[Open book, pink book, handouts, and notes **and Computer**] You may not discuss any aspect of this exam with anyone other than your instructor until after 4:00pm, Wednesday, April 6, 1999. Show work only for questions you wish to have regraded. You must provide a complete solution for any question you wish to have regraded. Show all of your work clearly in the space provided. Be sure to **read each problem carefully**. No points will be awarded for a solution to the bonus question. Note that the exam is double sided.

Honor pledge: I did not discuss this exam with anyone or receive help from anyone except my CS-280 instructor for a 48-hour period ending at 4:00pm, Wednesday, April 6, 1999. I will happily accept a failing grade for this course if determined otherwise.

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student signature

1. (10 points) The instruction `oraa 0,x` requires four clock cycles to complete whereas the instruction `orab 72,y` requires five clock cycles. Why?

2. (10 points) Indicate the contents of the stack (and the memory locations associated with the contents) after the following operations.

```
lds  #0xF000
ldd  #0x30F2
ldx  #0x1234
psha
pshb
pshx
pulb
pshx
psha
puly
```

Memory Location	Memory Contents

3. (20 points) To the right of each statement, indicate the value contained by each of the condition code registers. Assume that the A accumulator initially contains `0x00`. For partial credit, show your work.

Instruction	S	X	H	I	N	Z	V	C
`tap`								
`ldaa #0x8B`								
`adda #0xAA`								
`ldab #0`								
`decb`								
`clra`								
`comb`								
`des`								

4. In this multi-part problem you will write a program that adds `count` 24-bit numbers and stores the result as a 32-bit number in a 4 byte memory location.

(a) (10 points) Write the appropriate assembler directives to:

- store the following 24-bit numbers in memory: `0x03F12D`, `0x055FFC`, ..., `0x1784D6` with a label `num` pointing to the most significant byte of the first number;
- reserve space for the 32-bit result; and
- create a label `ans` that points to the most significant byte of the 32-bit result.

(b) (15 points) Write a subroutine which adds a 24-bit number to a 32-bit number and stores the result in the location of the 32-bit number. Assume that the X index register points to the most significant byte of the 24-bit number and that the Y register points to the most significant byte of the 32-bit number.

(c) (15 points) Write the body of the main program that will use the subroutine in part **(b)** to add `count` 24-bit numbers and store the result in four bytes of memory beginning at `ans`. (Note: `count` is a label that will be defined in part **(d)**.)

(d) (10 points) Write the source (`exam1.s`) file for the above code where `count=36`. Be sure to include all necessary assembler directives and initialization instructions not included in parts **(a)** – **(c)**. For convenience, you may signify the contents of your answers to the previous parts by the part letter with a box around it.

(e) (10 points) Write the link (`exam1.lnk`) file for the source file in part **(d)** such that the data is stored beginning at `0xD000` and the program is stored beginning at `0xC000`.