Homework 03

Due before (or by end of) next class

**Learning Objectives:**

* Practice to understand how data is created, stored, and moved around.

**To do:**

1. Go through ALL the lab exercises that we started on yesterday. (Note that I added #2d. ie, Total of 4 exercises in Part One, and 4 exercises in Part Two. )
   * Try tracing the code BEFORE you assemble with nasm.
   * Try to understand the results that you see.
   * Create a makefile to organize all the exercises
2. For part two, trace intermediate states, ie, What is the state of memory and registers after each MOV, INC, ADD instruction etc. You can print and do this part by hand. and hand in paper too if you like.

#### Exercise 2a

Beginning state

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | 04 | 70 | 5C | 56 | 65 | 76 | 69 | 6C | 00 | 00 | 00 | 00 |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 59 | 6F | CC | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 59 | 6F | CC | |

After first “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | 04 | 70 | 5C | 56 | 65 | 76 | 69 | 6C | 00 | 00 | 00 | 00 |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 6C | 69 | 76 | 65 | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 59 | 6F | CC | |

After second “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | 04 | 70 | 5C | 56 | 65 | 76 | 69 | 6C | 00 | 00 | 00 | 00 |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 56 | 6F | CC | |

#### Exercise 2b

Beginning state

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | 04 | D0 | 60 | 56 | 65 | 76 | 69 | 6C | 25 | 69 | 00 | 25 |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 61 | 9F | CC | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 61 | 9F | CC | |

After first “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | 04 | D0 | 60 | 56 | 65 | 76 | 69 | 6C | 25 | 69 | 00 | 25 |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | AA | BB | CC | DD | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 61 | 9F | CC | |

After second “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | 04 | D0 | 60 | 56 | DD | CC | BB | AA | 25 | 69 | 00 | 25 |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | AA | BB | CC | DD | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 61 | 9F | CC | |

After 3rd “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 00 | 00 | 00 | 04 | D0 | 60 | 56 | DD | CC | BB | AA | 25 | 69 | 00 | 25 |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | AA | BB | CC | DD | | ebx   |  |  |  |  | | --- | --- | --- | --- | | AA | BB | CC | DD | |

#### Exercise 2c

Beginning state

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 04 | 12 | A4 | A5 | 00 | 61 | 64 | 66 |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 62 | 3F | CC | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 62 | 3F | CC | |

After first “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 04 | 12 | A4 | A5 | 00 | 61 | 64 | 66 |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5B | 30 | 08 | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 62 | 3F | CC | |

After “inc”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 04 | 12 | A4 | A5 | 00 | 61 | 64 | 66 |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5B | 30 | 09 | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 62 | 3F | CC | |

After “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 04 | 12 | A4 | A5 | 00 | 61 | 64 | 66 |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5B | 30 | 09 | | ebx   |  |  |  |  | | --- | --- | --- | --- | | A5 | A4 | 12 | 04 | |

After “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 04 | 12 | A4 | 04 | 12 | A4 | A5 | 66 |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5B | 30 | 09 | | ebx   |  |  |  |  | | --- | --- | --- | --- | | A5 | A4 | 12 | 04 | |

After “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 00 | 04 | 12 | A4 | 04 | 12 | 6E | A5 | 66 |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5B | 30 | 09 | | eax   |  |  |  |  | | --- | --- | --- | --- | | A5 | A4 | 12 | 04 | |

#### Exercise 2d

Beginning state

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | B3 | 00 | 00 | 00 | A3 | 17 | 12 | 62 | 63 | 61 |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5F | 1F | CC | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5F | 1F | CC | |

After first “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | B3 | 00 | 00 | 00 | A3 | 17 | 12 | 62 | 63 | 61 |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5F | 20 | 08 | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 64 | 1F | CC | |

After “add”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | B3 | 00 | 00 | 00 | A3 | 17 | 12 | 62 | 63 | 61 |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5F | 20 | 0B | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 56 | 64 | 1F | CC | |

After “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | B3 | 00 | 00 | 00 | A3 | 17 | 12 | 62 | 63 | 61 |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5F | 20 | 0B | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 12 | 17 | A3 | 00 | |

After “add”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | B3 | 00 | 00 | 00 | A3 | 17 | 12 | 62 | 63 | 61 |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5F | 20 | 0B | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 12 | 17 | A3 | 05 | |

After “mov”

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| memory   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 05 | A3 | 17 | 12 | A3 | 17 | 12 | 62 | 63 | 61 |  |  |  |  |  |  |  |  |  |  |  |  | | |
| eax   |  |  |  |  | | --- | --- | --- | --- | | 56 | 5F | 20 | 0B | | ebx   |  |  |  |  | | --- | --- | --- | --- | | 12 | 17 | A3 | 05 | |

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Submit this document: (***lastname\_firstname\_hw03.docx***). (Printed and hand-written OK too).

AND, submit your working direction with makefile inside: ***(lastname\_firstname\_hw03.zip)***

Marking:

|  |  |
| --- | --- |
|  | Max |
| Completeness | 4 |
| Files are well organized | 2 |
| Code is well commented and documented | 2 |
| Proper file naming conventions | 2 |