Lab 4: Memory Management

Linear Address Space

0xa0001fff to 0xffffffff	
0xa0001000 to 0xa0001fff	Data(RO)
Blank	
0x80000000 to 0x80000fff	Data(RW)
Blank	
0xf000 to 0xffff	PT
0xe000 to 0xefff	PD
0xd000 to 0xdfff	Sys(GDT)
0xc000 to 0xcfff	Stack/Data
0xb000 to 0xbfff	Data
0xa000 to 0xafff	Code
0x0000 to 0x9fff	Misc.

Physical Address Space

0xf000 to 0xffff	Page Table
0xe000 to 0xefff	Page Dir
0xd000 to 0xdfff	GDT/IDT etc.
0xc000 to 0xcfff	Stack
0xb000 to 0xbfff	Data(common)
0xa000 to 0xafff	Code
0x0000 to 0x9fff	Misc.

Instrument Lab2 code(that handles exactly 5 students) to achieve the following:

1) Change DS(Read Only) and ES(R/W) to point to higher virtual addresses.

DS: 0xa0001000 to 0xa0001fff

ES: 0x80000000 to 0x80000fff

2) We would like to achieve the mapping mentioned in figure. Specifically,

- DS: 0xa0001000 to 0xa0001fff maps to physical address 0xb000 to 0xbfff with Read Only permissions.
- ES: 0x80000000 to 0x80000fff maps to physical address 0xb000 to 0xbfff with RW permissions.

3)Now the following operation are involved when executing the instruction mov [ES:0x10], 0xcafe.

ES:0x10 (called the virtual address) gets translated to 0x80000010 after segment translation. The address 0x8000010 is called the linear address. The linear address is a 32 bit address that must be converted to a physical address by the memory management unit using [10 bit page dir index, 10 bit page table index, 12 bit offset].

Setup the page tables/page directories such that ox80000010 gets translated to the physical address 0xb010.

4) Setup page permissions such that you will be able to write into 0xb000 - 0xbfff using ES but not using DS.

5) It is also necessary to map the other pages from the linear address space to the physical address space as shown in the figure above. You will also have to setup the CR0 and CR3 registers as required.