Phase 1 Report

1st Stage:

- **Bios_cls**
  - This function uses INT 10 for
    - Clearing the screen
    - video display mode function
- **Bios_print**
  - This function uses INT 10 for
    - Clearing the screen
  - It receives the string address that ends with a null character
  - loops on each byte
    - if it's not zero it uses displaying char function
    - repeat until zero is reached
      - ends the function and returns
- **Detect_boot_disk**
  - This function is used to detect whether we have booted from a floppy or a disk
    - This is done by checking the number that is stored in DL according to the drive table in the slides
  - If it was booted from floppy / Disk
    - Print a message on the screen
    - If it was from a Disk
      - Call a function to load the parameters of this disk
  - if the device that was booted from was unknown
    - Print a message on the screen
    - Exit with error on the screen
- **First_stage_data**
  - This function is used to declare and specify all the data that will be used in the first stage.
    - First, we define memory variables to store boot drive number, initialized to zero, and another memory variable (lba_sector) that stores the next sector to read, intialized to 0x1 since the first sector is already loaded by hardware and stored in lba 0x0.
    - We then specify the memory variables that would store the number of sectors/track and head/cylinder. Both variables are initialized to the default values of the floppy.
    - Memory variables for Cylinder, Head and Sector are also used to be able to able to use CHS.
    - Finally, we define the messages that will be used in the first stage.

- **Get_key_stroke**
    - This function uses INT 16 for:
        - Waiting to read a key press to be able to proceed and jump to second boot stage
- **Lba_2_chs**
    - This function performs the conversion from lbs to CHS
        - Make sure that dx=0
        - Move the vale of lba into register ax to be able to perform needed calculations
        - Divide ax by spt then increment remainder by 1 to get the [sector] value which is the remainder of [lba_sector]/[spt] +1
        - Divide the quotient of the previous division by hpc to get the [cylinder] value which is the Quotient of (([lba_sector]/[spt]) / [hpc])
        - Finally, [Head] is equal to the remainder of the previous division (([lba_sector]/[spt]) / [hpc])
- **Load_boot_drive_parameters**
    - This function is used to update the hpc and spt of a disk number and fetch that disk's parameters.
        - First, function uses INT 13 to fetch the disk's parameter by taking the disk number.
        - We then increment the value of the last head base zero, stored in dh by 1 to retrieve the number of hpc.
        - This number is then placed into the lower byte of hpc.
        - Extract the 6 rightmost bits of cx to extract the number of spc. Then place this number into [spc] memory variable.
- **Read_disk_sectors**
    - This function is used to read 512 sectors and store the Cylinder, Sector and Head into specific registers
        - Loop to read each disk sector
        - First convert current lba to its equivalent value of CHS by calling Lba_2_chs function
        - Use INT 13H to read each sector, one by one
        - [cylinder] of current sector is read and stored into register cx
        - [sector] of current sector is read and stored into first 6 bits of register cx
        - If the carry flag is set, jump to read_disk_error, otherwise print a dot (.) which indicates that a successful sector has been read.
        - We then proceed to read the next sector and check if last sector is reached, if not loop again.

- **first_stage (Main Program)**
    - In this main program we will include all the functions above inorder to be used
    - We will need to initialize
        - DS and SS by zero
        - Sp by the stack offset which was specified
    - Make sure the screen is cleared (Bios_cls)
        - To print greeting using (Bios_print)
    - We need to detect the disk that we have booted from using (Detect_boot_disk)
    - Then we will read the disk sectors of both the second and the third stages
    - To ensure that the second stage boot loader is loaded
        - A message will be printed and a key must be pressed to go to second boot stage
    - A hang function is implemented in the main to make sure an infinite loop occurs when an interrupt is fired

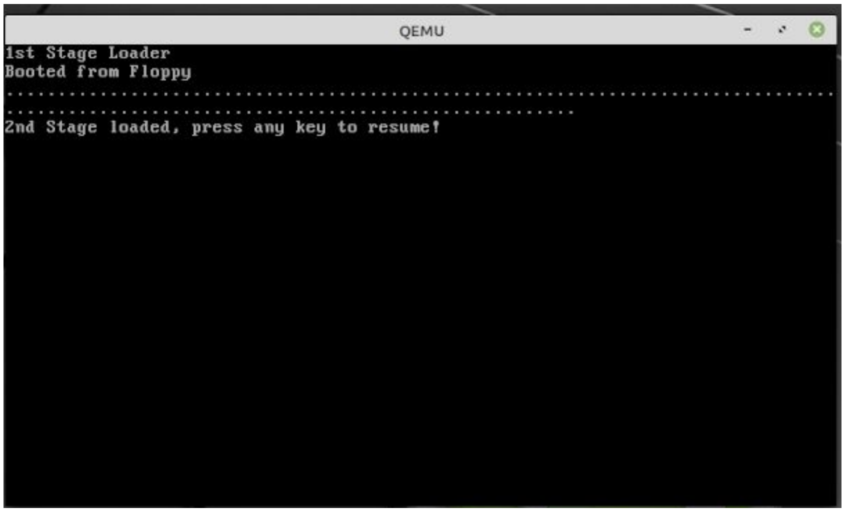
<u>2nd Stage:</u>

- **A20_gate**
    - This function uses INT 15 with function number 0x2402
        - Check if A20 Gate is enabled (i.e. is set to zero)
    - o If A20 Gate is disabled, we will enable it using INT 15 with function number 0x2401
    - o If an error has occurred, we will check AH
        - AH = 0x1 —> Keyboard Controller error
        - AH = 0x86 —> Function is not supported
        - Error is printed accordingly
- **check _long_mode**
    - In this function we want to check whether bit 21 can be overwritten or not as an indication of CPUID
        - If bit 21 is flipped then CPUID is supported
        - Else it is not supported
    - This is done by pushing the eflags in to the stack
    - Then make only bit 21 equals to 1 in eax
    - Move eax to eflags and check bit 21
- **second_stage (Main Program)**
    - Make sure the screen is cleared (Bios_cls)
        - To print greeting using (Bios_print)
    - Get a keystroke using (Get_key_stroke)

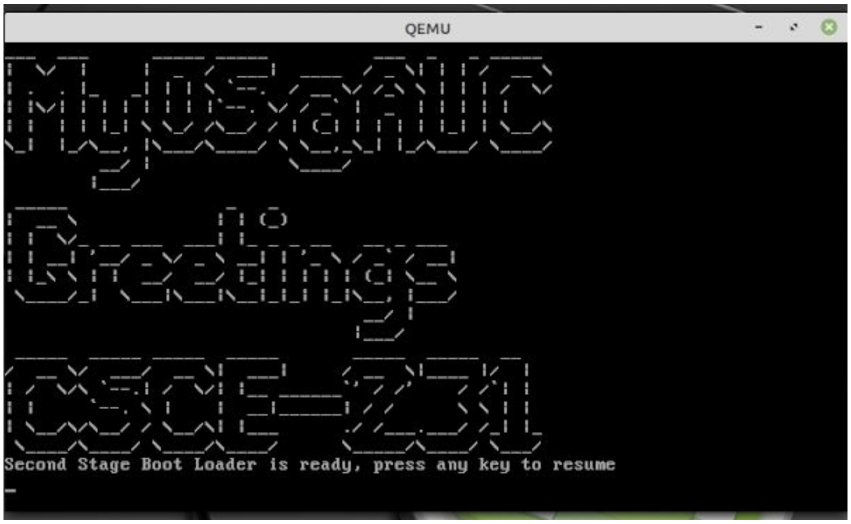
<u>3rd Stage:</u>

- **third_stage (Main Program)**

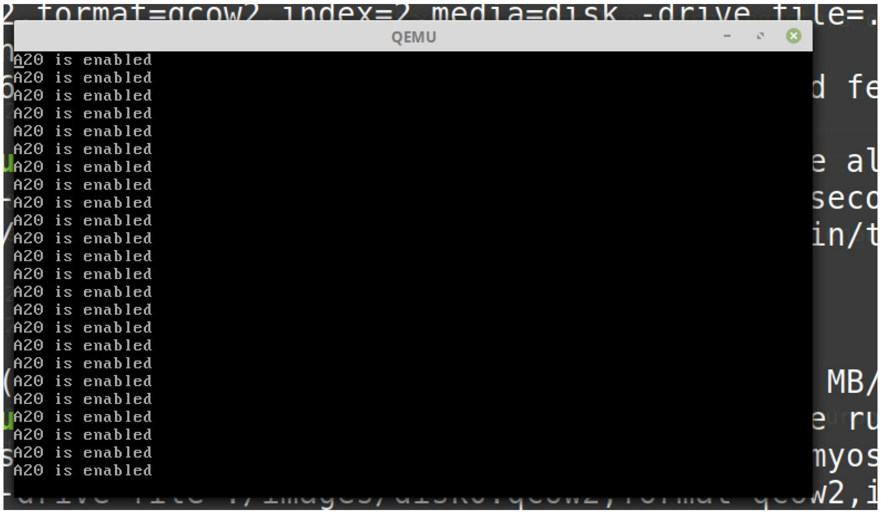
Screenshots:



```
1st Stage Loader
Booted from Floppy
................................................................................
.......................................................
2nd Stage loaded, press any key to resume!
```



```
Second Stage Boot Loader is ready, press any key to resume
_
```



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A20 is enabled
A20 is enabled
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A20 is enabled
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A20 is enabled
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Steps Needed to run the code:

- Open the project skeleton directory
- Open terminal in the directory
- make all
- make run_myos (for first stage run)
- make run_myos_drv (for first stage run)

Contribution: Comments and Documentation for the following Functions

Hana Asal - 900160573:

- Bios_cls
- Detect_boot_disk
- check _long_mode

Osama El Farnawany - 900161355:

- Get_key_stroke
- Load_boot_drive_parameters
- A20_gate
- First_stage_data

Salma Afifi - 900151060:

- Bios_print
- Read_disk_sectors
- Lba_2_chs