

Lab 3_solution2

Brief: Toggle led on GPIO PORTF PIN 3 on Tiva-c Board TM4C123 and debug with keil-uvision.

1. **Code:** In the same file in which this file attached

2. **Sections:** sections for object and .elf files.

2.1. main.o

```
MINGW64:/d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_so...
Mina@Bello MINGW64 /d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_solution2 (main)
$ arm-none-eabi-objdump -h main.o

main.o:      file format elf32-littlearm

Sections:
Idx Name          Size      VMA           LMA           File off  Algn
  0 .text          000000b4  00000000  00000000  00000034  2**2
    CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data          00000010  00000000  00000000  000000e8  2**2
    CONTENTS, ALLOC, LOAD, DATA
  2 .bss           00000000  00000000  00000000  000000f8  2**0
    ALLOC
  3 .debug_info     0000012f  00000000  00000000  000000f8  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev   000000ca  00000000  00000000  00000227  2**0
    CONTENTS, READONLY, DEBUGGING
  5 .debug_loc      00000038  00000000  00000000  000002f1  2**0
    CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges  00000020  00000000  00000000  00000329  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line     00000063  00000000  00000000  00000349  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str       000000fe  00000000  00000000  000003ac  2**0
    CONTENTS, READONLY, DEBUGGING
  9 .comment        00000012  00000000  00000000  000004aa  2**0
    CONTENTS, READONLY
10 .ARM.attributes 00000033  00000000  00000000  000004bc  2**0
    CONTENTS, READONLY
11 .debug_frame     0000002c  00000000  00000000  000004f0  2**2
    CONTENTS, RELOC, READONLY, DEBUGGING
```

2.2. startup.o

```
MINGW64:/d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_so...
Mina@Bello MINGW64 /d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_solution2 (main)
$ arm-none-eabi-objdump -h startup.o

startup.o:      file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text          000000fc  00000000  00000000  00000034  2**2
    CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data          00000000  00000000  00000000  00000130  2**0
    CONTENTS, ALLOC, LOAD, DATA
  2 .bss           00000400  00000000  00000000  00000130  2**2
    ALLOC
  3 .vectors        00000010  00000000  00000000  00000130  2**2
    CONTENTS, ALLOC, LOAD, RELOC, DATA
  4 .debug_info     00000150  00000000  00000000  00000140  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  5 .debug_abbrev   000000b6  00000000  00000000  00000290  2**0
    CONTENTS, READONLY, DEBUGGING
  6 .debug_loc      00000064  00000000  00000000  00000346  2**0
    CONTENTS, READONLY, DEBUGGING
  7 .debug_aranges  00000020  00000000  00000000  000003aa  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_line     00000067  00000000  00000000  000003ca  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  9 .debug_str       0000013a  00000000  00000000  00000431  2**0
    CONTENTS, READONLY, DEBUGGING
10 .comment         00000012  00000000  00000000  0000056b  2**0
    CONTENTS, READONLY
11 .ARM.attributes  00000033  00000000  00000000  0000057d  2**0
    CONTENTS, READONLY
12 .debug_frame     0000004c  00000000  00000000  000005b0  2**2
    CONTENTS, RELOC, READONLY, DEBUGGING
```

2.3. lab_3.elf

```
MINGW64:/d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_so...
Mina@Bello MINGW64 /d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_solution2 (main)
$ arm-none-eabi-objdump -h lab_3.elf

lab_3.elf:      file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text          000001c0  00000000  00000000  00008000  2**2
    CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .data          00000010  20000000  000001c0  00010000  2**2
    CONTENTS, ALLOC, LOAD, DATA
  2 .bss           00000404  20000010  000001d0  00010010  2**2
    ALLOC
  3 .debug_info     0000027f  00000000  00000000  00010010  2**0
    CONTENTS, READONLY, DEBUGGING
  4 .debug_abbrev   00000180  00000000  00000000  0001028f  2**0
    CONTENTS, READONLY, DEBUGGING
  5 .debug_loc      0000009c  00000000  00000000  0001040f  2**0
    CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges  00000040  00000000  00000000  000104ab  2**0
    CONTENTS, READONLY, DEBUGGING
  7 .debug_line     000000ca  00000000  00000000  000104eb  2**0
    CONTENTS, READONLY, DEBUGGING
  8 .debug_str      00000199  00000000  00000000  000105b5  2**0
    CONTENTS, READONLY, DEBUGGING
  9 .comment        00000011  00000000  00000000  0001074e  2**0
    CONTENTS, READONLY
10 .ARM.attributes 00000033  00000000  00000000  0001075f  2**0
    CONTENTS, READONLY
11 .debug_frame     00000078  00000000  00000000  00010794  2**2
    CONTENTS, READONLY, DEBUGGING
```

3. Symbols: symbols for each object file and .elf file

3.1. main.o

```
MINGW64:/d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_so...
Mina@Bello MINGW64 /d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_solution2 (main)
$ arm-none-eabi-nm main.o
00000008 D GPIOF_DATA
00000004 D GPIOF_DEN
00000000 D GPIOF_DIR
00000000 T main
0000000c D SYSCTL_RCGC2
```

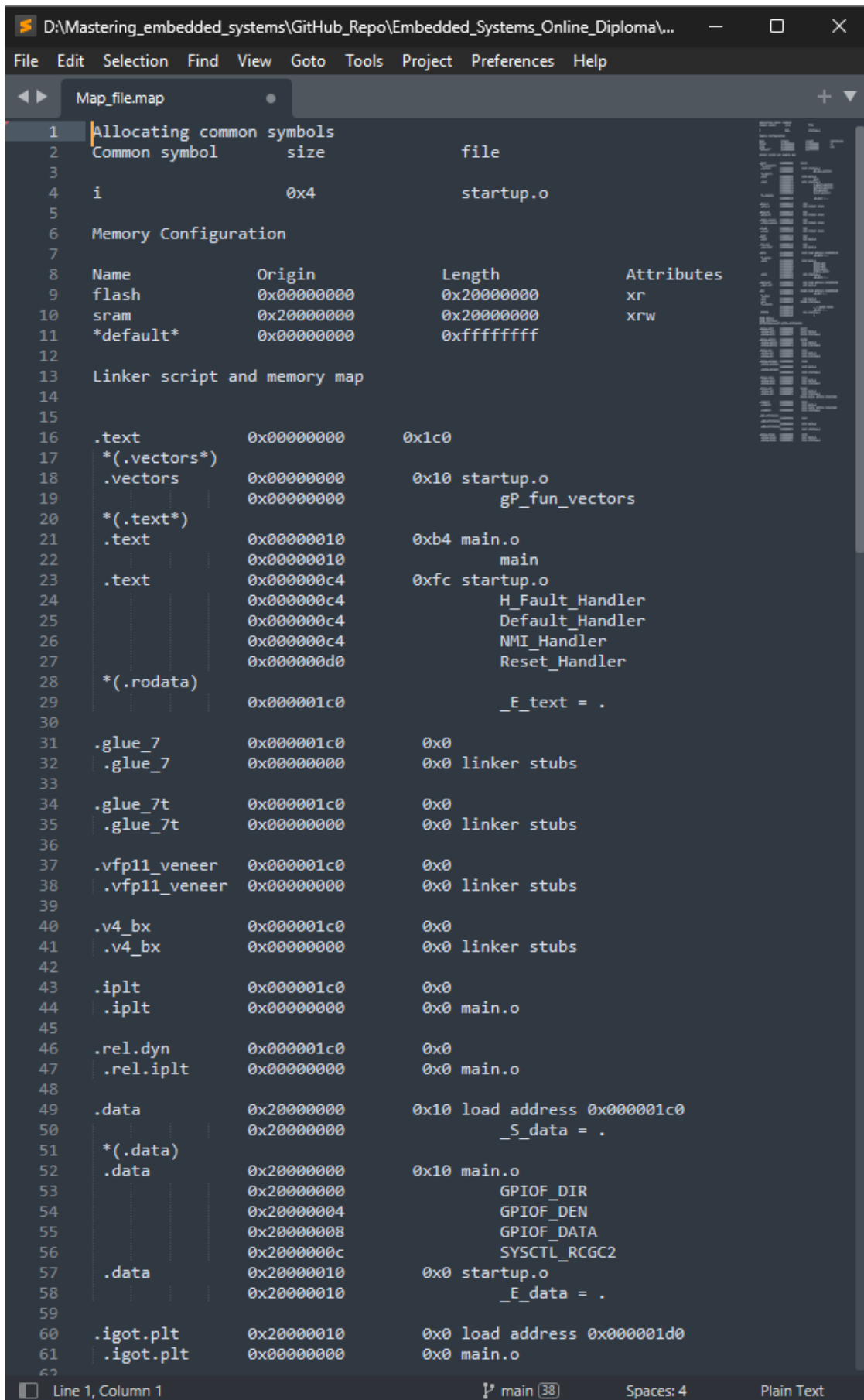
3.2. startup.o

```
MINGW64/d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_so...  
Mina@Bello MINGW64 /d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_solution2 (main)  
$ arm-none-eabi-nm startup.o  
                 U _E_bss  
                 U _E_data  
                 U _E_text  
                 U _S_bss  
                 U _S_data  
00000000 T Default_Handler  
00000000 D gP_fun_vectors  
00000000 W H_Fault_Handler  
00000004 C i  
                 U main  
00000000 W NMI_Handler  
0000000c T Reset_Handler  
00000000 b Stack_Top
```

3.3. lab_3.elf and lab_3.axf are the same.

```
MINGW64/d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_so...  
Mina@Bello MINGW64 /d/Mastering_embedded_systems/GitHub_Repo/Embedded_Systems_Online_Diploma/Unit3-Embedded_C/Lecture_4/Lab3_solution2 (main)  
$ arm-none-eabi-nm lab_3.elf  
20000410 B _E_bss  
20000010 D _E_data  
000001c0 T _E_text  
20000010 B _S_bss  
20000000 D _S_data  
000000c4 T Default_Handler  
00000000 T gP_fun_vectors  
20000008 D GPIOF_DATA  
20000004 D GPIOF_DEN  
20000000 D GPIOF_DIR  
000000c4 W H_Fault_Handler  
20000410 B i  
00000010 T main  
000000c4 W NMI_Handler  
000000d0 T Reset_Handler  
20000010 b Stack_Top  
2000000c D SYSCTL_RCGC2
```

4. Map_file.map



```
1 Allocating common symbols
2 Common symbol      size      file
3
4 i                  0x4       startup.o
5
6 Memory Configuration
7
8 Name              Origin              Length              Attributes
9 flash             0x00000000      0x20000000         xr
10 sram              0x20000000      0x20000000         xrw
11 *default*        0x00000000      0xffffffff
12
13 Linker script and memory map
14
15
16 .text             0x00000000      0x1c0
17 *(.vectors*)
18 .vectors          0x00000000      0x10 startup.o
19                  0x00000000                      gP_fun_vectors
20 *(.text*)
21 .text            0x00000010      0xb4 main.o
22                  0x00000010                      main
23 .text            0x000000c4      0xfc startup.o
24                  0x000000c4                      H_Fault_Handler
25                  0x000000c4                      Default_Handler
26                  0x000000c4                      NMI_Handler
27                  0x000000d0                      Reset_Handler
28 *(.rodata)
29                  0x000001c0                      _E_text = .
30
31 .glue_7           0x000001c0      0x0
32 .glue_7           0x00000000      0x0 linker stubs
33
34 .glue_7t          0x000001c0      0x0
35 .glue_7t          0x00000000      0x0 linker stubs
36
37 .vfp11_veneer     0x000001c0      0x0
38 .vfp11_veneer     0x00000000      0x0 linker stubs
39
40 .v4_bx            0x000001c0      0x0
41 .v4_bx            0x00000000      0x0 linker stubs
42
43 .iplt             0x000001c0      0x0
44 .iplt             0x00000000      0x0 main.o
45
46 .rel.dyn          0x000001c0      0x0
47 .rel.iplt         0x00000000      0x0 main.o
48
49 .data             0x20000000      0x10 load address 0x000001c0
50                  0x20000000                      _S_data = .
51 *(.data)
52 .data             0x20000000      0x10 main.o
53                  0x20000000                      GPIOF_DIR
54                  0x20000004                      GPIOF_DEN
55                  0x20000008                      GPIOF_DATA
56                  0x2000000c                      SYSCTL_RCGC2
57 .data             0x20000010      0x0 startup.o
58                  0x20000010                      _E_data = .
59
60 .igot.plt         0x20000010      0x0 load address 0x000001d0
61 .igot.plt         0x00000000      0x0 main.o
```

Line 1, Column 1 main (38) Spaces: 4 Plain Text

```

63 .bss 0x20000010 0x404 load address 0x000001d0
64 .bss 0x20000010 _S_bss = .
65 *(.bss)
66 .bss 0x20000010 0x0 main.o
67 .bss 0x20000010 0x400 startup.o
68 *(.stack)
69 0x20000410 . = ALIGN (0x4)
70 0x20000410 _E_bss = .
71 COMMON 0x20000410 0x4 startup.o
72 0x20000410 i
73 LOAD main.o
74 LOAD startup.o
75 OUTPUT(lab_3.elf elf32-littlearm)
76
77 .debug_info 0x00000000 0x27f
78 .debug_info 0x00000000 0x12f main.o
79 .debug_info 0x0000012f 0x150 startup.o
80
81 .debug_abbrev 0x00000000 0x180
82 .debug_abbrev 0x00000000 0xca main.o
83 .debug_abbrev 0x000000ca 0xb6 startup.o
84
85 .debug_loc 0x00000000 0x9c
86 .debug_loc 0x00000000 0x38 main.o
87 .debug_loc 0x00000038 0x64 startup.o
88
89 .debug_aranges 0x00000000 0x40
90 .debug_aranges
91 0x00000000 0x20 main.o
92 .debug_aranges
93 0x00000020 0x20 startup.o
94
95 .debug_line 0x00000000 0xca
96 .debug_line 0x00000000 0x63 main.o
97 .debug_line 0x00000063 0x67 startup.o
98
99 .debug_str 0x00000000 0x199
100 .debug_str 0x00000000 0xfe main.o
101 .debug_str 0x000000fe 0x9b startup.o
102 0x13a (size before relaxing)
103
104 .comment 0x00000000 0x11
105 .comment 0x00000000 0x11 main.o
106 0x12 (size before relaxing)
107 .comment 0x00000000 0x12 startup.o
108
109 .ARM.attributes
110 0x00000000 0x33
111 .ARM.attributes
112 0x00000000 0x33 main.o
113 .ARM.attributes
114 0x00000033 0x33 startup.o
115
116 .debug_frame 0x00000000 0x78
117 .debug_frame 0x00000000 0x2c main.o
118 .debug_frame 0x0000002c 0x4c startup.o
119

```