

# Boot code tutorial

- read the following code and write a simple explanation of what it is performing
  - the code is the first boot code (the role of the first boot code was described during the lecture)

`boot.S`

```
!  
!   Bootstrap loader which must be <= 512 bytes of code  
!           and have no data segment!  
!
```

```
entry _start
```

```
!  
!  
! Note that the operating system must be <= 9*64k as we place boot  
!   and secondary boot code at 640k-64k..640k  
!
```

# Boot code tutorial

boot.S

```
!  
! The task of this piece of code is to load the secondary bootstrap  
! code written in Modula-2 for the 8088/8086. We also set up the  
! ss, cs, ds registers. We set them to the same value 640k-64k  
! and we know that the secondary boot code is small and will fit into  
! 64k including stack, data and code. This makes life alot easier!  
!  
!
```

# Boot code tutorial



`boot.S`

```
TOPOFMEM      = 0xA0000      ! We assume every machine has at least 640k
TOPOFMEMSEG   = TOPOFMEM / 16
SIXTYFOURKSEG= 0x10000 / 16
BOTOFMEMSEG   = TOPOFMEMSEG - SIXTYFOURKSEG
STACKSIZE     = 0x1000      ! 4k of stack space

BOOTSEG       = 0x7C00 / 16 ! This is where the BIOS puts the
                ! first sector (boot sector).

MAXSECONDSEG  = 0x8000 / 16  ! Max no of clicks of code for secondary boot

STACKCLKS     = STACKSIZE / 16
STACKSEG      = TOPOFMEMSEG - STACKCLKS      ! Assign the stack here

SECONDSEG     = 0x90200 / 16 ! BOTOFMEMSEG
                ! Secondary boot code
SECTORSIZE    = 256  ! number of 2 byte words in a sector
SECONDSIZE    = 14   ! max number of sectors which may contain the
                ! secondary boot.

!BOOTDRIVE    = 0x00 ! floppy (/dev/fd0 or a:)
BOOTDRIVE     = 0x80 ! harddisk (USB-HDD in the BIOS)
```

# Boot code tutorial

boot.S

```
!  
! we choose 14 since:  
!  
! (i) a 5 and 1/4 inch floppy drive has 15 sectors / track  
! (ii) a 3 and 1/2 inch floppy drive has 18 sectors / track  
! (iii) ROM BIOS insists that the bootsector is 1 sector.  
! (iv) therefore the minimum number of sectors available on track 1  
! is 15-1 = 14  
!  
!  
! (v) we could make boot more complicated (so it could load in second  
! from a range of tracks) but I really wanted to  
! keep it as simple as possible and jump into Modula-2 as soon  
! as possible. The whole intention of using a secondary  
! bootstage was to keep any complexity in a HLL  
!
```

# Boot code tutorial



`boot.S`

```
extern minbios_WriteChar
```

```
_start:
```

```
    jmp after_sig
```

```
    nop
```

```
OEM_ID: .ascii "luk-boot"
```

```
BytesPerSector: DW 0x0200
```

```
SectorsPerCluster: DB 0x01
```

```
ReservedSectors: DW 0x0001
```

```
TotalFATs: DB 0x02
```

```
MaxRootEntries: DW 0x00E0
```

```
TotalSectorsSmall: DW 0x0B40
```

```
MediaDescriptor: DB 0xF0
```

```
SectorsPerFAT: DW 0x0009
```

```
SectorsPerTrack: DW 0x0012
```

```
NumHeads: DW 0x0002
```

```
HiddenSectors: DD 0x00000000
```

```
TotalSectorsLarge: DD 0x00000000
```

```
DriveNumber: DB BOOTDRIVE
```

```
Flags: DB 0x00
```

```
Signature: DB 0x29
```

```
VolumeID: DD 0xFFFFFFFF
```

```
VolumeLabel: .ascii "luk-bootusb"
```

```
SystemID: .ascii "FAT12  "
```



# Boot code tutorial

boot.S

```
after_sig:
    mov     DriveNumber, dl    ! save the bios given bootdrive
    !
    ! set up stack
    !
    mov ax, #BOTOFMEMSEG
    mov ss, ax
    mov ax, #0xffe0
    mov sp, ax

    mov ax, #'1
    pushax
    callminbios_WriteChar
    pop ax
```

# Boot code tutorial



**boot.S**

```
!  
! now jump to _load at a new code segment BOOTSEG:  
!  
! we need to do this so that the cs is initialised to _start.  
! The bios doesn't do this for us.  
jmp_i_load,BOOTSEG          ! jmp far _load:BOOTSEG
```

# Boot code tutorial

boot.S

```
_load:
    ! excellent now we set our Data segment = Code segment
    ! we need to do this because there are some OS parameters
    ! right at the end of this 512 disk sector.
    ! We pick these up in Util.S just before we go into Modula-2 in second

    mov ax,cs
    mov ds,ax          ! set up Data Segment

    mov ax, #'2
    pushax
    callminbios_WriteChar
    pop ax

    call _SecondLoad
```

# Boot code tutorial

boot.S

```
!  
! now jump to _SecondLoad at a new code segment SECONDSEG:  
!  
mov ax, #'4  
pushax  
callminbios_WriteChar  
pop ax  
  
xor     dx, dx  
mov dl, DriveNumber      ! take DriveNumber value with us  
jmp i0, SECONDSEG       ! jmp far 0:SECONDSEG
```

# Boot code tutorial



`boot.S`

`_SecondLoad:`

`mov ax, #'3`

`pushax`

`callminbios_WriteChar`

`pop ax`

`mov ax, #SECONDSEG`

`mov es, ax ! ES = SECONDSEG`

`mov bx, #0x0 ! address = SECONDSEG:0`

`xor dx, dx ! dh (head no) = 0`

`mov dl, DriveNumber ! drive no`

`mov cx, #0x02 ! sector 2, track 0`

`mov ax, #0x0200+SECONDSIZE ! service 2, nr of sectors`

`! (assume all on head 0, track 0)`

`int 0x13 ! read it`

`jnc ok_found ! ok - continue`

`mov ah, #'e`

`pushax ! display error message`

`callminbios_WriteChar`

`pop ax`

# Boot code tutorial



**boot.S**

```
    mov dl, DriveNumber      ! drive number
    xor ah, ah
    int 0x13
    jmp _SecondLoad        ! try to load Secondary boot again

ok_found:
    ret
```