APP.C

```c
#include "Uart.h"
unsigned char string_buffer[100]="learn_in_depth:<Moaz>";


void main()
{

        UART_Send_string(string_buffer);

}
```

UART.C

```c
#include "Uart.h"
#define UART0DR *((volatile unsigned int* const )((unsigned int*)0x101f1000))

void UART_Send_string(unsigned char *P_tx_string){
        while(*P_tx_string !='\0')
        {
                UART0DR =(unsigned int )(*P_tx_string);
                P_tx_string++;
        }
}
```

UART.H

```
#ifndef UART_H_

#define UART_H_

void UART_Send_string(unsigned char *P_tx_string);

#endif
```

STARTUP.S

```
.global reset

reset:

        ldr sp, =stack_top

        bl  main

stop:   b   stop
```

LINKER_SCRIPT.LD

```
ENTRY(reset)

MEMORY {

    Mem (rwx) : ORIGIN = 0x00000000, LENGTH = 64M

    }

SECTIONS

{

        . = 0x10000;

        .startup . :

        {

                startup.o(.text)

        }>Mem


.text :{

                *(.text) *(.rodata)

}>Mem

.data :{

                *(.data)

}>Mem

.bss :

{               *(.bss)

}>Mem

. = . +0x1000;

stack_top = . ;
```

APP.O SECTIONS

MINGW64:/d/Courses/Embedded Systems/Working_dir/Unit3_Embedded_C/lesson_2

```
Moaz Omar@DESKTOP-VLIBMOT MINGW64 /d/Courses/Embedded Systems/Working_dir/Unit3_
Embedded_C/lesson_2 (master)
$ 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         00000018  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000064  00000000  00000000  0000004c  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  000000b0  2**0
                  ALLOC
  3 .debug_info   0000006b  00000000  00000000  000000b0  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 00000058  00000000  00000000  0000011b  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    0000002c  00000000  00000000  00000173  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020 00000000  00000000  0000019f  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   00000035  00000000  00000000  000001bf  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    0000006d  00000000  00000000  000001f4  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      00000012  00000000  00000000  00000261  2**0
                  CONTENTS, READONLY
 10 .ARM.attributes 00000032 00000000  00000000  00000273  2**0
                  CONTENTS, READONLY
 11 .debug_frame  0000002c  00000000  00000000  000002a8  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
```

UART.O SECTIONS


```
Moaz Omar@DESKTOP-VLIBMOT MINGW64 /d/Courses/Embedded Systems/Working_dir/Unit3_
Embedded_C/lesson_2 (master)
$ 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         00000058  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .data         00000000  00000000  00000000  0000008c  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  0000008c  2**0
                  ALLOC
  3 .debug_info   00000059  00000000  00000000  0000008c  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 00000055  00000000  00000000  000000e5  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_aranges 00000020 00000000  00000000  0000013a  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  6 .debug_line   0000004e  00000000  00000000  0000015a  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_str    000000c0  00000000  00000000  000001a8  2**0
                  CONTENTS, READONLY, DEBUGGING
  8 .comment      0000004a  00000000  00000000  00000268  2**0
                  CONTENTS, READONLY
  9 .debug_frame  00000030  00000000  00000000  000002b4  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 10 .ARM.attributes 0000002c 00000000 00000000  000002e4  2**0
                  CONTENTS, READONLY
```

STARTUP.O SECTIONS

APP.O SYMBOLS

```
Moaz Omar@DESKTOP-VLIBMOT MINGW64 /d/Courses/Embedded Systems/Working_dir/Unit3_Embedded_C/lesson_2 (master)
$ arm-none-eabi-nm.exe App.o
00000000 T main
00000000 D string_buffer
         U UART_Send_string
```

UART.O SYMBOLS

```
Moaz Omar@DESKTOP-VLIBM0T MINGW64 /d/Courses/Embedded Systems/Working_dir/Unit3_Embedded_C/lesson_2 (master)
$ arm-none-eabi-nm.exe startup.o
         U main
00000000 T reset
         U stack_top
00000008 t stop
```

LEARN-IN-DEPTH SYMBOLS


```
Moaz Omar@DESKTOP-VLIBMOT MINGW64 /d/Courses/Embe
$ arm-none-eabi-nm.exe learn-in-depth.elf
00000010 T main
00000000 T reset
000010e8 D stack_top
00000008 t stop
00000084 D string_buffer
0000002c T UART_Send_string
```

LEARN-IN-DEPTH.ELF SECTIONS


```
Moaz Omar@DESKTOP-VLIBMOT MINGW64 /d/Courses/Embedded Systems/Working_dir/Unit3_Embedded_C/lesson_2 (master)
$ arm-none-eabi-objdump.exe -h learn-in-depth.elf

learn-in-depth.elf:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .startup      00000010  00010000  00010000  00008000  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .text         00000070  00010010  00010010  00008010  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  2 .data         00000064  00010080  00010080  00008080  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  3 .ARM.attributes 0000002e  00000000  00000000  000080e4  2**0
                  CONTENTS, READONLY
  4 .comment      0000005a  00000000  00000000  00008112  2**0
                  CONTENTS, READONLY
  5 .debug_info   000000c4  00000000  00000000  0000816c  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_abbrev 000000ad  00000000  00000000  00008230  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_loc    0000002c  00000000  00000000  000082dd  2**0
                  CONTENTS, READONLY, DEBUGGING
  8 .debug_aranges 00000040  00000000  00000000  00008309  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .debug_line   00000083  00000000  00000000  00008349  2**0
                  CONTENTS, READONLY, DEBUGGING
 10 .debug_str    000000ee  00000000  00000000  000083cc  2**0
                  CONTENTS, READONLY, DEBUGGING
 11 .debug_frame  0000005c  00000000  00000000  000084bc  2**2
                  CONTENTS, READONLY, DEBUGGING
```

OUTPUT

```
Moaz Omar@DESKTOP-VLIBMOT MINGW64 /d/Courses/Embedded Systems/Working_dir/training
$ qemu-system-arm -M versatilepb -m 128M -nographic -kernel learn-in-depth.bin
dsound: Could not initialize DirectSoundCapture
dsound: Reason: No sound driver is available for use, or the given GUID is not a valid DirectSound device ID
learn_in_depth:<Moaz>
```