

Temple University  
College of Engineering  
Department of Electrical and Computer Engineering (ECE)

## Student Lab Report Cover Page

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**Course Number** : 3613

**Course Section** : 002

**Experiment #** : Lab #9

**Student Name (print)** : Robert Bara

**TUId#** : 915614617

**Date** : 10/28/2020

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**Grade** : \_\_\_\_\_ /100

**TA Name** : Sung Choi

## ACTIVITIES:

**Important:** Extra 5 points deduction for each case will be applied for every activities if

- the comments are not enough to explain the code,
- you use screenshot for code
- you do not use the conditioning to check whether each data is ASCII letter or ASCII number to store them in SRAM.)

## Activity 1

### 1. Code and Description

(1) Code (Full-Comment)

```
//Robert Bara Lab 9
//Activity 1
.INCLUDE <M324PADEF.INC>
//Initialize Stack pointer
LDI R16,HIGH(RAMEND)
OUT SPH,R16
LDI R16,LOW(RAMEND)
OUT SPL,R16
LDI R16,0XFF
OUT DDRA,R16
//TO READ THE DATA FROM FLASH, SET Z POINTER, Z=0X200
ldi ZL,LOW(DATA<<1) ;ZH=R31
ldi ZH, HIGH(DATA<<1) ;ZL=R30
//write DATA CONTENTS to the address of EEPROM, EEAR=0x0200 (EEARH=0x02, EEARL=0x00)
LDI R18,0x02 ;load high byte of address to R18
LDI R17,0x00 ;load low byte of address to R17
WAIT:
//STEP 1: check the bit 1 of EECR = EEPE=0,
;wait for last write to finish
SBIC EECR,EEPE ;check EEPE to see if last write is finished
RJMP WAIT ;wait more
//STEP 2: Set the address of the data in EEPROM
//Address of EEPROM, EEAR=0x0200
OUT EEARH, R18 ;load high byte of address to EEARH
OUT EEARL, R17 ;load low byte of address to EEARL
//STEP 3: load value of the data
LPM R16,Z+
OUT EEDR,R16 ;load R16 to EEPROM Data Register
//STEP 4-1. Set EEMPE and EEPE to write data
SBI EECR,EEMPE ;set Master Write Enable to one
SBI EECR,EEPE ;set Write Enable to one
INC R17
CPI R16,0
BRNE WAIT

//Data memory 0x200, Data to read in
.ORG 0x0100
DATA: .DB 'E','C','E', '3', '6', '1', '3', 'F', 'A', 'L', 'L','2', '0', '2', '0', 0
```

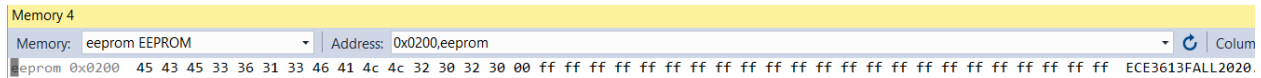
## 2. Result

(1) Flash Memory Contents (show the ASCII characters in the screenshot)



[Figure. Flash Memory Contents at 0x0200]

(2) EEPROM Memory Contents (show the ASCII characters in the screenshot)

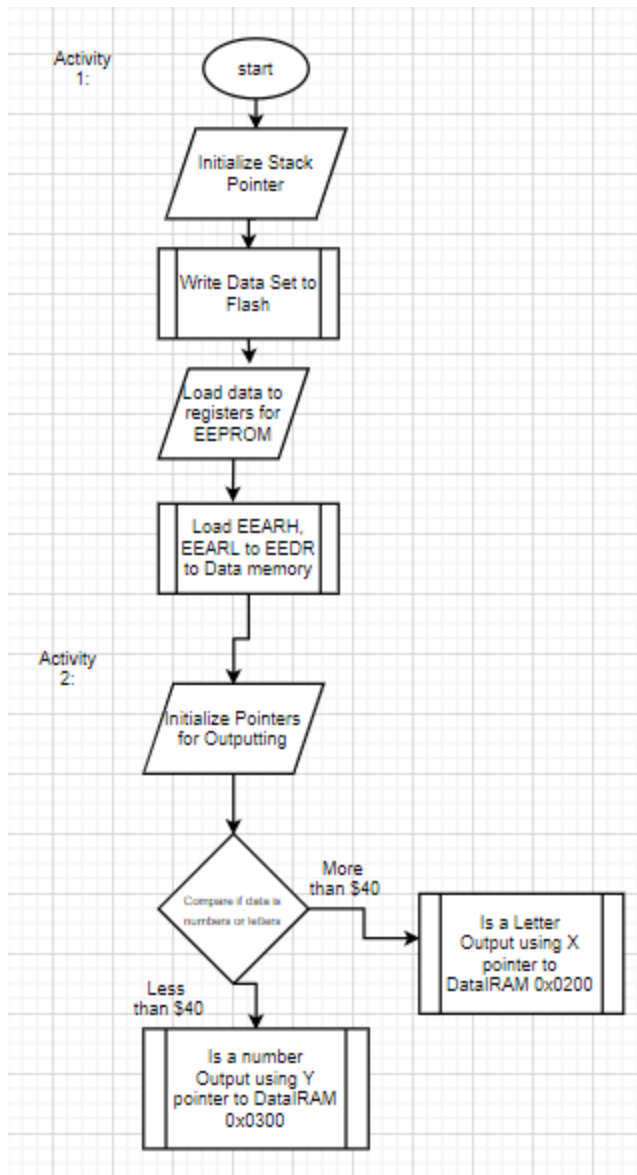


[Figure. EEPROM Memory Contents at 0x0200]

## Activity 2

### 1. Code and flowchart

(1) Flowchart (Use the correct symbols for each operation. Do not use hand drawing – 0 credit if you do not use an appropriate tool to draw flowchart.)



## (2) Code (Full-Comment)

```

//Robert Bara Lab 9
//Activity 1
#include <M324PADEF.INC>
//Initialize Stack pointer
LDI R16,HIGH(RAMEND)
OUT SPH,R16
LDI R16,LOW(RAMEND)
OUT SPL,R16
LDI R16,0XFF
OUT DDRA,R16
//TO READ THE DATA FROM FLASH, SET Z POINTER, Z=0X200
Ldi ZL,LOW(DATA<<1) ;ZH=R31
Ldi ZH, HIGH(DATA<<1) ;ZL=R30
//write DATA CONTENTS to the address of EEPROM, EEAR=0x0200 or 0x0300 (EEARH=0x02,
EEARL=0x00)
LDI R18,0x02 ;load high byte of address to R18
  
```

```

LDI R19,0X03 ;Load high byte of address to R19
LDI R17,0x00 ;load low byte of address to R17
WAIT:
//STEP 1: check the bit 1 of EECR = EEPE=0,
;wait for last write to finish
SBIC EECR,EEPE ;check EEPE to see if last write is finished
RJMP WAIT ;wait more
//STEP 2: Set the address of the data in EEPROM
//Adrees of EEPROM, EEAR=0x0200
//EEAR=0x0200
OUT EEARH, R18 ;load high byte of address to EEARH
OUT EEARL, R17 ;load low byte of address to EEARL
//STEP 3: load value of the data
LPM R16,Z+
OUT EEDR,R16 ;load R16 to EEPROM Data Register
//STEP 4-1. Set EEMPE and EEPE to write data
SBI EECR,EEMPE ;set Master Write Enable to one
SBI EECR,EEPE ;set Write Enable to one
INC R17
CPI R16,0
BRNE WAIT

//ACTIVITY 2. READ DATA FROM EEPROM
//SET X POINTER
LDI XH,HIGH(0X0200)
LDI XL,LOW(0X0200)
LDI YH,HIGH(0X0300) //Y pointer to put numbers in dataIram 0x0300
LDI YL, LOW(0X0300)
//EEAR = 0X200
LDI R18,0X02
LDI R17,0X00

//STEP 1. CHECK THE BIT 1 OF EECR = EEPE = 0
LET: //CHECKING FOR LETTERS, OUTPUT TO DATAIRAM 0X0200
;wait for last write to finish
SBIC EECR,EEPE ;check EEPE to see if last write is finished
RJMP LET ;wait more
//STEP 2: Set the address of the data in EEPROM
//Adress of EEPROM, EEAR=0x0200
OUT EEARH, R18 ;load high byte of address to EEARH
OUT EEARL, R17 ;load low byte of address to EEARL
//STET 4-2. Read data from EEPROM
SBI EECR,EERE ;set Read Enable to one
IN R16,EEDR ;load EEPROM Data Register to R16
CPI R16,$40
BRLT NUM
ST X+,R16
INC R17
CPI R16,0
BRNE LET
HERE: JMP HERE

NUM: //CHECK FOR NUMBERS OUTPUT TO DATAIRAM 0X0300
;wait for last write to finish
SBIC EECR,EEPE ;check EEPE to see if last write is finished
RJMP NUM ;wait more
//STEP 2: Set the address of the data in EEPROM
//Adress of EEPROM, EEAR=0x0200

```

## 2. Result

Memory: data IRAM Address: 0x0200,data

(2) Data Memory Contents (starts at 0x300 for numbers: 36132020, show the ASCII characters in the screenshot)

[illegible]

[Figure. DATA Memory Contents, Letters in Data at 0x0200, Numbers in Data at 0x0300]

## ECE3613 Processor System Laboratory Rubric

Lab #: 9

Section: 001/002

Name: \_\_\_\_\_

Activity	Task	Full Points	Earned Points	Comment
1	Code (Full comments)	10		
	Result – memory values	40		Flash Memory (20 points) and EEPROM (20 points)
2	Flowchart	10		
	Code (full comments)	10		
	Result – memory values	30		Data Memory contents (letters: 15 points and numbers: 15 points)
Total		100		