TD n°1 Assembleur du 90S8535

Objectifs :

- Analyser un petit programme assembleur (recopie.asm)
- Analyser le résultat de l'assemblage (évolution du compteur de programme, contenu de la mémoire programme…)
- Vérifier l'adéquation entre programme et organisation de la mémoire Flash. Evaluer la quantité et le % de mémoire consommée par le programme.
- Justifier le démarrage à l'adresse $0 du programme.
- Mettre en évidence l'adéquation entre le programme d'initialisation des ports // et le schéma électrique associé aux broches d'entrées/sorties.
- Evaluer le temps d'exécution d'une partie d'un programme et la boucle « delai »

PS : travaux sur les fichiers « recopie.asm », « recopie_assemble.doc » et « compteur.asm »

Programme « recopie.asm »

```
.include "8535def.inc"
.def temp = r16
.cseg
.org $000
        rjmp    main_prog
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
main_prog:
        ldi     temp,low (RAMEND)
        out     SPL,temp
        ldi     temp,high (RAMEND)
        out     SPH,temp
        ser     temp
        out     DDRB,temp
        clr     temp
        out     DDRD,temp
        ser     temp
        out     PORTD,temp
debut:
        in      temp,PIND
        out     PORTB,temp
        rjmp   debut
```

Programme « compteur.asm »

```
.include "8535def.inc"
.def temp = r16
.def compteur = r20
.cseg
.org $000
        rjmp main_pro;Resetinterrupt
.org $012
main_prog:
        ldi     temp,low (RAMEND)
        out     SPL,temp
        ldi     temp,high (RAMEND)
        out     SPH,temp
        ser     temp
        out     DDRB,temp
        clr     temp
        out      DDRD,temp
        ser     temp
        out     PORTD,temp
debut:
        in      temp,PIND
        sbrs    temp, 0
        rjmp    raz
        in      temp,pind
        sbrs    temp,1
        rjmp    debut
        dec     compteur
affich:
        out     portb,compteur
        rcall   delai
        rjmp    debut
raz:
        ser     compteur
        rjmp    affich
delai:
        ldi     r19,$08
        ldi     r18,$FF
        ldi     r17,$FF
delai3:
        dec     r17
        brne    delai3
        dec     r18
        brne    delai3
        dec     r19
        brne    delai3
        ret
```

Programme “recopie_assemble”

```
+00000000:  C010      RJMP   PC+0x0011      Relative jump
7:          nop
+00000001:  0000      NOP                   No operation
8:          nop
+00000002:  0000      NOP                   No operation
9:          nop
+00000003:  0000      NOP                   No operation
10:         nop
+00000004:  0000      NOP                   No operation
11:         nop
+00000005:  0000      NOP                   No operation
12:         nop
+00000006:  0000      NOP                   No operation
13:         nop
+00000007:  0000      NOP                   No operation
14:         nop
+00000008:  0000      NOP                   No operation
15:         nop
+00000009:  0000      NOP                   No operation
16:         nop
+0000000A:  0000      NOP                   No operation
17:         nop
+0000000B:  0000      NOP                   No operation
18:         nop
+0000000C:  0000      NOP                   No operation
19:         nop
+0000000D:  0000      NOP                   No operation
20:         nop
+0000000E:  0000      NOP                   No operation
21:         nop
+0000000F:  0000      NOP                   No operation
22:         nop
+00000010:  0000      NOP                   No operation
@00000011: main_prog
25:         ldi       temp,low (RAMEND)
+00000011:  E50F      LDI    R16,0x5F       Load immediate
26:         out       SPL,temp
+00000012:  BF0D      OUT    0x3D,R16       Out to I/O location
27:         ldi temp,high (RAMEND)
+00000013:  E002      LDI    R16,0x02       Load immediate
28:         out       SPH,temp
+00000014:  BF0E      OUT    0x3E,R16       Out to I/O location
29:         ser       temp
+00000015:  EF0F      SER    R16            Set Register
30:         out       DDRB,temp
+00000016:  BB07      OUT    0x17,R16       Out to I/O location
31:         clr temp
+00000017:  2700      CLR    R16            Clear Register
32:         out DDRD,temp
+00000018:  BB01      OUT    0x11,R16       Out to I/O location
33:         ser temp
+00000019:  EF0F      SER    R16            Set Register
34:         out PORTD,temp
+0000001A:  BB02      OUT    0x12,R16       Out to I/O location
@0000001B: debut
36:         in temp,PIND
+0000001B:  B300      IN     R16,0x10       In from I/O location
37:         out       PORTB,temp
+0000001C:  BB08      OUT    0x18,R16       Out to I/O location
38:         rjmp debut
+0000001D:  CFFD      RJMP   PC-0x0002      Relative jump
```