ECE 212 Lab - Introduction to Microprocessors
Department of Electrical and Computer Engineering
University of Alberta

Lab 1: Introduction to Assembly Language.

Student Name	Student
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Contents

1 Introduction

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2 Design

2.1 Part A

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2.2 Part B

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3 Testing

3.1 Part A

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat

in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetuer.

3.2 Part B

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

4 Questions

4.1 Question 1

"What happens when there is no exit code 0x0D provided in the initialization process? Would it cause a problem? Why or why not?"

A: Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

4.2 Question 2

"How can our code be modified to provide a variable address range? For example, what if I only wanted to convert the first 10 data entires? "

A: Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Donec odio elit, dictum in, hendrerit sit amet, egestas sed, leo. Praesent feugiat sapien aliquet odio. Integer vitae justo. Aliquam vestibulum fringilla lorem. Sed neque lectus, consectetuer at, consectetuer sed, eleifend ac, lectus. Nulla facilisi. Pellentesque eget lectus. Proin eu metus. Sed porttitor. In hac habitasse platea dictumst. Suspendisse eu lectus. Ut mi mi, lacinia sit amet, placerat et, mollis vitae, dui. Sed ante tellus, tristique ut, iaculis eu, malesuada ac, dui. Mauris nibh leo, facilisis non, adipiscing quis, ultrices a, dui.

5 Conclusion

Morbi luctus, wisi viverra faucibus pretium, nibh est placerat odio, nec commodo wisi enim eget quam. Quisque libero justo, consectetuer a, feugiat vitae, porttitor eu, libero. Suspendisse sed mauris vitae elit sollicitudin malesuada. Maecenas ultricies eros sit amet ante. Ut venenatis velit. Maecenas sed mi eget dui varius euismod. Phasellus aliquet volutpat odio. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Pellentesque sit amet pede ac sem eleifend consectetuer. Nullam elementum, urna vel imperdiet sodales, elit ipsum pharetra ligula, ac pretium ante justo a nulla. Curabitur tristique arcu eu metus. Vestibulum lectus. Proin mauris. Proin eu nunc eu urna hendrerit faucibus. Aliquam auctor, pede consequat laoreet varius, eros tellus scelerisque quam, pellentesque hendrerit ipsum dolor sed augue. Nulla nec lacus.

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6 Appendix

6.1 Part A Assembler Code

```
/* DO NOT MODIFY THIS ------------------------------------------------------*/
.text

.global AssemblyProgram

AssemblyProgram:
lea       -40(%a7),%a7 /*Backing up data and address registers */
movem.l %d2-%d7/%a2-%a5,(%a7)
/*------------------------------------------------------------------------*/

/*************************************************************/
/* General Information ***************************************/
/* File Name: Lab1a.s ****************************************/
/* Names of Students: Arun Woosaree and Navras Kamal        **/
/* Date: 1/29/2018                                          **/
/* General Description:                                     **/
/*                                                          **/
/*************************************************************/

/*Write your program here*************************************/

movea.l #0x2300000, %a1          /* save input address to a1*/
movea.l #0x2310000, %a2          /* save output address to a2*/

/* let a value in quotation marks be the ASCII value of the character
   enclosed by the quotation marks*/

loop:                /* the looping function                    */
 move.l (%a1), %d2   /* move the value at address a1 to d2,     */
                     /* call this 'inval' from henceforth       */

 cmp.l #0x0D, %d2    /* Check if the inval is the enter code    */
 beq end             /* if it is, go to the end of the program  */
                     /* (breaking the loop)                     */

 cmp.l #0x2F, %d2    /* compare inval to the hex value of "0"   */
 blt err             /* if inval is less than ASCII zero        */
                     /* it is not valid, throw an error         */

 cmp.l #0x3A, %d2    /* compare the inval to the hex value of ":", */
                     /* which is one ASCII value higher than "9"   */
 blt zeronine        /* if it is less than the value of ":"     */
```

```
                    /* then it must be a value between "0" and "9"*/
                    /* thus go to the proper part of the code to  */
                    /* handle this value                          */

 cmp.l #0x41, %d2                    /* compare the inval to "A"*/
 blt err                                    /* if it is less than the "A" than it is invalid,

 cmp.l #0x47, %d2                    /* compare the inval to "G"*/
 blt bigathruf                       /* if it is less than the value of "G" then it must be in
                                                /*       thus go to the part of the code

 cmp.l #0x61, %d2                    /* compare the inval to "a"*/
 blt err                                    /* if it is in this range it is invalid, thus thr

 cmp.l #0x67, %d2                    /* compare the inval to "g"*/
 blt littleathruf                    /* if it is less than "g" then it must be in the range "a
                                                /*       thus go to the part of the code

err:                                        /* if the inval is equal to or above "g" then the
 move.l #0xFFFFFFFF, (%a2)      /* throw the error code to the output address location*/
 bra endloop                         /* go to the end of the loop before restarting the loop*/

zeronine:                                   /* inval is between "0" and "9"*/
 sub.l #0x30, %d2                    /* subtract the hex value of "0" from inval, which will l
 move.l %d2, (%a2)                   /* move this calculted hex value to the output address lo
 bra endloop                         /* go to the end of the loop before restarting the loop*/

bigathruf:                                  /* inval is between "A" and "F"*/
 sub.l #0x41, %d2                    /* subtracts the hex value of "A" d2. This is the differe
 add.l #0xA, %d2                     /* adds the value of "A" to d2, which will make it into t
 move.l %d2, (%a2)                   /* move this value to the output address location*/
 bra endloop                         /* go to the end of the loop before restarting the loop*/

littleathruf:                       /* inval is between "a" and "f"*/
 sub.l #0x61, %d2                    /* subtracts the hex value of "a" d2. This is the differe
 add.l #0xA, %d2                     /* adds the value of "a" to d2, which will make it into t
 move.l %d2, (%a2)                   /* move this value to the output address location*/
 bra endloop                         /* go to the end of the loop before restarting the loop*/

endloop:                                    /* handles code to be executed before the start o
 add.l #0x4, %a1                     /* increment the input address by 4*/
 add.l #0x4, %a2                     /* increment the output address by 4*/
 bra loop                                   /* restart the loop*/

end:                                        /* end the custom part of the program*/
```

```
/*End of program ************************************************/

/* DO NOT MODIFY THIS ------------------------------------------------------*/
movem.l (%a7),%d2-%d7/%a2-%a5 /*Restore data and address registers */
lea     40(%a7),%a7
rts
/*------------------------------------------------------------------------*/
```

6.2 Part B Assembler Code

```
/* DO NOT MODIFY THIS ------------------------------------------------------*/
.text

.global AssemblyProgram

AssemblyProgram:
lea       -40(%a7),%a7 /*Backing up data and address registers */
movem.l %d2-%d7/%a2-%a5,(%a7)
/*------------------------------------------------------------------------*/

/************************************************************/
/* General Information ******************************************/
/* File Name: Lab1b.s *******************************************/
/* Names of Students: Arun Woosaree and Navras Kamal            **/
/* Date: 1/29/2018                                              **/
/* General Description:                                         **/
/*                                                              **/
/************************************************************/

/*Write your program here*****************************************/

movea.l #0x2300000, %a1          /* save input address to a1*/
movea.l #0x2320000, %a2          /* save output address to a2*/

/* let a value in quotation marks be the ASCII value of the character enclosed by the q

loop:                                        /* the looping function*/
 move.l (%a1), %d2                    /* move the value at address a1 to d2, call thi

 cmp.l #0x0D, %d2                     /* Check if the inval is the enter code*/
 beq end                                     /* if it is, go to the end of the progra

 cmp.l #0x41, %d2                     /* compare the inval to "A"*/
 blt err                                     /* if it is less than the "A" than it i

 cmp.l #0x5B, %d2                     /* compare the inval to "["*/
 blt bigathruz                        /* if it is less than the value of "[" then it
                                                 /*       thus go to the part of


 cmp.l #0x61, %d2                     /* compare the inval to "a"*/
 blt err                                     /* if it is in this range it is invalid

 cmp.l #0x7B, %d2                     /* compare the inval to "{"*/
 blt littleathruz                     /* if it is less than "{" then it must be in th
```

```
                                                    /*       thus go to the part of

 bigathruz:                                                 /* inval is between "A" and "Z"*/
 add.l #0x20, %d2                                  /* adds the hex difference between "A" and "a",
 move.l %d2, (%a2)                                 /* move this value to the output address locatio
 bra endloop                                       /* go to the end of the loop before restarting
 /*TODO*/
littleathruz:                                      /* inval is between "a" and "z"*/
 sub.l #0x20, %d2                                  /* subtracts the hex difference between "a" and
 move.l %d2, (%a2)                                 /* move this value to the output address locatio
 bra endloop                                       /* go to the end of the loop before restarting
 /*TODO*/
 err:                                                       /* if the inval is not a valid characte
 move.l #0xFFFFFFFF, (%a2)       /* throw the error code to the output address location*
 bra endloop                                       /* go to the end of the loop before restarting

 endloop:                                                   /* handles code to be executed before t
 add.l #0x4, %a1                                   /* increment the input address by 4*/
 add.l #0x4, %a2                                   /* increment the output address by 4*/
 bra loop                                                   /* restart the loop*/

 end:


/*End of program ************************************************/

/* DO NOT MODIFY THIS ------------------------------------------------------*/
movem.l (%a7),%d2-%d7/%a2-%a5 /*Restore data and address registers */
lea       40(%a7),%a7
rts
/*-----------------------------------------------------------------------------*/
```