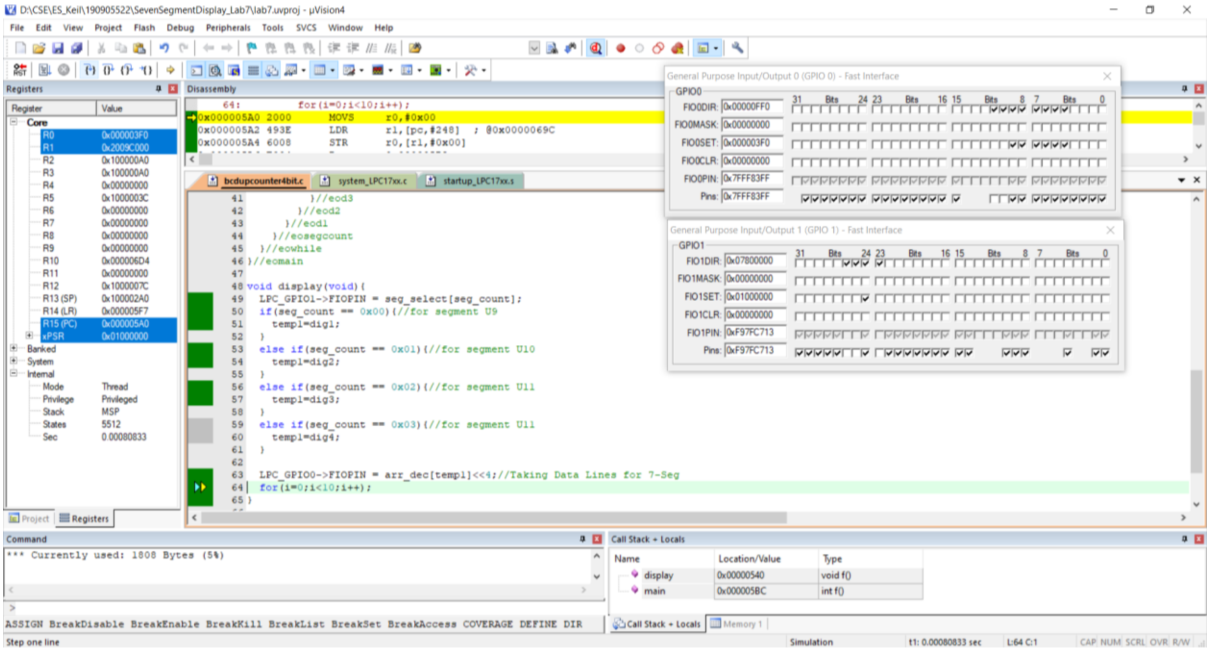
```
*** Currently used: 1808 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

Call Stack + Locals

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Step one line    Simulation    t1: 0.00071967 sec    L:64 C:1

In the third position, the 2nd bit shown in GPIO1 we can see output of seven segment display of the digit 0 in GPIO0 which is of value 0011 1111 in binary:


D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
Registers
Disassembly
bcdupcounter4bit.c
system_LPC17xx.c
startup_LPC17xx.s
Project
Registers
Command
Call Stack + Locals
Memory 1

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000003F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 5512 |
| Sec | 0.00080833 |

```
    64:         for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

```
          }//eod3
        }//eod2
      }//eod1
    }//eosegcount
  }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=digl;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

| GPIO0 | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000003F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF83FF |
| Pins: | 0x7FFF83FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

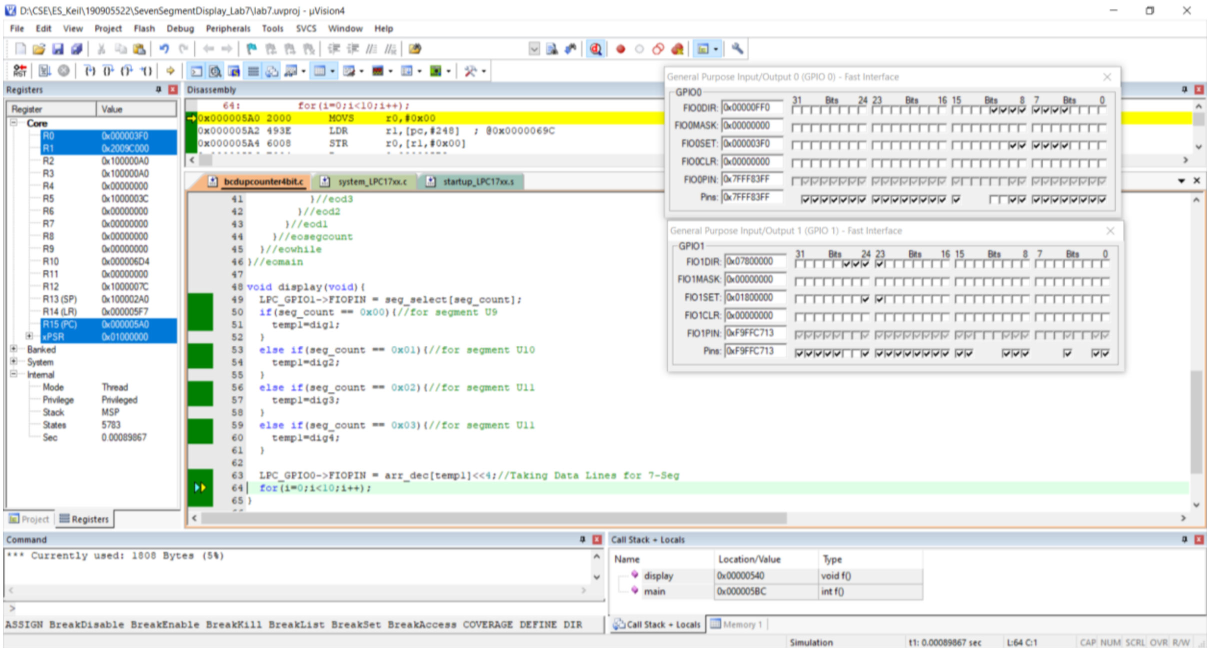
| GPIO1 | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x01000000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF97FC713 |
| Pins: | 0xF97FC713 |

```
*** Currently used: 1808 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Step one line | Simulation | t1: 0.00080833 sec | L:64 C:1 | CAP NUM SCRL OVR R/W

In the fourth position, the 3rd bit shown in GPIO1 we can see output of seven segment display of the digit 0 in GPIO0 which is of value 0011 1111 in binary:


D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
Registers
Disassembly
bcdupcounter4bit.c
system_LPC17xx.c
startup_LPC17xx.s
Project
Registers
Command
Call Stack + Locals
Memory 1

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000003F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 5783 |
| Sec | 0.00089867 |

```
    64:         for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

```
          }//eod3
        }//eod2
      }//eod1
    }//eosegcount
  }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=digl;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

| GPIO0 | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000003F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF83FF |
| Pins: | 0x7FFF83FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

| GPIO1 | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x01800000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF9FFC713 |
| Pins: | 0xF9FFC713 |

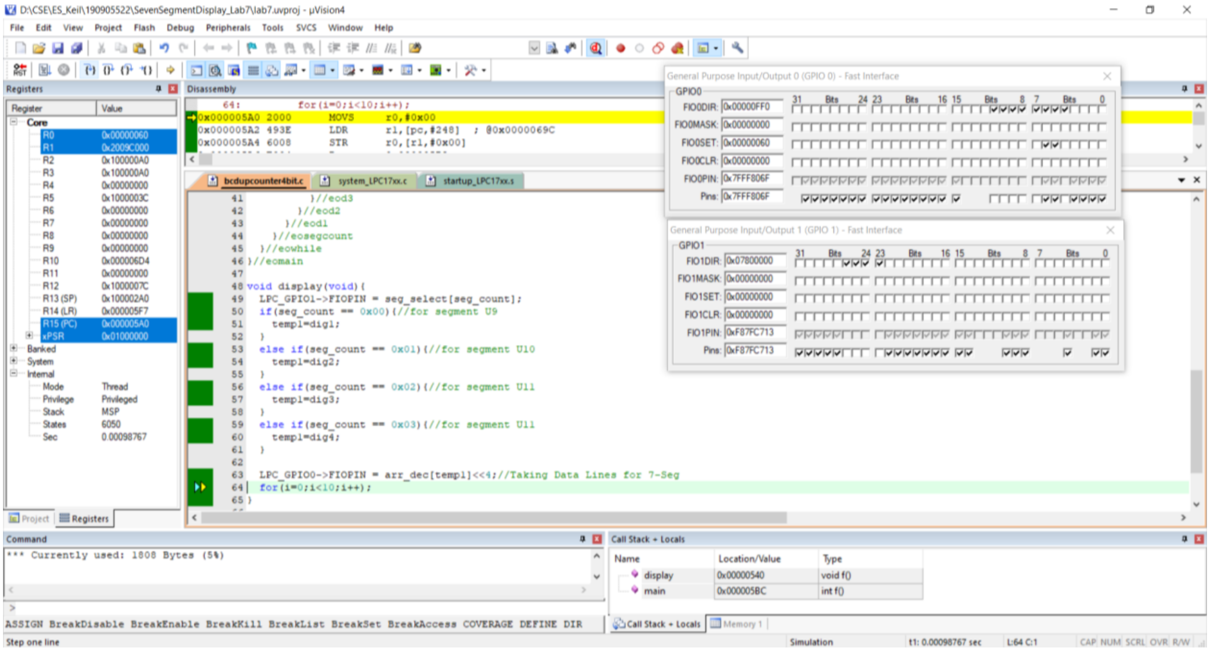
```
*** Currently used: 1808 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Simulation | t1: 0.00089867 sec | L:64 C:1 | CAP NUM SCRL OVR R/W

In the second iteration of the program the BCD number to be displayed will be 0001. So, we can see that for 0001 the bits made 0 will be bits 1, 2, and 3 and bit 0 will be made 1:

In the first position, the 0th bit shown in GPIO1 we can see output of seven segment display of the digit 1 in GPIO0 which is of value 0000 0110 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x00000060 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 6050 |
| Sec | 0.00098767 |

Disassembly

```
    64:             for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

bcdupcounter4bit.c

```
            }//eod3
          }//eod2
        }//eod1
      }//eosegcount
    }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=digl;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

| | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x00000060 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF806F |
| Pins: | 0x7FFF806F |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

| | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x00000000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF87FC713 |
| Pins: | 0xF87FC713 |

Command

```
*** Currently used: 1808 Bytes (5%)
```

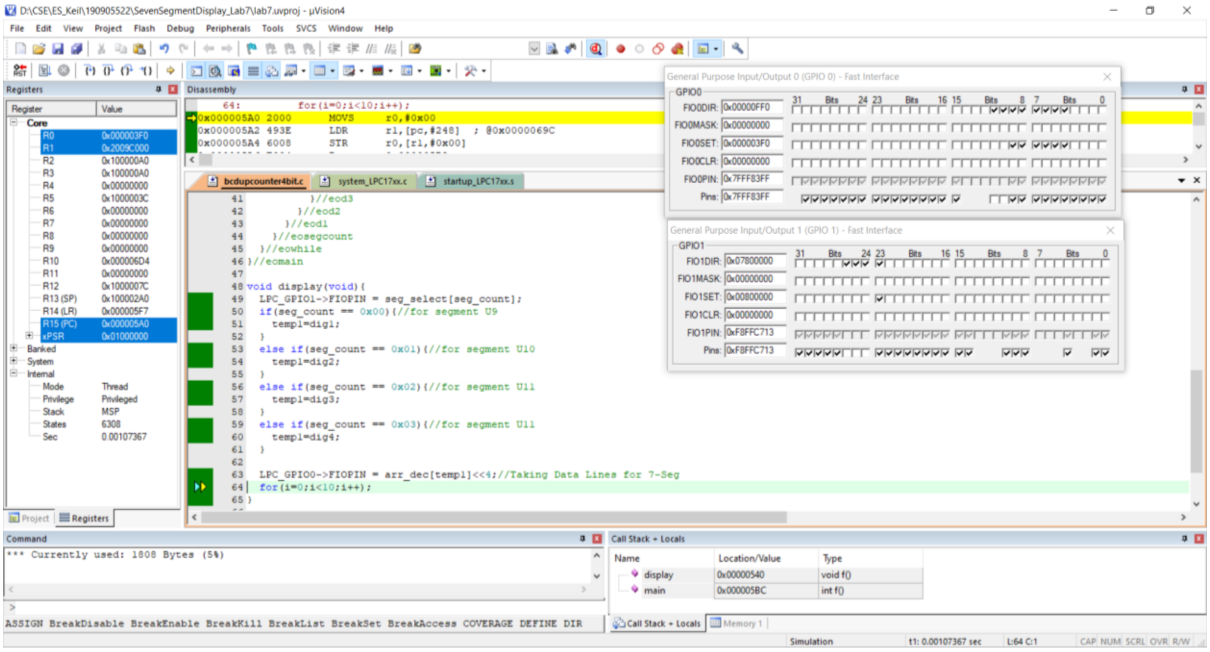
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR

Call Stack + Locals

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Step one line    Simulation    t1: 0.00098767 sec    L:64 C:1

In the second position, the 1st bit shown in GPIO1 we can see output of seven segment display of the digit 0 in GPIO0 which is of value 0011 1111 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000003F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 6308 |
| Sec | 0.00107367 |

Disassembly

```
    64:             for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

bcdupcounter4bit.c

```
            }//eod3
          }//eod2
        }//eod1
      }//eosegcount
    }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=digl;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

| | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000003F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF83FF |
| Pins: | 0x7FFF83FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

| | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x00800000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF8FFC713 |
| Pins: | 0xF8FFC713 |

Command

```
*** Currently used: 1808 Bytes (5%)
```

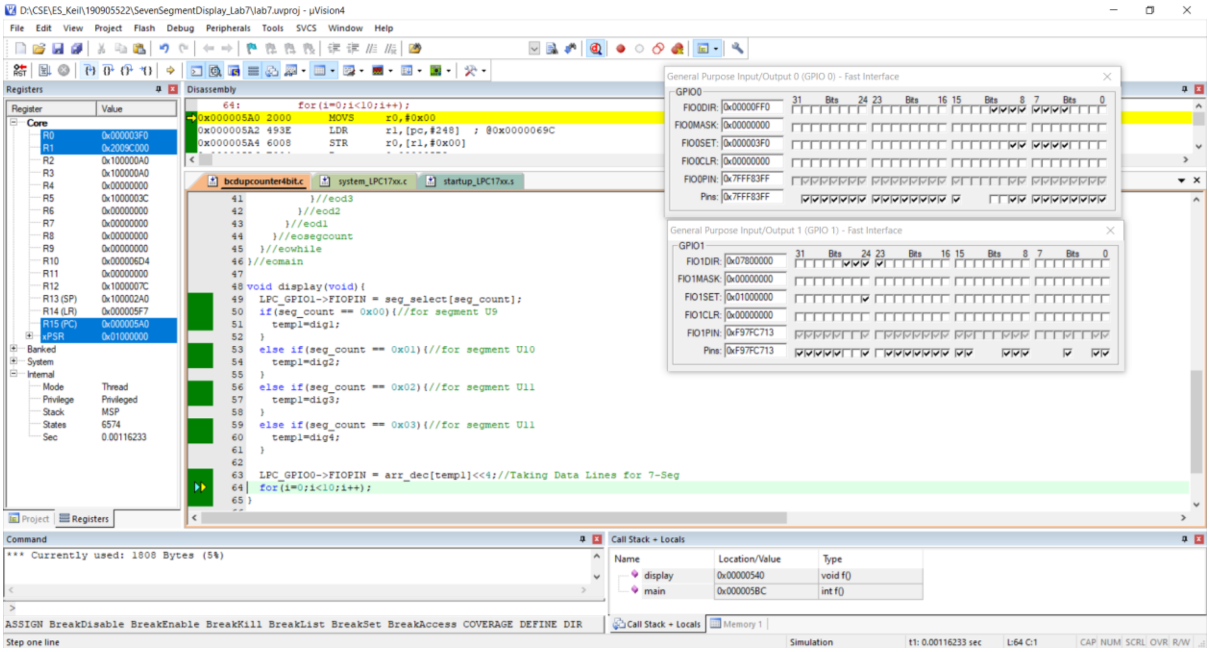
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR

Call Stack + Locals

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Simulation    t1: 0.00107367 sec    L:64 C:1

In the third position, the 2nd bit shown in GPIO1 we can see output of seven segment display of the digit 0 in GPIO0 which is of value 0011 1111 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

File Edit View Project Flash Debug Peripherals Tools SVCS Window Help

Registers

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000003F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 6574 |
| Sec | 0.00116233 |

Disassembly

```
    64:          for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

bcdupcounter4bit.c | system_LPC17xx.c | startup_LPC17xx.s

```
          }//eod3
        }//eod2
      }//eod1
    }//eosegcount
  }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=dig1;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

| | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000003F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF83FF |
| Pins: | 0x7FFF83FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

| | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x01000000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF97FC713 |
| Pins: | 0xF97FC713 |

Command

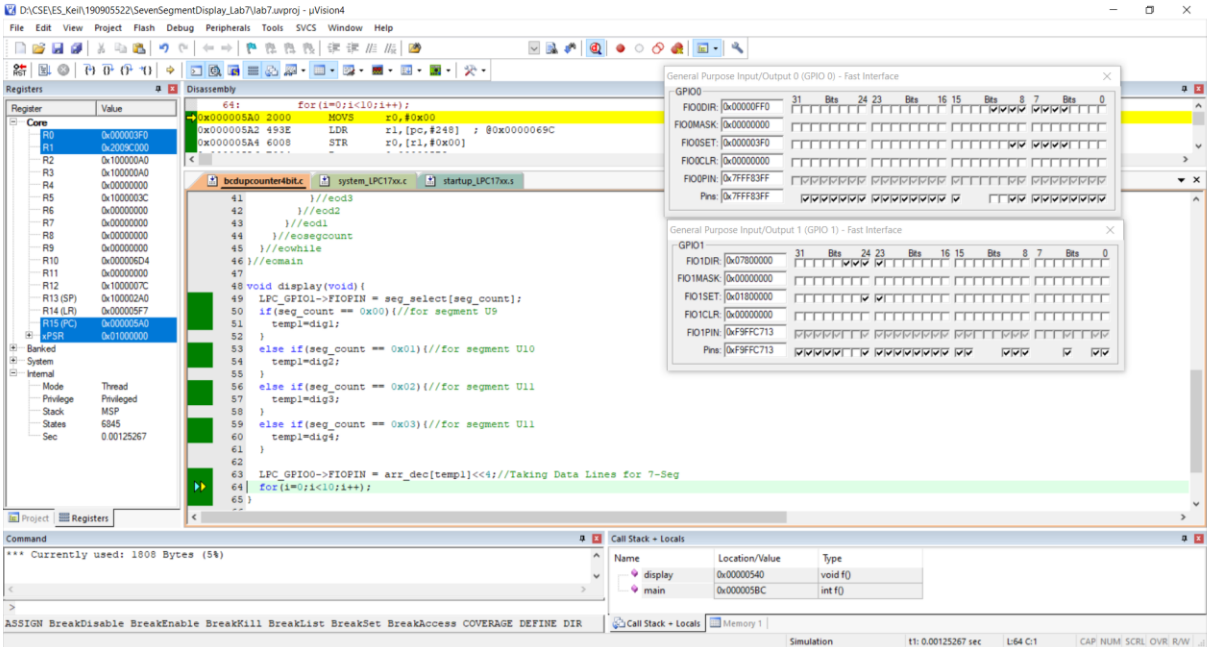
```
*** Currently used: 1808 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

Call Stack + Locals

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Step one line | Simulation | t1: 0.00116233 sec | L:64 C:1

In the fourth position, the 3rd bit shown in GPIO1 we can see output of seven segment display of the digit 0 in GPIO0 which is of value 0011 1111 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

File Edit View Project Flash Debug Peripherals Tools SVCS Window Help

Registers

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000003F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000A0 |
| R3 | 0x100000A0 |
| R4 | 0x00000000 |
| R5 | 0x1000003C |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000006D4 |
| R11 | 0x00000000 |
| R12 | 0x1000007C |
| R13 (SP) | 0x100002A0 |
| R14 (LR) | 0x000005F7 |
| R15 (PC) | 0x000005A0 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 6845 |
| Sec | 0.00125267 |

Disassembly

```
    64:          for(i=0;i<10;i++);
0x000005A0 2000      MOVS     r0,#0x00
0x000005A2 493E      LDR      r1,[pc,#248]  ; @0x0000069C
0x000005A4 6008      STR      r0,[r1,#0x00]
```

bcdupcounter4bit.c | system_LPC17xx.c | startup_LPC17xx.s

```
          }//eod3
        }//eod2
      }//eod1
    }//eosegcount
  }//eowhile
}//eomain

void display(void){
  LPC_GPIO1->FIOPIN = seg_select[seg_count];
  if(seg_count == 0x00){//for segment U9
    templ=dig1;
  }
  else if(seg_count == 0x01){//for segment U10
    templ=dig2;
  }
  else if(seg_count == 0x02){//for segment U11
    templ=dig3;
  }
  else if(seg_count == 0x03){//for segment U11
    templ=dig4;
  }

  LPC_GPIO0->FIOPIN = arr_dec[templ]<<4;//Taking Data Lines for 7-Seg
  for(i=0;i<10;i++);
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

| | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000003F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF83FF |
| Pins: | 0x7FFF83FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

| | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x01800000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF9FFC713 |
| Pins: | 0xF9FFC713 |

Command

```
*** Currently used: 1808 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

Call Stack + Locals

| Name | Location/Value | Type |
|---|---|---|
| display | 0x00000540 | void f() |
| main | 0x000005BC | int f() |

Simulation | t1: 0.00125267 sec | L:64 C:1

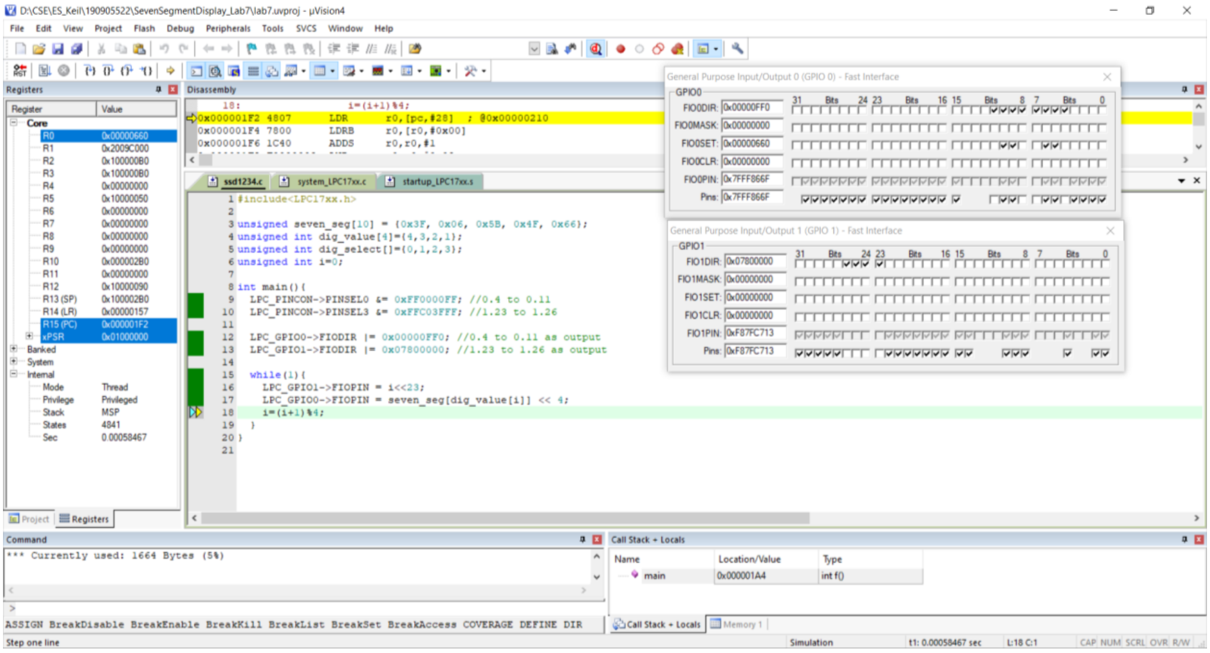
1. **Write a C program to display the number "1 2 3 4" serially in the seven-segment display.**

**CODE:**

```
#include<LPC17xx.h>

unsigned seven_seg[10] = {0x3F, 0x06, 0x5B, 0x4F, 0x66};
unsigned int dig_value[4]={4,3,2,1};
unsigned int dig_select[]={0,1,2,3};
unsigned int i=0;

int main(){
    LPC_PINCON->PINSEL0 &= 0xFF0000FF; //0.4 to 0.11
    LPC_PINCON->PINSEL3 &= 0xFFC03FFF; //1.23 to 1.26

    LPC_GPIO0->FIODIR |= 0x00000FF0; //0.4 to 0.11 as output
    LPC_GPIO1->FIODIR |= 0x07800000; //1.23 to 1.26 as output

    while(1){
        LPC_GPIO1->FIOPIN = i<<23;
        LPC_GPIO0->FIOPIN = seven_seg[dig_value[i]] << 4;
        i=(i+1)%4;
    }
}
```

**OUTPUT:**

In the first position, the 0th bit shown in GPIO1 we can see output of seven segment display of the digit 4 in GPIO0 which is of value 0110 0110 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x00000660 |
| R1 | 0x2009C000 |
| R2 | 0x100000B0 |
| R3 | 0x100000B0 |
| R4 | 0x00000000 |
| R5 | 0x10000050 |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000002B0 |
| R11 | 0x00000000 |
| R12 | 0x10000090 |
| R13 (SP) | 0x100002B0 |
| R14 (LR) | 0x00000157 |
| R15 (PC) | 0x000001F2 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 4841 |
| Sec | 0.00058467 |

```
    18:                     i=(i+1)%4;
0x000001F2 4807      LDR      r0,[pc,#28]  ; @0x00000210
0x000001F4 7800      LDRB     r0,[r0,#0x00]
0x000001F6 1C40      ADDS     r0,r0,#1
```

```
#include<LPC17xx.h>

unsigned seven_seg[10] = {0x3F, 0x06, 0x5B, 0x4F, 0x66};
unsigned int dig_value[4]={4,3,2,1};
unsigned int dig_select[]={0,1,2,3};
unsigned int i=0;

int main(){
  LPC_PINCON->PINSEL0 &= 0xFF0000FF; //0.4 to 0.11
  LPC_PINCON->PINSEL3 &= 0xFFC03FFF; //1.23 to 1.26

  LPC_GPIO0->FIODIR |= 0x00000FF0; //0.4 to 0.11 as output
  LPC_GPIO1->FIODIR |= 0x07800000; //1.23 to 1.26 as output

  while(1){
    LPC_GPIO1->FIOPIN = i<<23;
    LPC_GPIO0->FIOPIN = seven_seg[dig_value[i]] << 4;
    i=(i+1)%4;
  }
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

| | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x00000660 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF866F |
| Pins: | 0x7FFF866F |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

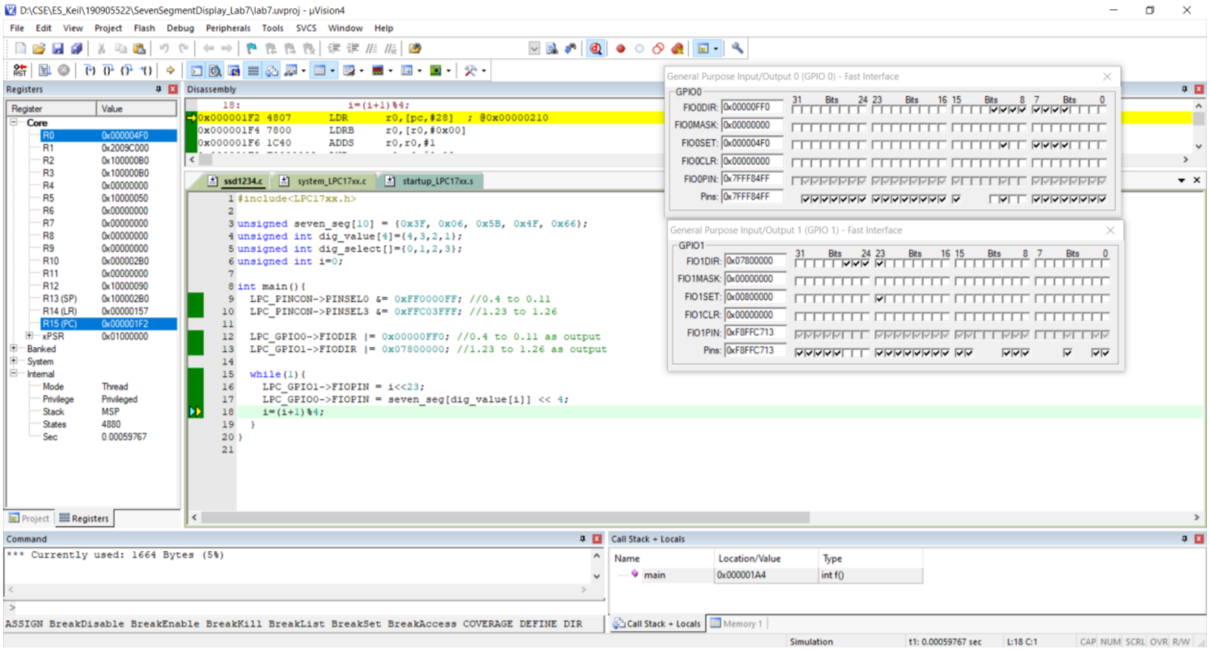
| | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x00000000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF87FC713 |
| Pins: | 0xF87FC713 |

```
*** Currently used: 1664 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

| Name | Location/Value | Type |
|---|---|---|
| main | 0x000001A4 | int f() |

Step one line    Simulation    t1: 0.00058467 sec    L:18 C:1    CAP NUM SCRL OVR R/W

In the second position, the 1st bit shown in GPIO1 we can see output of seven segment display of the digit 3 in GPIO0 which is of value 0100 1111 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000004F0 |
| R1 | 0x2009C000 |
| R2 | 0x100000B0 |
| R3 | 0x100000B0 |
| R4 | 0x00000000 |
| R5 | 0x10000050 |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000002B0 |
| R11 | 0x00000000 |
| R12 | 0x10000090 |
| R13 (SP) | 0x100002B0 |
| R14 (LR) | 0x00000157 |
| R15 (PC) | 0x000001F2 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 4880 |
| Sec | 0.00059767 |

```
    18:                 i=(i+1)%4;
0x000001F2 4807      LDR      r0,[pc,#28]  ; @0x00000210
0x000001F4 7800      LDRB     r0,[r0,#0x00]
0x000001F6 1C40      ADDS     r0,r0,#1
```

```c
#include<LPC17xx.h>

unsigned seven_seg[10] = {0x3F, 0x06, 0x5B, 0x4F, 0x66};
unsigned int dig_value[4]={4,3,2,1};
unsigned int dig_select[]={0,1,2,3};
unsigned int i=0;

int main(){
  LPC_PINCON->PINSEL0 &= 0xFF0000FF; //0.4 to 0.11
  LPC_PINCON->PINSEL3 &= 0xFFC03FFF; //1.23 to 1.26

  LPC_GPIO0->FIODIR |= 0x00000FF0; //0.4 to 0.11 as output
  LPC_GPIO1->FIODIR |= 0x07800000; //1.23 to 1.26 as output

  while(1){
    LPC_GPIO1->FIOPIN = i<<23;
    LPC_GPIO0->FIOPIN = seven_seg[dig_value[i]] << 4;
    i=(i+1)%4;
  }
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

| | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000004F0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF84FF |
| Pins: | 0x7FFF84FF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

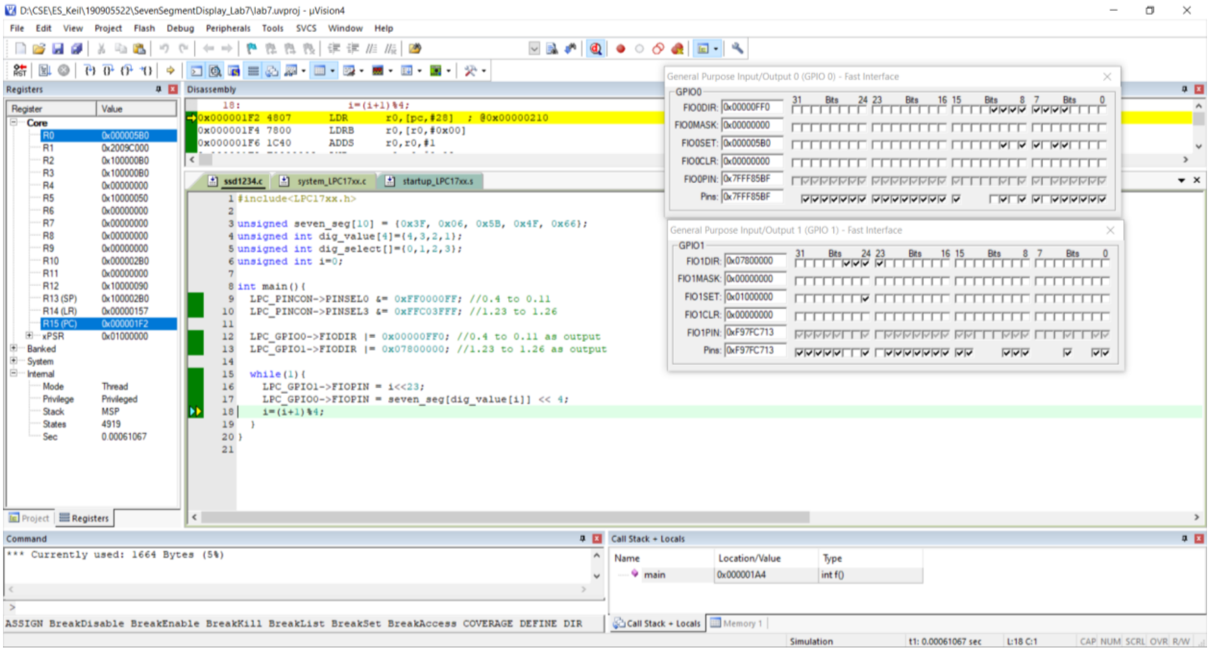
| | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x00800000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF8FFC713 |
| Pins: | 0xF8FFC713 |

```
*** Currently used: 1664 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

| Name | Location/Value | Type |
|---|---|---|
| main | 0x000001A4 | int f() |

Simulation t1: 0.00059767 sec L:18 C:1 CAP NUM SCRL OVR R/W

In the third position, the 2nd bit shown in GPIO1 we can see output of seven segment display of the digit 2 in GPIO0 which is of value 0101 1011 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x000005B0 |
| R1 | 0x2009C000 |
| R2 | 0x100000B0 |
| R3 | 0x100000B0 |
| R4 | 0x00000000 |
| R5 | 0x10000050 |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000002B0 |
| R11 | 0x00000000 |
| R12 | 0x10000090 |
| R13 (SP) | 0x100002B0 |
| R14 (LR) | 0x00000157 |
| R15 (PC) | 0x000001F2 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 4919 |
| Sec | 0.00061067 |

```
    18:                 i=(i+1)%4;
0x000001F2 4807      LDR      r0,[pc,#28]  ; @0x00000210
0x000001F4 7800      LDRB     r0,[r0,#0x00]
0x000001F6 1C40      ADDS     r0,r0,#1
```

```c
#include<LPC17xx.h>

unsigned seven_seg[10] = {0x3F, 0x06, 0x5B, 0x4F, 0x66};
unsigned int dig_value[4]={4,3,2,1};
unsigned int dig_select[]={0,1,2,3};
unsigned int i=0;

int main(){
  LPC_PINCON->PINSEL0 &= 0xFF0000FF; //0.4 to 0.11
  LPC_PINCON->PINSEL3 &= 0xFFC03FFF; //1.23 to 1.26

  LPC_GPIO0->FIODIR |= 0x00000FF0; //0.4 to 0.11 as output
  LPC_GPIO1->FIODIR |= 0x07800000; //1.23 to 1.26 as output

  while(1){
    LPC_GPIO1->FIOPIN = i<<23;
    LPC_GPIO0->FIOPIN = seven_seg[dig_value[i]] << 4;
    i=(i+1)%4;
  }
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

| | |
|---|---|
| FIO0DIR: | 0x00000FF0 |
| FIO0MASK: | 0x00000000 |
| FIO0SET: | 0x000005B0 |
| FIO0CLR: | 0x00000000 |
| FIO0PIN: | 0x7FFF85BF |
| Pins: | 0x7FFF85BF |

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

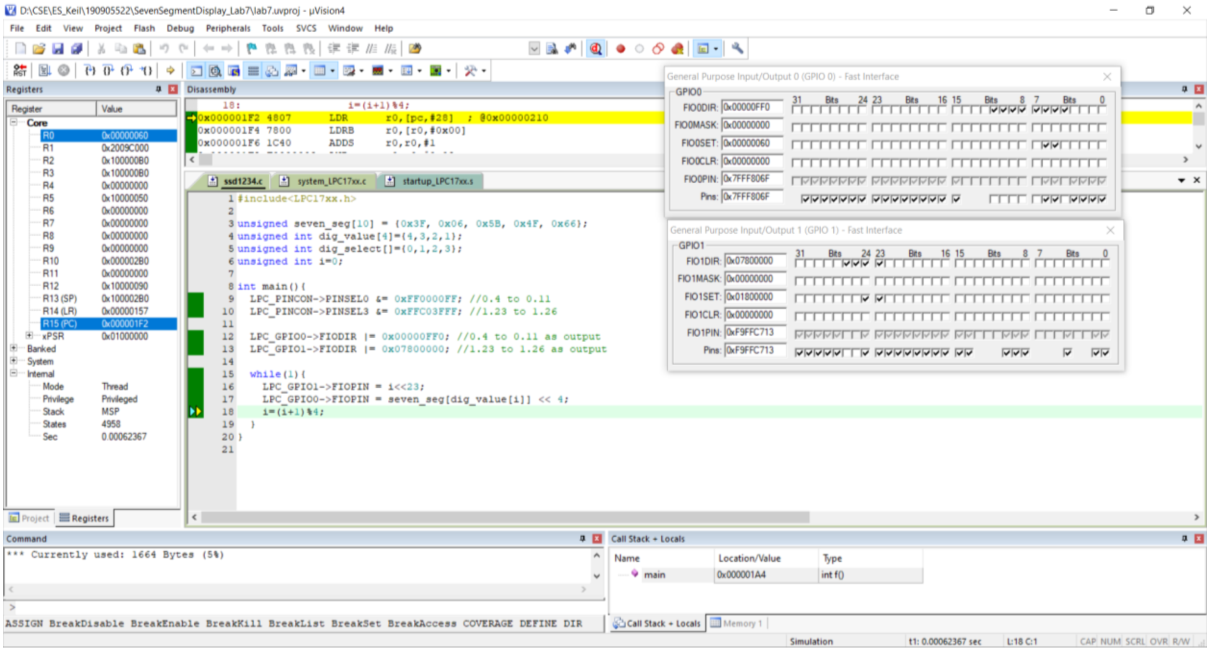
| | |
|---|---|
| FIO1DIR: | 0x07800000 |
| FIO1MASK: | 0x00000000 |
| FIO1SET: | 0x01000000 |
| FIO1CLR: | 0x00000000 |
| FIO1PIN: | 0xF97FC713 |
| Pins: | 0xF97FC713 |

```
*** Currently used: 1664 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

| Name | Location/Value | Type |
|---|---|---|
| main | 0x000001A4 | int f() |

Simulation t1: 0.00061067 sec L:18 C:1 CAP NUM SCRL OVR R/W

In the fourth position, the 3rd bit shown in GPIO1 we can see output of seven segment display of the digit 1 in GPIO0 which is of value 0000 0110 in binary:



D:\CSE\ES_Keil\190905522\SevenSegmentDisplay_Lab7\lab7.uvproj - µVision4

| Register | Value |
|---|---|
| Core | |
| R0 | 0x00000060 |
| R1 | 0x2009C000 |
| R2 | 0x100000B0 |
| R3 | 0x100000B0 |
| R4 | 0x00000000 |
| R5 | 0x10000050 |
| R6 | 0x00000000 |
| R7 | 0x00000000 |
| R8 | 0x00000000 |
| R9 | 0x00000000 |
| R10 | 0x000002B0 |
| R11 | 0x00000000 |
| R12 | 0x10000090 |
| R13 (SP) | 0x100002B0 |
| R14 (LR) | 0x00000157 |
| R15 (PC) | 0x000001F2 |
| xPSR | 0x01000000 |
| Banked | |
| System | |
| Internal | |
| Mode | Thread |
| Privilege | Privileged |
| Stack | MSP |
| States | 4958 |
| Sec | 0.00062367 |

```
    18:                         i=(i+1)%4;
0x000001F2 4807      LDR      r0,[pc,#28]  ; @0x00000210
0x000001F4 7800      LDRB     r0,[r0,#0x00]
0x000001F6 1C40      ADDS     r0,r0,#1
```

```
#include<LPC17xx.h>

unsigned seven_seg[10] = {0x3F, 0x06, 0x5B, 0x4F, 0x66};
unsigned int dig_value[4]={4,3,2,1};
unsigned int dig_select[]={0,1,2,3};
unsigned int i=0;

int main(){
  LPC_PINCON->PINSEL0 &= 0xFF0000FF; //0.4 to 0.11
  LPC_PINCON->PINSEL3 &= 0xFFC03FFF; //1.23 to 1.26

  LPC_GPIO0->FIODIR |= 0x00000FF0; //0.4 to 0.11 as output
  LPC_GPIO1->FIODIR |= 0x07800000; //1.23 to 1.26 as output

  while(1){
    LPC_GPIO1->FIOPIN = i<<23;
    LPC_GPIO0->FIOPIN = seven_seg[dig_value[i]] << 4;
    i=(i+1)%4;
  }
}
```

General Purpose Input/Output 0 (GPIO 0) - Fast Interface

GPIO0

FIO0DIR: 0x00000FF0

FIO0MASK: 0x00000000

FIO0SET: 0x00000060

FIO0CLR: 0x00000000

FIO0PIN: 0x7FFF806F

Pins: 0x7FFF806F

General Purpose Input/Output 1 (GPIO 1) - Fast Interface

GPIO1

FIO1DIR: 0x07800000

FIO1MASK: 0x00000000

FIO1SET: 0x01800000

FIO1CLR: 0x00000000

FIO1PIN: 0xF9FFC713

Pins: 0xF9FFC713

```
*** Currently used: 1664 Bytes (5%)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE DEFINE DIR
```

| Name | Location/Value | Type |
|---|---|---|
| main | 0x000001A4 | int f() |

Simulation t1: 0.00062367 sec L:18 C:1 CAP NUM SCRL OVR R/W

**THE END**