

Lab 1

```
W app 2023-07-12 3:56 PM C File 1 KB
W app 2023-07-12 3:57 PM O File 3 KB
W uart 2023-07-12 3:54 PM C File 1 KB
W uart 2023-07-12 3:56 PM H File 1 KB
W uart 2023-07-12 3:58 PM O File 3 KB

MINGW64:/e/Daiploma/xx

Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-gcc.exe -c -g -I -mcpu=arm926ej -s app.c -o app.o

Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-gcc.exe -c -g -I -mcpu=arm926ej -s uart.c -o uart.o

Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ !
$
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-gcc.exe -c -g -I -mcpu=arm926ej -s uart.c -o uart.o

Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-objdump.exe -h app.o

app.o:      file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text          00000020  00000000  00000000  00000034  2**2
    CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data          00000064  00000000  00000000  00000054  2**2
    CONTENTS, ALLOC, LOAD, DATA
  2 .bss           00000000  00000000  00000000  000000b8  2**0
    ALLOC
  3 .rodata        00000064  00000000  00000000  000000b8  2**2
    CONTENTS, ALLOC, LOAD, READONLY, DATA
  4 .debug_info    00000083  00000000  00000000  0000011c  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  5 .debug_abbrev  00000061  00000000  00000000  0000019f  2**0
    CONTENTS, READONLY, DEBUGGING
  6 .debug_loc     0000002c  00000000  00000000  00000200  2**0
    CONTENTS, READONLY, DEBUGGING
  7 .debug_aranges 00000020  00000000  00000000  0000022c  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_line    00000035  00000000  00000000  0000024c  2**0
    CONTENTS, RELOC, READONLY, DEBUGGING
  9 .debug_str     0000005a  00000000  00000000  00000281  2**0
    CONTENTS, READONLY, DEBUGGING
10 .comment       00000012  00000000  00000000  000002db  2**0
    CONTENTS, READONLY
11 .ARM.attributes 00000030  00000000  00000000  000002ed  2**0
    CONTENTS, READONLY
12 .debug_frame   0000002c  00000000  00000000  00000320  2**2
    CONTENTS, RELOC, READONLY, DEBUGGING

Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ !
$
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-gcc.exe -c -I -mcpu=arm926ej -s app.c -o app.o
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-objdump.exe -h app.o
```

```
app.o:      file format elf32-littlearm
```

```
Sections:
```

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	00000020	00000000	00000000	00000034	2**2
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE					
1	.data	00000064	00000000	00000000	00000054	2**2
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000000	00000000	00000000	000000b8	2**0
	ALLOC					
3	.rodata	00000064	00000000	00000000	000000b8	2**2
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
4	.comment	00000012	00000000	00000000	0000011c	2**0
	CONTENTS, READONLY					
5	.ARM.attributes	00000030	00000000	00000000	0000012e	2**0
	CONTENTS, READONLY					

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-gcc.exe -c -I -mcpu=arm926ej -s uart.c -o uart.o
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-objdump.exe -h uart.o
```

```
uart.o:      file format elf32-littlearm
```

```
Sections:
```

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	00000050	00000000	00000000	00000034	2**2
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE					
1	.data	00000000	00000000	00000000	00000084	2**0
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000000	00000000	00000000	00000084	2**0
	ALLOC					
3	.comment	00000012	00000000	00000000	00000084	2**0
	CONTENTS, READONLY					
4	.ARM.attributes	00000030	00000000	00000000	00000096	2**0
	CONTENTS, READONLY					

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-objdump.exe -s app.o
```

```
app.o:      file format elf32-littlearm
```

```
Contents of section .text:
```

0000	00482de9	04b08de2	0c009fe5	feffffeb	.H-.....
0010	04d04be2	0048bde8	1eff2fe1	00000000	..K..H....

```
Contents of section .data:
```

0000	6c656172	6e2d696e	2d646570	74683a52	learn-in-depth:R
0010	61736861	64000000	00000000	00000000	ashad.....
0020	00000000	00000000	00000000	00000000	.....
0030	00000000	00000000	00000000	00000000	.....
0040	00000000	00000000	00000000	00000000	.....
0050	00000000	00000000	00000000	00000000	.....
0060	00000000				....

```
Contents of section .rodata:
```

0000	6c656172	6e2d696e	2d646570	74683a52	learn-in-depth:R
0010	61736861	64000000	00000000	00000000	ashad.....
0020	00000000	00000000	00000000	00000000	.....
0030	00000000	00000000	00000000	00000000	.....
0040	00000000	00000000	00000000	00000000	.....
0050	00000000	00000000	00000000	00000000	.....
0060	00000000				....








```
Contents of section .comment:
```

0000	00474343	3a202847	4e552920	342e372e	.GCC: (GNU) 4.7.
0010	3200				2.

```
Contents of section .ARM.attributes:
```

0000	412f0000	00616561	62690001	25000000	A/...aeabi...%
0010	0541524d	3754444d	49000602	08010901	.ARM7TDMI.....
0020	12041401	15011703	18011901	1a011e06	.....

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$
```








	app	2023-07-12 4:05 PM	C File	1 KB
	app	2023-07-12 4:02 PM	O File	2 KB
	startup	2023-07-12 4:09 PM	O File	1 KB
	startup	2023-07-12 4:05 PM	S File	1 KB
	uart	2023-07-12 3:54 PM	C File	1 KB
	uart	2023-07-12 3:56 PM	H File	1 KB
	uart	2023-07-12 4:08 PM	O File	1 KB

MINGW64:/e/Daiploma/xx

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-as.exe -mcpu=arm926ej-s startup.s -o startup.o
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
```

```
$ .....
```

	app	2023-07-12 4:05 PM	C File	1 KB
	app	2023-07-12 4:02 PM	O File	2 KB
	startup	2023-07-12 4:09 PM	O File	1 KB
	startup	2023-07-12 4:05 PM	S File	1 KB
	uart	2023-07-12 3:54 PM	C File	1 KB
	uart	2023-07-12 3:56 PM	H File	1 KB
	uart	2023-07-12 4:08 PM	O File	1 KB

MINGW64:/e/Daiploma/xx

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-as.exe -mcpu=arm926ej-s startup.s -o startup.o
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-objdump.exe -h startup.o
```

```
startup.o:      file format elf32-littlearm
```

Sections:

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	00000010	00000000	00000000	00000034	2**2
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE					
1	.data	00000000	00000000	00000000	00000044	2**0
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000000	00000000	00000000	00000044	2**0
	ALLOC					
3	.ARM.attributes	00000022	00000000	00000000	00000044	2**0
	CONTENTS, READONLY					

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
```

```
$ .....
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ touch linker_script.ld
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-nm.exe app.o
00000000 T main
00000000 D string_buffer
00000000 R string_buffer2
          U Uart_Send_string
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ .....
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ touch linker_script.ld
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-nm.exe app.o
00000000 T main
00000000 D string_buffer
00000000 R string_buffer2
          U Uart_Send_string
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-nm.exe uart.o
00000000 T Uart_Send_string
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ .....
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-ld.exe -T linker_script.ld app.o uart.o startup.o -o Rashad.elf
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-nm.exe Rashad.elf
00010010 T main
00010000 T reset
00011148 D stack_top
00010008 t stop
000100e4 D string_buffer
00010080 T string_buffer2
00010030 T Uart_Send_string
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ .....
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-readelf.exe -a Rashad.elf
ELF Header:
  Magic:   7f 45 4c 46 01 01 01 00 00 00 00 00 00 00 00 00
  Class:                           ELF32
  Data:                             2's complement, little endian
  Version:                           1 (current)
  OS/ABI:                            UNIX - System V
  ABI Version:                       0
  Type:                              EXEC (Executable file)
  Machine:                            ARM
  Version:                           0x1
  Entry point address:                0x10000
  Start of program headers:           52 (bytes into file)
  Start of section headers:           33232 (bytes into file)
  Flags:                              0x5000002, has entry point, Version5 EABI
  Size of this header:                 52 (bytes)
  Size of program headers:             32 (bytes)
  Number of program headers:           1
  Size of section headers:             40 (bytes)
  Number of section headers:           9
  Section header string table index: 6
```

```
Section Headers:
 [Nr] Name                Type              Addr      Off      Size    ES Flg Lk Inf Al
 [ 0]                      NULL              00000000  000000  000000  00   0  0  0  0
 [ 1] .reset                 PROGBITS          00010000  008000  000010  00   AX  0  0  4
 [ 2] .text                  PROGBITS          00010010  008010  0000d4  00   AX  0  0  4
 [ 3] .data                  PROGBITS          000100e4  0080e4  000064  00   WA  0  0  4
 [ 4] .ARM.attributes        ARM_ATTRIBUTES     00000000  008148  00002e  00   0  0  0  1
 [ 5] .comment                PROGBITS          00000000  008176  000011  01   MS  0  0  1
 [ 6] .shstrtab               STRTAB            00000000  008187  000047  00   0  0  1
 [ 7] .symtab                 SYMTAB            00000000  008338  000190  10   8 19  4
 [ 8] .strtab                 STRTAB            00000000  0084c8  000066  00   0  0  1
```

```
Key to Flags:
 W (write), A (alloc), X (execute), M (merge), S (strings)
 I (info), L (link order), G (group), T (TLS), E (exclude), x (unknown)
 0 (extra OS processing required) o (OS specific), p (processor specific)
```

File Name	Created	Type	Size
app	2023-07-12 4:05 PM	C File	1 KB
app	2023-07-12 4:02 PM	O File	2 KB
linker_script	2023-07-12 4:11 PM	LD File	1 KB
Rashad.bin	2023-07-12 4:17 PM	BIN File	1 KB
Rashad.elf	2023-07-12 4:13 PM	ELF File	34 KB
startup	2023-07-12 4:09 PM	O File	1 KB
startup	2023-07-12 4:05 PM	S File	1 KB
uart	2023-07-12 3:54 PM	C File	1 KB
uart	2023-07-12 3:56 PM	H File	1 KB
uart	2023-07-12 4:08 PM	O File	1 KB

MINGW64:/e/Daiploma/xx

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-objcopy.exe -O binary Rashad.elf Rashad.bin
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ ..
```

```
Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ arm-none-eabi-objcopy.exe -O binary Rashad.elf Rashad.bin

Rashad@DESKTOP-I2KI93V MINGW64 /e/Daiploma/xx
$ ../qemu/qemu-system-arm -M versatilepb -m 128m -nographic -kernel Rashad.bin
learn-in-depth:Rashad
```