### EEEN 3449

### Microprocessor Systems

# Lab # 2 Compute the Array Sum

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Fall 2016

1. **Objective**

Indent half an inch to start a new paragraph. Hitting five spaces may not be equivalent to half an inch. Setting the tab to indent half an inch will be the right way to do. The font size of your lab report should be either 11 or 12 points. Use **double spacing**, **full justify** and do not insert blank space between each paragraph, unless you start another heading, or sub-heading like between objective and procedure.

Set 1½ inch for the left margin, 1 inch for the right margin, top and bottom margin. There should be a blank spacing between headings.

1. **Procedure**

If you are writing a lab report, you must have done the lab first and then write the lab report later, please use **past passive voice**. What is past passive voice? For example, the motor module was connected to the MiniDragonPlus. Of course, only the sentences related to the procedure are in past passive voice. The purpose in using past passive voice is to hide the subject.



Fig. 1: Book and more books

Note: There should be a tab or several spaces between the colon and the figure label. Apply single spacing for the label if it is more than one line.

Any circuit in your report must have the value next to the component in the figure. Telling me you use 1 KΩ, 5.6 KΩ, and 10 KΩ, resistors do not tell me your designed circuit. You can put 1 K instead of 1 KΩ next to a resistor, and there should be a space betwe*en* 1 and K (must be upper case). For capacitor value you have to label 10 μF, 10 nF or 10 pFnext to a capacitor. Note: μ stands for 10 −6, n stands for 10−9, and p stands for 10−12 all are in lower case.

Use equation editor to type the equation. Microsoft Equation version 3.0 can be found under the insert menu, object option. Symbols like Ω, and μ can be located under the insert menu, symbol option. Generate subscript and superscript by selecting the font under format menu.

Please do not scan or copy the lecture notes for the lab as your procedure. Your procedure should be in your own words. If you have to copy any figure from any website or pdf file, please cite the reference.

You will have to provide a flowchart for your program if the procedure includes an assembly program as part of the experiment. There are three basic shapes are required for the flowchart, start or end block, decision block, and the process block.

**III. Data and analysis**

There should be a label for any figure and table. Provide a line or two before you insert your table. Do not start this section with the table for your data.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **LDAA #0** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2000 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0000 |
|  |  |  |  |  |  |  |  |
| **STAA i** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2002 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0100 |
|  |  |  |  |  |  |  |  |
| **STAA sum** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2005 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0100 |
|  |  |  |  |  |  |  |  |
| **STAA sum+1** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2008 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0100 |
|  |  |  |  |  |  |  |  |
| **loop LDAB i** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 200B | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0100 |
|  |  |  |  |  |  |  |  |
| **CMPB #N** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 200E | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0100 |
|  |  |  |  |  |  |  |  |
| **BEQ done** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2010 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 1001 |
|  |  |  |  |  |  |  |  |
| **LDX #array** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2012 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 1001 |
|  |  |  |  |  |  |  |  |
| **ABX** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2015 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **LDAB 0,X** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2017 | 3C00 | 2027 | 0000 | 00 | 00 | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **LDY sum** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2019 | 3C00 | 2027 | 0000 | 00 | 0A | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **ABY** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 201C | 3C00 | 2027 | 0000 | 00 | 0A | 1001 0101 |
|  |  |  |  |  |  |  |  |
| **STY sum** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 201E | 3C00 | 2027 | 000A | 00 | 0A | 1001 0101 |
|  |  |  |  |  |  |  |  |
| **INC i** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2021 | 3C00 | 2027 | 000A | 00 | 0A | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **BRA loop** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2024 | 3C00 | 2027 | 000A | 00 | 0A | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **loop LDAB i** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 200B | 3C00 | 2027 | 000A | 00 | 0A | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **CMPB #N** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 200E | 3C00 | 2027 | 000A | 00 | 01 | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **BEQ done** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2010 | 3C00 | 2027 | 000A | 00 | 01 | 1001 1001 |
|  |  |  |  |  |  |  |  |
| **LDX #array** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2012 | 3C00 | 2027 | 000A | 00 | 01 | 1001 1001 |
|  |  |  |  |  |  |  |  |
| **ABX** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2015 | 3C00 | 2027 | 000A | 00 | 00 | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **LDAB 0,X** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2017 | 3C00 | 2028 | 000A | 00 | 01 | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **LDY sum** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2019 | 3C00 | 2028 | 000A | 00 | 0D | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **ABY** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 201C | 3C00 | 2028 | 000A | 00 | 0D | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **STY sum** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 201E | 3C00 | 2028 | 0017 | 00 | 0D | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **INC i** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2021 | 3C00 | 2028 | 0017 | 00 | 0D | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **BRA loop** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2024 | 3C00 | 2028 | 0017 | 00 | 0D | 1001 0001 |
|  |  |  |  |  |  |  |  |
| **loop LDAB i** | |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 200B | 3C00 | 2028 | 0017 | 00 | 0D | 1001 0001 |

Table 1: Label

Note: There should be a tab or several spaces between the colon and the table label. Apply single spacing for the label if it is more than one line.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ldaa #0** |  |  |  |  |  |  |  |
| PP | PC | SP | X | Y | A | B | SXHI NZVC |
| 38 | 2000 | 3C00 | 0000 | 0000 | 00 | 00 | 1001 0000 |

The table label can be either on top or below the table and centered.

There should be a paragraph for analysis too!

1. **Conclusion**

The conclusion of the experiment can also be verified in [2]. The number within the square bracket is the reference number. The reference number should be cited in the order as it appears in your text.

**References**

All reference should be in single spacing, all reference number should be aligned and the reference information should be listed as shown below. There should be one single spacing between each reference.

[1] Jonathan W. Valvano, *Introduction to Embedded Microcomputer Systems: Motorola 6811 and 6812 Simulation*, Brooks/Cole-Thomson Learning, 2003.

[2] V. P. Nelson, H. T. Nagle, B. D. Carroll, and J. D. Irwin, *Digital Logic Circuit Analysis and Design*, Prentice-Hall, 1995.

**APPENDIX A**

**ASSEMBLY PROGRAM**

The listing of the program has to be in **Courier New font**, size can be between 8, 9 or 10 points. Try to **align** the **Opcode**, **Operand**, and the **semicolon** for the comment. Use **single spacing** for the program.

Key\_In movb #$80,DDRC ;activate **row3** (%**1**000 0000)

ldaa PORTC

anda #$0E ;select bit 3,2,1 (%0000 1110)

cmpa #$06 ;”1” pressed? (%0000 0110)

bne not1

ldaa #’1’ ;’1’-ASCII code for keypad 1

bra found

not1 cmpa #$0A ;”2” pressed? (%0000 1010)

bne not2

ldaa #’2’ ;’2’-ASCII code for keypad 2

bra found

not2 cmpa #$0C ;”3” pressed? (%0000 1100)

bne not3

ldaa #’3’ ;’3’-ASCII code for keypad 3

bra found

not3 movb #$40,DDRC ;activate **row2** (%0**1**00 0000)

ldaa PORTC

anda #$0E ;select bit 3,2,1 (%0000 1110)

cmpa #$06 ;”4” pressed? (%0000 0110)

bne not4

ldaa #’4’ ;’4’-ASCII code for keypad 4

bra found

not4 cmpa #$0A ;”5” pressed? (%0000 1010)

bne not5

ldaa #’5’ ;’5’-ASCII code for keypad 5

bra found

not5 cmpa #$0C ;”6” pressed? (%0000 1100)

bne not6

ldaa #’6’ ;’6’-ASCII code for keypad 6

bra found

not6 movb #$20,DDRC ;activate **row1** (%00**1**0 0000)

ldaa PORTC

anda #$0E ;select bit 3,2,1 (%0000 1110)

cmpa #$06 ;”7” pressed? (%0000 0110)

bne not7

ldaa #’7’ ;’7’-ASCII code for keypad 7

bra found

not7 cmpa #$0A ;”8” pressed? (%0000 1010)

bne not8

ldaa #’8’ ;’8’-ASCII code for keypad 8

bra found

not8 cmpa #$0C ;”9” pressed? (%0000 1100)

bne not9

ldaa #’9’ ;’9’-ASCII code for keypad 9

bra found

not9 movb #$10,DDRC ;activate **row0** (%000**1** 0000)

ldaa PORTC

anda #$0E ;select bit 3,2,1 (%0000 1110)

cmpa #$0A ;”0” pressed? (%0000 1010)

bne not0

ldaa #’0’ ;’0’-ASCII code for keypad 0

bra found

not0 bra Key\_In ;wait for exactly one

C

found rts