

CPE 390: Microprocessor Systems

HW4

Due: 3/8/18

1. Write a program starting at location \$4000 to copy a string (of unknown length) starting at location \$5000 to location \$5020 converting all lower case alphabetic characters to upper case. Use an assembler directive to initialize the string at location \$5000 to be "CpE 390 Microprocessor Systems". Enter your code into the simulator and check the result. Show a screen shot of the simulator showing the initial and the copied string.

Now change your program so that the string is initialized to be your name in upper and lower case characters and the year you expect to graduate (e.g. "Fred Bloggs 2020"), run the program again and show a screen shot of the final result.

2. What will be the value of the SP, register Y and the contents of the stack (addresses and data, when known) after the following instruction sequence is executed.

```
lds    #$4800
ldab   #$2B
pshb
stab   2, -SP
ldaa   #$41
psha
lsl
pshd
pshb
puly
```

Suppose you have two arrays of 8-bit signed integers $P[i]$ and $Q[i]$ for $0 \leq i < N$. Write a subroutine *minsum* that will find the minimum of $(P[i] + Q[i])$ for $0 \leq i < N$. A pointer to the array P is passed in register X and a pointer to the array Q is passed in register Y. The number of elements in each array N is passed in accumulator A. The result should be returned in accumulator A, overwriting the value N. (*You can assume that the values of $P(i)$ and $Q(i)$ lie between -63 and +63 so that their sum is always representable as an 8-bit signed quantity*)

- (i) You are required to save and restore any accumulators and/or registers used by the subroutine (other than A). The pointers in X and Y should be returned unchanged to the calling program.
- (ii) The contents of the arrays P and Q should not be changed.

(Hint: Create a local variable on the stack to record the minimum sum of P and Q . Use accumulator A as a loop counter and accumulator B to do your arithmetic)

- (a) Draw the stack frame as seen by the subroutine
- (b) Write the code for the subroutine