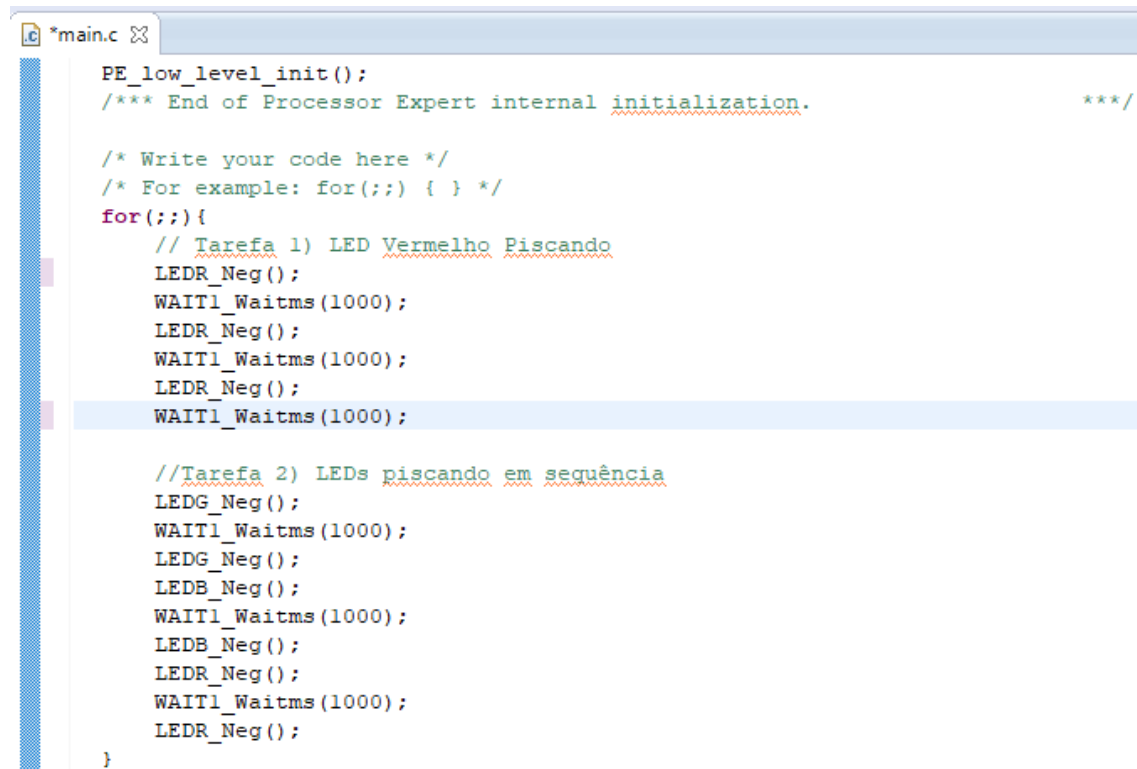


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- 1) Faça um LED Piscar utilizando o Processor Expert do CodeWarrior.
- 2) Agora faça os 3 LEDs da placa piscarem sequencialmente.

Código utilizado para as tarefas 1 e 2:



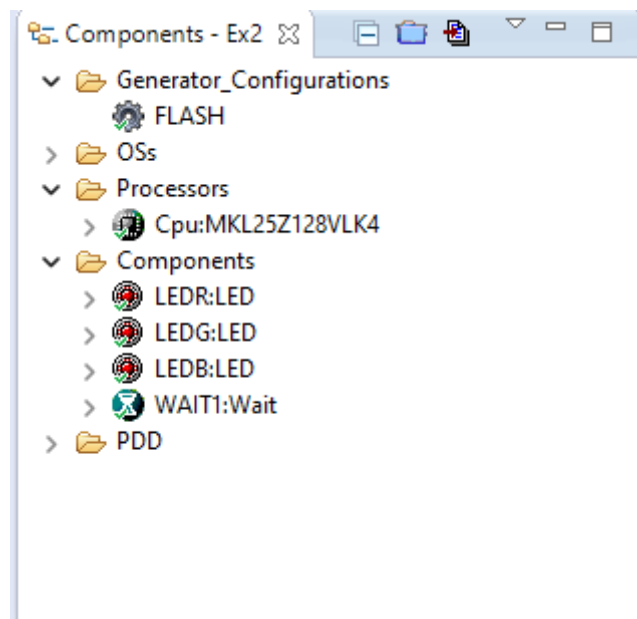
```
*main.c

PE_low_level_init();
/** End of Processor Expert internal initialization.          */

/* Write your code here */
/* For example: for(;;) { } */
for(;;){
    // Tarefa 1) LED Vermelho Piscando
    LEDR_Neg();
    WAIT1_Waitms(1000);
    LEDR_Neg();
    WAIT1_Waitms(1000);
    LEDR_Neg();
    WAIT1_Waitms(1000);

    //Tarefa 2) LEDs piscando em sequência
    LEDG_Neg();
    WAIT1_Waitms(1000);
    LEDG_Neg();
    LEDB_Neg();
    WAIT1_Waitms(1000);
    LEDB_Neg();
    LEDR_Neg();
    WAIT1_Waitms(1000);
    LEDR_Neg();
}
```

Janela “Components” utilizada nas tarefas 1 e 2:



- 3) Faça um LED piscar sem utilizar o Processor Expert do CodeWarrior.
- 4) Analise a mudança dos registradores no debugger.

5) Modifique o código para piscar dois LEDs ao mesmo tempo.

Código utilizado para as tarefas 3 e 5:

```
main.c
#define SIM_SCGC5 (*(volatile unsigned int*)0x40048038) /* System Integration Module System Clock Gating Control Register 5 */
#define PORTB_PCR19 (*(volatile unsigned int*)0x4004A04C) /* Port B Pin Control Register 19 */
#define GPIO_PDDR (*(volatile unsigned int*)0x400FF054) /* Port B Data Direction Register */
#define GPIO_PDOR (*(volatile unsigned int*)0x400FF040) /* Port B Data Output Register */
#define GPIOB_OTOR (*(volatile unsigned int*)0x400FF04C) /* Port B Toggle Output Register */

#define PORTB_PCR18 (*(volatile unsigned int*)0x4004A048) /* Port B Pin Control Register 18 */

#define GREEN_PIN (19)
#define GREEN_SHIFT (1<<GREEN_PIN)
#define GREEN_TOGGLE (GPIOB_OTOR |= GREEN_SHIFT)
#define RED_PIN (18)
#define RED_SHIFT (1<<RED_PIN)
#define RED_TOGGLE (GPIOB_OTOR |= RED_SHIFT)

void delayMs(int n) {
    int i, j;
    for(i = 0; i < n; i++)
        for(j = 0; j < 7000; j++) {}
}

int main(void) {
    SIM_SCGC5 |= 0x400;

    PORTB_PCR19 |= 0x0100;
    PORTB_PCR18 |= 0x0100;

    GPIO_PDDR |= GREEN_SHIFT;
    GPIO_PDOR |= GREEN_SHIFT;

    GPIO_PDDR |= RED_SHIFT;
    GPIO_PDOR |= RED_SHIFT;

    // Tarefa 3
    while(1) {
        GREEN_TOGGLE;
        delayMs(200);
        GREEN_TOGGLE;
        delayMs(500);
    }

    // Tarefa 5
    while(1) {
        GREEN_TOGGLE;
        RED_TOGGLE;
        delayMs(200);
        GREEN_TOGGLE;
        RED_TOGGLE;
        delayMs(500);
    }

    return 0;
}
```

Mudanças ocorridas nos registradores, observadas no debugger:

Usando o Processor Expert:

Variables Breakpoints Registers Memory Modules		
Name	Value	Location
Pin Control and Interrupts (PORTD)		
PORTD_PCR0	0x00000005	0x4004c000
PORTD_PCR1	0x00000105	0x4004c004
PORTD_PCR2	0x00000005	0x4004c008
PORTD_PCR3	0x00000005	0x4004c00c
PORTD_PCR4	0x00000001	0x4004c010
PORTD_PCR5	0x00000001	0x4004c014
PORTD_PCR6	0x00000001	0x4004c018
PORTD_PCR7	0x00000001	0x4004c01c
No details to display for the current selection.		

<div> <div>(x)= Variables</div> <div>Breakpoints</div> <div>Registers</div> <div>Memory</div> <div>Modules</div> </div>		
Name	Value	Location
<div>1010 0101</div> PORTB_PCR14	0x00000000	0x4004a038
<div>1010 0101</div> PORTB_PCR15	0x00000000	0x4004a03c
<div>1010 0101</div> PORTB_PCR16	0x00000001	0x4004a040
<div>1010 0101</div> PORTB_PCR17	0x00000001	0x4004a044
<div>1010 0101</div> PORTB_PCR18	0x00000105	0x4004a048
<div>1010 0101</div> PORTB_PCR19	0x00000105	0x4004a04c
<div>1010 0101</div> PORTB_PCR20	0x00000000	0x4004a050
<div>1010 0101</div> PORTB_PCR21	0x00000000	0x4004a054
<div>1010 0101</div> PORTB_PCR22	0x00000000	0x4004a058
No details to display for the current selection.		

Sem usar o Processor Expert:

<div> <div>(x)= Variables</div> <div>Breakpoints</div> <div>Registers</div> <div>Memory</div> <div>Modules</div> </div>		
Name	Value	Location
<div>1010 0101</div> PORTB_PCR13	0x00000000	0x4004a034
<div>1010 0101</div> PORTB_PCR14	0x00000000	0x4004a038
<div>1010 0101</div> PORTB_PCR15	0x00000000	0x4004a03c
<div>1010 0101</div> PORTB_PCR16	0x00000001	0x4004a040
<div>1010 0101</div> PORTB_PCR17	0x00000001	0x4004a044
<div>1010 0101</div> PORTB_PCR18	0x00000005	0x4004a048
<div>1010 0101</div> PORTB_PCR19	0x00000105	0x4004a04c
<div>1010 0101</div> PORTB_PCR20	0x00000000	0x4004a050
<div>1010 0101</div> PORTB_PCR21	0x00000000	0x4004a054

- 6) Compile o código abaixo e escreva os valores de next em cada iteração. Qual o nome desta série de números?

c	next
1	0
2	1
3	1
4	2
5	3
6	5
7	8
8	13
9	21
10	34

Valores das variáveis em c=4:

<div> <div>(x)= Variables</div> <div>Breakpoints</div> <div>Registers</div> <div>Memory</div> <div>Modules</div> </div>		
Name	Value	Location
(x)= first	1	0x20002ff4
(x)= second	2	0x20002ff0
(x)= next	2	0x20002fe8
(x)= c	4	0x20002fec

Valores das variáveis em c=10:

<div> <div>(x)= Variables</div> <div>Breakpoints</div> <div>Registers</div> <div>Memory</div> <div>Modules</div> </div>		
Name	Value	Location
(x)= first	21	0x20002ff4
(x)= second	34	0x20002ff0
(x)= next	34	0x20002fe8
(x)= c	10	0x20002fec