**GNU Assembly Language** **Introduction** worksheet:

What is a ***label*** in Assembly Language **and** how is it used?

Go to: [https://en.wikipedia.org/wiki/Label\_(computer\_science)](https://en.wikipedia.org/wiki/Label_%28computer_science%29)

**Suffixes to Commands:**

Go to: <https://en.wikibooks.org/wiki/X86_Assembly/GAS_Syntax#Operation_Suffixes>

|  |  |
| --- | --- |
| suffix: | meaning: |
| b |  |
| s |  |
| w |  |
| l |  |
| q |  |
| t |  |

What purpose does the suffix serve?

Are you required to use a suffix?

If you use the command without a suffix what happens?

**Commands:**

Go to: <https://en.wikibooks.org/wiki/X86_Assembly/GAS_Syntax#Quick_reference>

and <http://cs.neiu.edu/fporps/2021Fall/cs301/CS301-08machine-basics.pdf> (note: change 2021Fall to current semester)

|  |  |
| --- | --- |
| **instruction** with sample | meaning/how it works: |
| **mov**q %rax, %rbx |  |
| **mov**q $123, %rax |  |
| **mov**q %rsi, -16(%rbp) |  |
| **sub**q $10, %rbp |  |
| **cmp**l %eax %ebx |  |
| **jmp** location |  |
| **je** location |  |
| **jg, jge, jl, jle, jne, …** |  |
| **lea**q |  |
| **sal**q |  |
| **add**q |  |
| **sub**q |  |
| **imul**q |  |
| **sar**q |  |
| **shr**q |  |
| **xor**q |  |
| **and**q |  |
| **or**q |  |
| **inc**q |  |
| **dec**q |  |
| **neg**q |  |
| **not**q |  |
| \* |  |

\*These are most common, but you can search the web for more (not required).

**Registers and storage (memory) addressing:** (This is your workspace in assembly language)

Go to: <https://cs61.seas.harvard.edu/site/2018/Asm1/>

Complete the register reference chart

General Purpose Registers:

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Special Purpose Registers:

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**Sample Code To Run (2 programs – copy, paste, and run individually):**

# exit program to “see” output Note: # 🡨used to mark a COMMENT (invisible ink) in Assembly Language

#PURPOSE: Simple program that exits and returns a

# status code back to the Linux kernel

#

#INPUT: none

#

#OUTPUT: returns a status code. This can be viewed

# by typing

#

# echo $?

#

# after running the program

#

#VARIABLES:

# %rax holds the system call number

# (this is always the case)

#

# %rbx holds the return status

#

.section .data

.section .text

.globl \_start

\_start:

movq $1, %rax # this is the linux kernel command

 # number (system call) for exiting

 # a program

movq $0, %rbx # this is the status number we will

 # return to the operating system.

 # Change this around and it will

 # return different things to

 # echo $?

int $0x80 # this wakes up the kernel to run

 # the exit command

# max program This program finds the maximum number of a set of data items.

#PURPOSE: This program finds the maximum number of a

# set of data items.

#

#VARIABLES: The registers have the following uses:

#

# %rdi - Holds the index of the data item being examined

# %ebx - Largest data item found

# %eax - Current data item

#

# The following memory locations are used:

#

# data\_items - contains the item data. A 0 is used

# to terminate the data

#

.section .data

data\_items: #These are the data items

.int 3,67,34,222,45,75,54,34,44,33,22,11,66,0

.section .text

.globl \_start

\_start:

movq $0, %rdi # move 0 into the index register

movl data\_items(,%rdi,4), %eax # load the first byte of data

movl %eax, %ebx # since this is the first item, %rax is

 # the biggest

start\_loop: # start loop

cmpl $0, %eax # check to see if we’ve hit the end

je loop\_exit

incq %rdi # load next value

movl data\_items(,%rdi,4), %eax

cmpl %ebx, %eax # compare values

jle start\_loop # jump to loop beginning if the new

 # one isn’t bigger

movl %eax, %ebx # move the value as the largest

jmp start\_loop # jump to loop beginning

loop\_exit:

# %rbx is the return value, and it already has the number

movq $1, %rax #1 is the exit() syscall

int $0x80