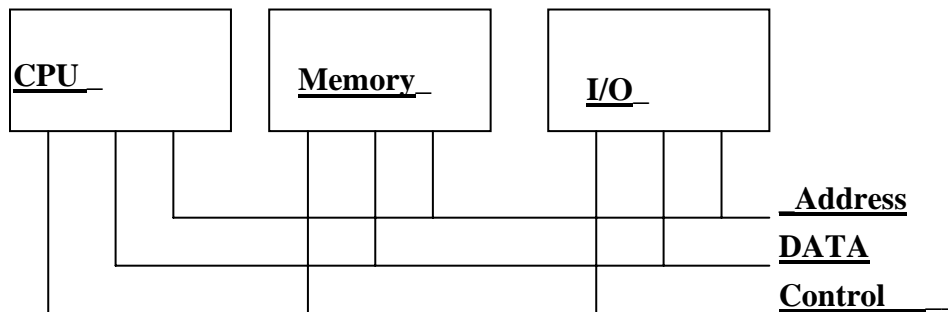


The questions in this exam refer to the 68HC11A8 single chip, unless otherwise noted in the question. This is an OPEN Book Open notes exam. You may use a calculator, but not a PDA, a cell phone, Tarot Cards, Ouija Board, or a laptop computer. Read the instructions carefully before completing the exam. All answers must be shown on these pages – no attached pages will be graded.

- 1 (10 points) Draw and label the Block diagram of the major components of a digital computer system and the busses connecting them



- 2 (3pts) For the 68HC11A8, how many bits are there for each the three busses?

2a Bus name: Data has # bits = 8
 2b Bus name: Address has #bits = 16
 2c Bus name: Control has #bits = Varies

- 3 (3pts) For a 32 bit microprocessor with an address space of 1024 words, how many bits are there for each of the three busses?

3a Bus name: Data has # bits = 32
 3b Bus name: Address has #bits = 10
 3c Bus name: Control has #bits = Varies

4. (5 points) Fill in the missing hexadecimal values, ASCII code, or binary values for the following table (0.5 point for each row):

hex	ASCII Character	binary							
\$31	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
<u>\$38</u>	<u>8</u>	0	0	1	1	1	0	0	0
<u>\$3E</u>	<u><</u>	0	0	1	1	1	1	0	0
<u>\$CA</u>	<u>Too big</u>	1	1	0	0	1	0	1	0
\$3E	<u>></u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>0</u>
<u>\$41</u>	A	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
<u>\$39</u>	9	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
<u>\$42</u>	B	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>
<u>\$32</u>	2	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>
<u>\$5A</u>	Z	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>0</u>

5. (5 pts) List the five types of instructions discussed in this class (one example type is data manipulation) and describe each type.

Data Manipulation – operates on the data, such as add, XOR, OR, or compare.

Memory Access – moves data between registers and main memory.

Flow control – adjusts the program counter register to determine which instructions to execute.

I/O – Input and Output to and from the digital computer system to other devices and the real world.

software directives – instruction to the assembler or comments for human consumption.

Extra:

Other – instructions that execute but do not **manipulate data, control flow of execution, direct the assemble, inform human readers, nor perform I/O. for example the nop or no operation command.**

Consider the following Program:

* ECEN3213 Fall 2007 Exam 1.

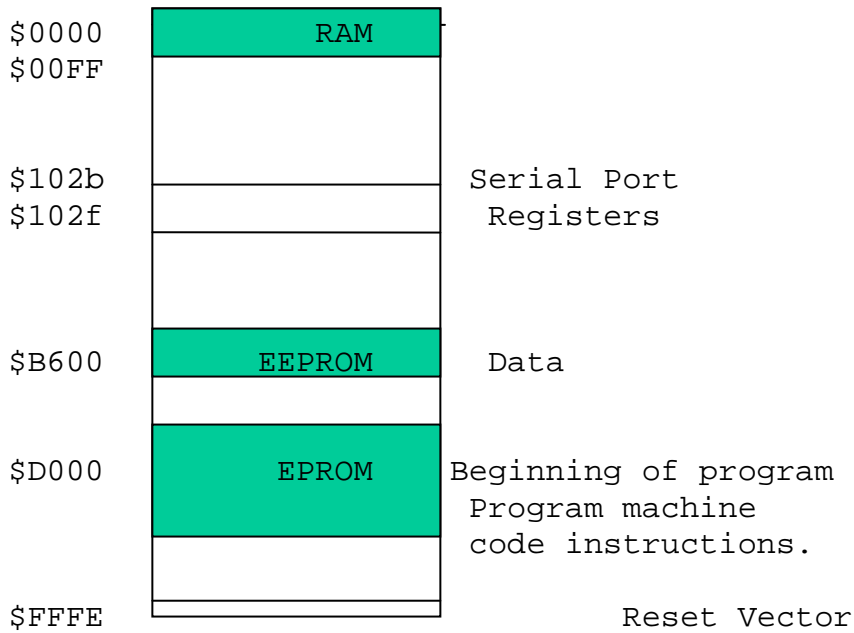
* Description: This program simply outputs to the serial

* Port values that are stored in memory.

*

```
    org $D000 object code goes in ROM
Main ldaa #$0c
    staa SCCR2 enable SCI
    ldaa #0
    staa BAUD baud rate=125000 bps
loop ldx #$B600
***** Output to serial PORT *
JMALoop ldaa ,X Next ASCII character from string
    inx
    cmpa #$00
    beq pause
* Output next byte
JoutWait ldab SCSR
    andb #$80
    beq JoutWait Gadfly wait for TDRE
* TDRE=1 when ready for more output
    staa SCDR Start Output
    bra JMALoop
pause ldaa #$00
    stop
    bra loop
**** Values are in EPROM *****
    org $B600
    fcb $57,$65,$6C,$63,$6F,$6D,$65,$20
    fcb $74,$6F,$20,$45,$43,$45,$4E,$20
    fcb $33,$32,$31,$33,$20,$20
    fcb $20,$3A,$2D,$29,$20,$0D,$0D,$00
***** give names to Serial PORT registers *****
BAUD equ $102b ;serial baud rate control
SCCR1 equ $102c ;serial control register 1
SCCR2 equ $102d ;serial control register 2
SCSR equ $102e ;serial status register
SCDR equ $102f ;serial data register
***** Set the RESET interrupt vector register ***
    org $FFFE
    fdb Main Start location after reset
end
```

6. (3 pts) Draw the memory map for the program on the previous page.



7. (5 pts) fill in the missing values for the following table (0.5 pt each correct row):

Decimal	Hexadecimal	Binary
7	<u>\$</u> <u>0</u> <u>0</u> <u>0</u> <u>7</u>	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1
8	<u>\$</u> <u>0</u> <u>0</u> <u>0</u> <u>9</u>	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
<u>63</u>	\$0 0 3 F	0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1
<u>64</u>	\$0 0 4 0	0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
127	<u>\$</u> <u>0</u> <u>0</u> <u>7</u> <u>F</u>	<u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u>
128	<u>\$</u> <u>0</u> <u>0</u> <u>8</u> <u>0</u>	<u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>1</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u>
1023	<u>\$</u> <u>0</u> <u>3</u> <u>F</u> <u>F</u>	<u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u>
4096	\$1 0 0 0	<u>0</u> <u>0</u> <u>0</u> <u>1</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u>
65535	<u>\$</u> <u>F</u> <u>F</u> <u>F</u> <u>F</u>	<u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u>
<u>65535</u>	<u>\$</u> <u>F</u> <u>F</u> <u>F</u> <u>F</u>	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

The following multiple-choice questions will be scored as 2 pts for each correct answer, -1 for an incorrect answer and 0 for unanswered questions.

8. What does PC stand for in the PC register? D
- a. Politically Correct
 - b. Personal Computer
 - c. Program Code
 - d. Program Counter**
 - e. Progress Counter
 - f. None of these choices
9. A characteristic for all of the ports on the 6811: A
- a. Memory Mapped.**
 - b. Un-Buffered
 - c. Parallel
 - d. All three of a, b, and c
 - e. None of these
10. What does it mean when the PC register has the value 65735? F
- a. The next instruction to be fetched is in memory location 65735.
 - b. The value of the operand of the next instruction is 65735.
 - c. The current instruction being fetched is at memory location 65735.
 - d. The last instruction fetched was from memory location 65735.
 - e. It could be any of a, c, or d (but not b) depending upon what phase of the instruction is occurring(fetch, decode, execute, load/store).
 - f. This is a trick question because a 16 bit PC register cannot hold a value of 65735**
11. What does it mean when the PC register has the value 60735? E
- a. The next instruction to be fetched is in memory location 60735.
 - b. The value of the operand of the next instruction is 60735.
 - c. The current instruction being fetched is at memory location 60735.
 - d. The last instruction fetched was from memory location 60735.
 - e. It could be any of a, c, or d (but not b) depending upon what phase of the instruction is occurring (fetch, decode, execute, load/store).**
 - f. This is a trick question because a 16-bit PC register cannot hold a value of 60735.
12. Register B contains \$AB. A logical OR is performed with Register B and the value \$F0. What is the result in Register B? G
- a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. 4
 - f. 8
 - g. None of these choices

13. What addressing mode does the instruction ldaa \$AF use? **B**
 a. extended **b. direct** c. indexed d. immediate e. inherent
14. What addressing mode does the instruction lsj \$\$GJ use? **f**
 a. extended b. direct c. indexed d. immediate e. inherent **f. illegal instruction**
15. What addressing mode does the instruction ldaa \$FA,x use? **C**
 a. extended b. direct **c. indexed** d. immediate e. inherent
16. What addressing mode does the instruction aba use? **E**
 a. extended b. direct c. indexed d. immediate **e. inherent**
17. What addressing mode does the instruction staa \$0F10 use? **A**
a. extended b. direct c. indexed d. immediate e. inherent
18. What addressing mode does the instruction ldaa #\$FA10 use? **D**
 a. extended b. direct c. indexed **d. immediate** e. inherent
19. For a Flow Chart, what shape is used to represent a decision? **A**
a. Diamond b. rectangle c. trapezoid d. None of these choices
20. How many LEDs (Light Emitting Diodes) does the 68HC11A8 have? **A**
a. 0 b. 1 c. 2 d. 3 e. 4 f. 8 g. None of these choices
21. How many LCDs (Liquid Crystal Displays) does the 68HC11A8 have? **A**
a. 0 b. 1 c. 2 d. 3 e. 4 f. 8 g. None of these choices
22. How does the 68HC11A8 determine whether a binary value is numerical data, ASCII character data, a memory address, or a machine code instruction? **C**
 A) Based upon which register has the value
 B) The memory location where the value is stored
C) It cannot be determined.
 D) From software instructions.
 E) From the flow chart or state diagrams.
 F) By the value itself.
23. How many cycles does it take to save the results of an instruction? **E**
 A) Never less than 3
 B) 1
 C) 2
 D) 3
E) Depends upon the addressing mode
 F) Depends upon the value of the operand

The following True / False questions are worth 2 points each correct answer, -1 for each incorrect answer, and 0 points for no answer. Circle T for True or F for False for your answer.

- F** 24. Embedded microcomputer systems are out of date and have not been used in any applications since May 2006.
- F** 25. Flowcharts and State diagrams are to be discarded as soon as the program is running correctly.
- F** 26. Extended addressing requires external memory for correct operation.
- T** 27. An entire Assembly program could be written without using any label fields.
- F** 28. Inherent addressing never uses the X register as an operand.
- F** 29. Inherent addressing always uses the A register as an operand.
- F** 30. Inherent addressing cannot use the B register as an operand.
- F** 31. Four bytes are required to hold three hexadecimal digits.
- F** 32. The latency to process any parallel port is always less than the latency to process any serial port.
- F** 33. BAUD rate is a measure of latency.
- F** 34. The throughput to process any parallel port is always less than the throughput to process any serial port.
- T** 35 There is an assembly code instruction for every machine code instruction.
- F** 36. There is a machine code instruction for each assembly level instruction.
- T** 37. There is a memory address for the start of every machine code instruction.
- T** 38. Some 6811 machine code instructions require 3 bytes of memory.
- F** 39. Assembly code comments slow down execution of the machine code.
- T** 40. A problem well stated is a problem half solved.