Homework 4

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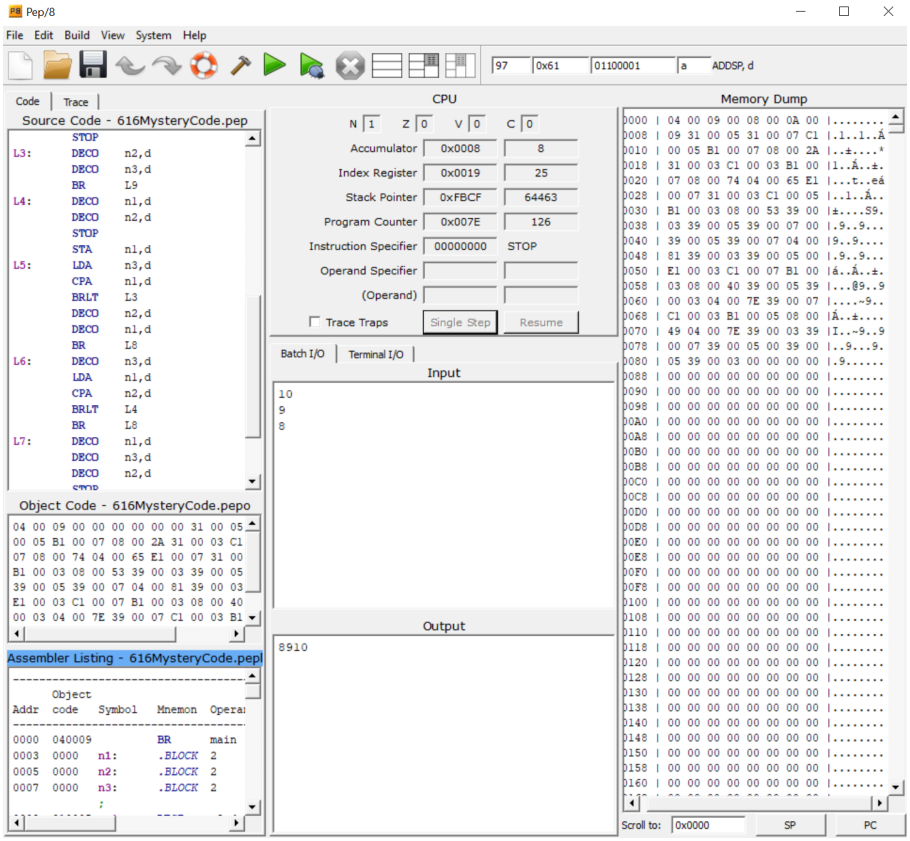
Homework 4

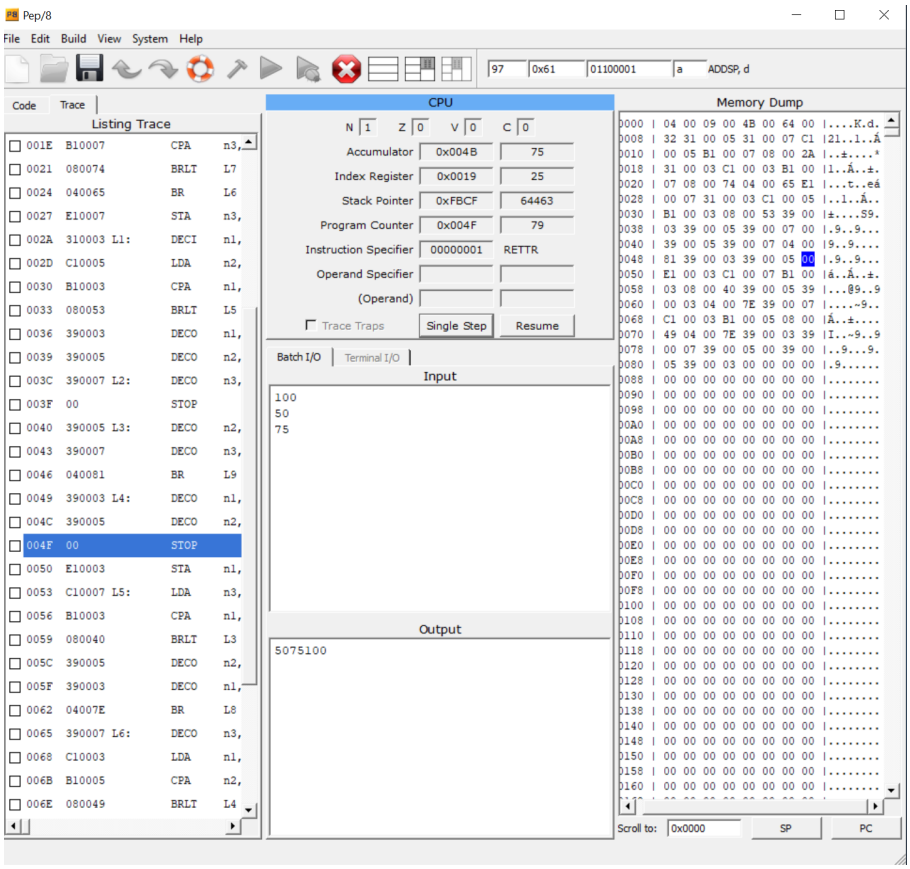
Problem 1

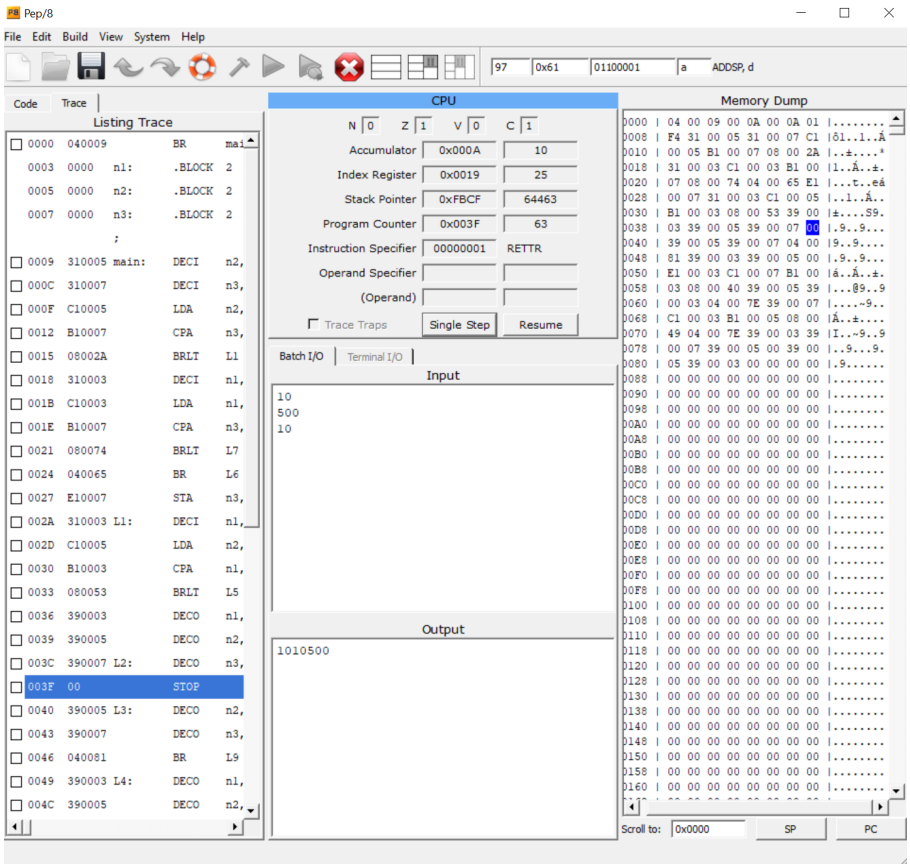
Run the mystery program from Fig 6.16 with the values supplied in the help solution of Pep8 and some of your own.

1.a

Show 3 screen shots with different inputs, including the output using Batch I/O.




Pep/8
File Edit Build View System Help
Code Trace
Listing Trace
CPU
Accumulator 0x004B 75
Index Register 0x0019 25
Stack Pointer 0xFBCF 64463
Program Counter 0x004F 79
Instruction Specifier 00000001 RETTR
Operand Specifier
(Operand)
Trace Traps Single Step Resume
Batch I/O Terminal I/O
Input
100
50
75
Output
5075100
Memory Dump
Scroll to: 0x0000 SP PC


Pep/8
File Edit Build View System Help
Code Trace
Listing Trace
CPU
Accumulator 0x000A 10
Index Register 0x0019 25
Stack Pointer 0xFBCF 64463
Program Counter 0x003F 63
Instruction Specifier 00000001 RETTR
Operand Specifier
(Operand)
Trace Traps Single Step Resume
Batch I/O Terminal I/O
Input
10
500
10
Output
1010500
Memory Dump
Scroll to: 0x0000 SP PC

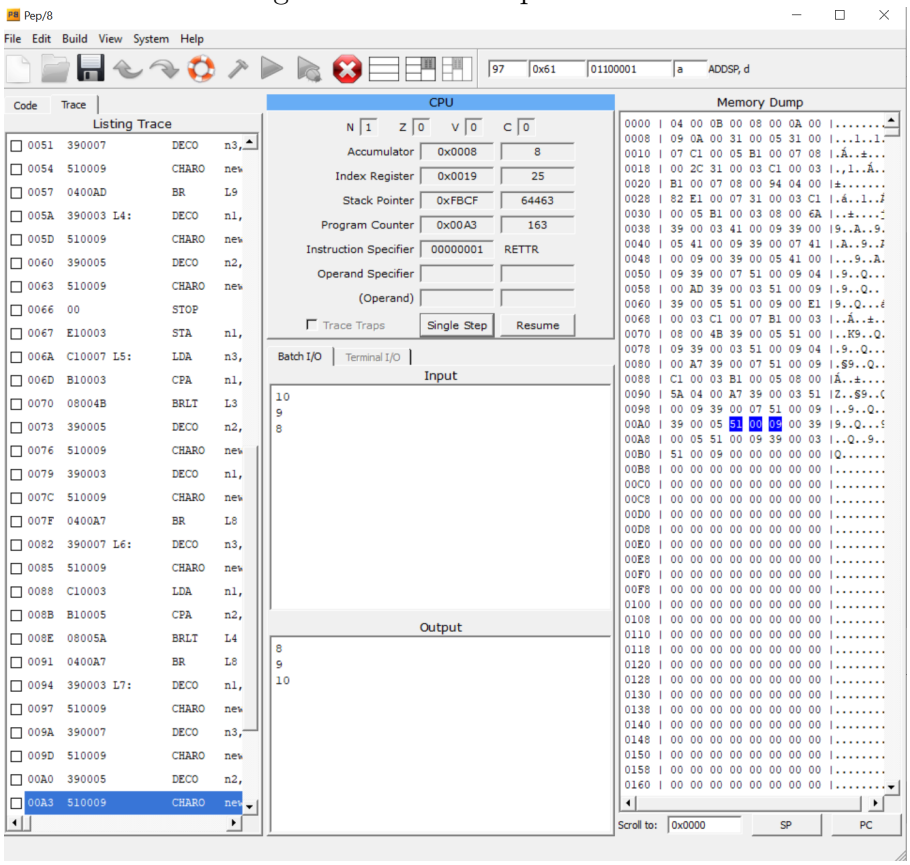
1.b

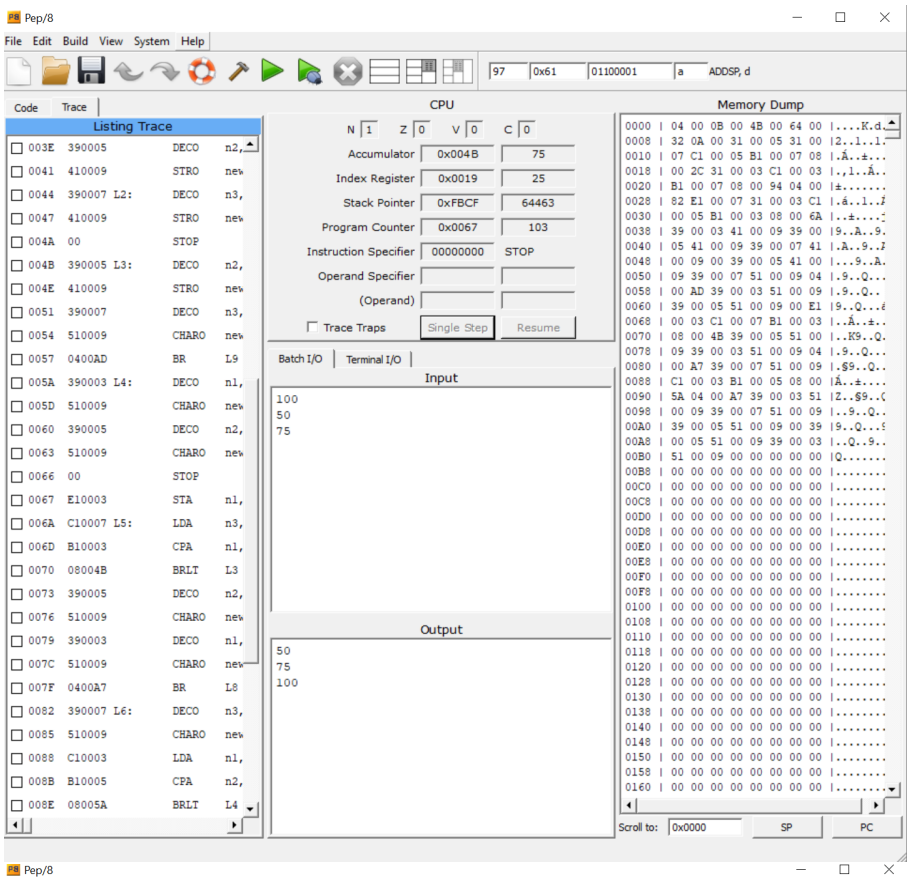
State in one sentence, what does this program do?
This program takes a series of numbers and returns them in numeric order.

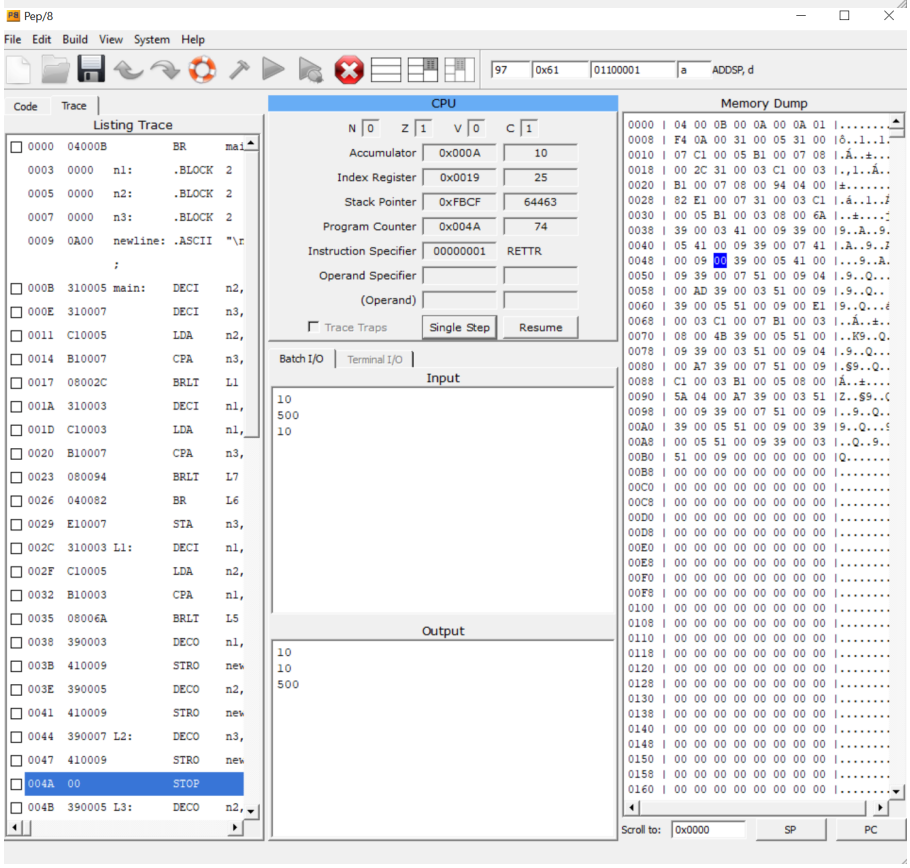
1.c

Modify the program to make the output clearer – Describe – Do not paste the code. Show the same 3 screen shots with the modification.

In order to make the output more clear I have decided to make better use of spacing on the output side. This was simply a matter of adding a reference to the \n character and calling it after each output.




Pep/8
File Edit Build View System Help
Code Trace
Listing Trace
CPU
Memory Dump
Accumulator 0x004B 75
Index Register 0x0019 25
Stack Pointer 0xFBCF 64463
Program Counter 0x0067 103
Instruction Specifier 00000000 STOP
Operand Specifier
(Operand)
Trace Traps
Single Step
Resume
Batch I/O
Terminal I/O
Input
100
50
75
Output
50
75
100
Scroll to: 0x0000
SP
PC


Pep/8
File Edit Build View System Help
Code Trace
Listing Trace
CPU
Memory Dump
Accumulator 0x000A 10
Index Register 0x0019 25
Stack Pointer 0xFBCF 64463
Program Counter 0x004A 74
Instruction Specifier 00000001 RETTR
Operand Specifier
(Operand)
Trace Traps
Single Step
Resume
Batch I/O
Terminal I/O
Input
10
500
10
Output
10
10
500
Scroll to: 0x0000
SP
PC

1.d

Is this spaghetti code or structured code? If it was the other type, would it be easier or harder to modify?

This is a bit of spaghetti code. If it had been written in a more structured manner it would have been much easier to modify. The modification in the previous part of the problem was doable by simply following each print command, which made the modification easier, but to restructure the code would have been a much more difficult task. However, once the code had been restructured further modification would have most likely been much easier.

Problem 2

Translate the program below into PEP/8 assembly language

- *Start with Assembly code for Fig 6.36 (Use Pep8 help)*
- *Change to output array in same order as input*
- *Add function twoVect*
- *Pass array as parameter as shown in Fig 6.38*
- *Use trace tags on all variables.*

2.a

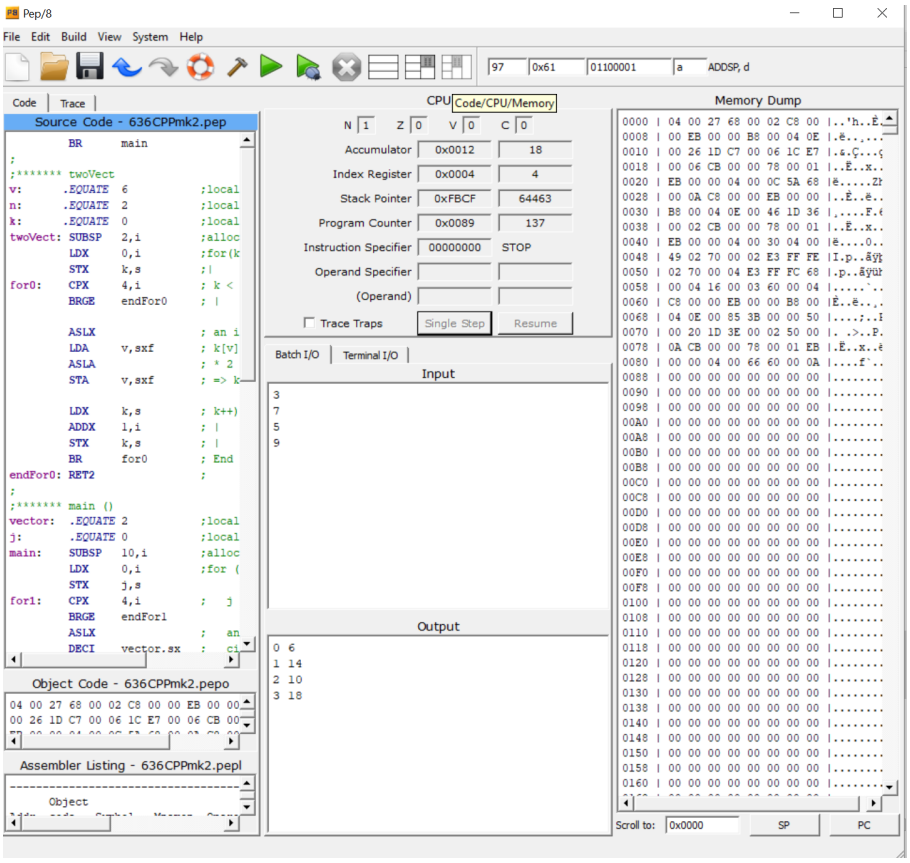
Comment lines of the source code to trace the C++ code. Cut & paste the Source Code Listing into your assignment document.

```
            BR          main
;
;*******    twoVect
v:          .EQUATE     6           ;local variable #2d4a
n:          .EQUATE     2           ;local variable #2d
k:          .EQUATE     0           ;local variable #2d
twoVect:    SUBSP       2,i         ;allocate k
            LDX         0,i         ;for(k = 0,
            STX         k,s         ;|
for0:       CPX         4,i         ; k < n,
            BRGE        endFor0     ; |

            ASLX                    ; an integer is two bytes
            LDA         v,sxf       ; k[v]
            ASLA                    ; * 2
            STA         v,sxf       ; => k[v]

            LDX         k,s         ; k++)
            ADDX        1,i         ; |
            STX         k,s         ; |
            BR          for0        ; End For0
endFor0:    RET2                    ;
;
```

```
;*******  main ()
vector:  .EQUATE  2        ;local variable #2d4a
j:       .EQUATE  0        ;local variable #2d
main:    SUBSP    10,i     ;allocate #vector #j
         LDX      0,i      ;for (j = 0
         STX      j,s
for1:    CPX      4,i      ; j < 4
         BRGE     endFor1
         ASLX               ; an integer is two bytes
         DECI     vector,sx ; cin » vector[j]
         LDX      j,s       ; j++)
         ADDX     1,i
         STX      j,s
         BR       for1
endFor1: BR       tvCall
;*******  Call:    twoVect
;
tvCall:  MOVSPA             ;push address of vector
         ADDA     vector,i
         STA      -2,s
         MOVSPA             ;push address of n
         ADDA     4,i
         STA      -4,s
         SUBSP    4,i       ;push n
         CALL     twoVect,i ;Call twoVect
         ADDSP    4,i       ;
;
;;;      Print Loop
         LDX      0,i       ;for (j = 0
         STX      j,s
for2:    CPX      4,i       ; j > 4
         BRGE     endFor2
         DECO     j,s       ; cout « j
         CHARO    ' ',i     ; « ' '
         ASLX               ; an integer is two bytes
         DECO     vector,sx ; « vector[j]
         CHARO    '/n',i    ; « endl
         LDX      j,s       ; j–)
         ADDX     1,i
         STX      j,s
         BR       for2
endFor2: ADDSP    10,i      ;deallocate #j #vector
         STOP
         .END
```

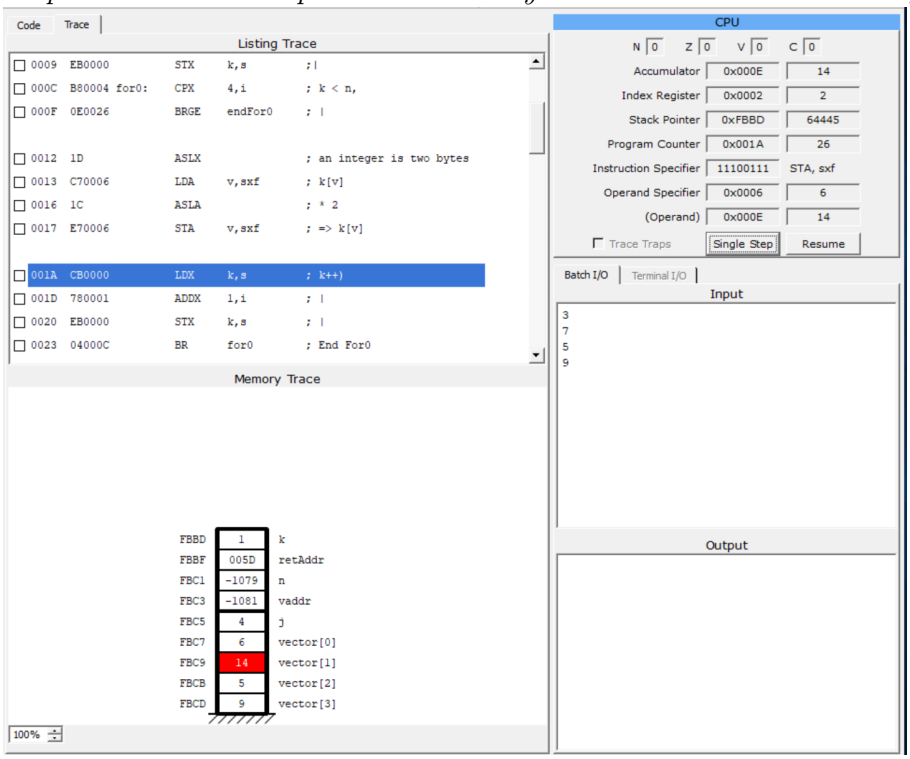
2.b

Run for a set of 4 inputs and paste a screen shot of the Output area of PEP/8.



2.c

Step thru & Cut and paste the memory trace when in the twoVect function.



Problem 3

Translate the program below into PEP/8 assembly language.

- *Use a jump table to implement the switch statement.*
- *Use trace tags on all variables.*
- *For invalid scores, output should be the same as the C++ program.*
- *Add something to the output that makes this program uniquely yours.*
- *The variable finish needs to be local.*
- *This is similar to Fig 6.40*

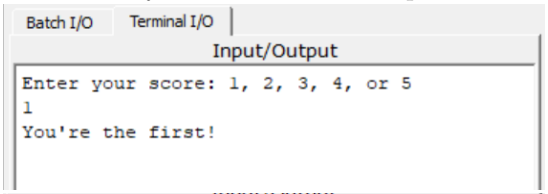
3.a

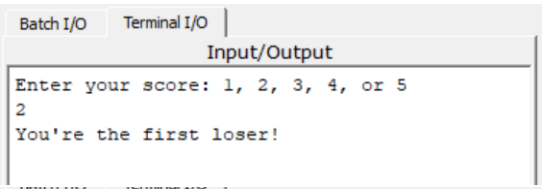
Comment lines of the source code to trace the C++ code. Cut & paste the Source Code Listing into your assignment document.

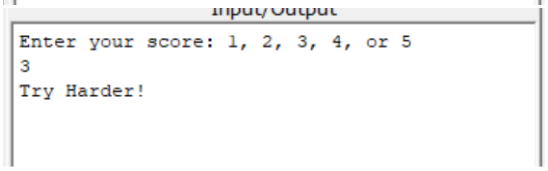
```
            BR          main
;
;*******    main ()
finish:     .EQUATE     0           ;local variable #2d
main:       SUBSP       2,i         ;allocate #finish
            STRO        msgIn,d     ;cout « "Enter your score: 1, 2, 3, 4, or 5"
            CHARO       '/n',i      ;cout « endl
            DECI        finish,s    ;cin » Guess
            LDX         finish,s    ;switch (Guess)
            SUBX        1,i         ;subtract 1
            ASLX                    ;addresses occupy two bytes
            BR          finishJT,x
finishJT:   .ADDRSS     case0
            .ADDRSS     case1
            .ADDRSS     case2
            .ADDRSS     case3
            .ADDRSS     case4
case0:      STRO        msg0,d      ;cout « "You're the first!"
            BR          endCase     ;break
case1:      STRO        msg1,d      ;cout « "You're the first loser!"
            BR          endCase     ;break
case2:      STRO        msg2,d      ;cout « "Try Harder!"
            BR          endCase     ;break
case3:      STRO        msg2,d      ;cout « "Try Harder!"
            BR          endCase     ;break
case4:      STRO        msg3,d      ;cout « "You weren't even Competing!"
endCase:    CHARO       '/n',i      ;count « endl
            ADDSP       2,i         ;deallocate #finish
            STOP
msgIn:      .ASCII      "Enter your score: 1, 2, 3, 4, or 5 /x00"
msg0:       .ASCII      "You're the first! /x00"
msg1:       .ASCII      "You're the first loser! /x00"
msg2:       .ASCII      "Try Harder! /x00"
msg3:       .ASCII      "You weren't even Competing! /x00"
            .END
```

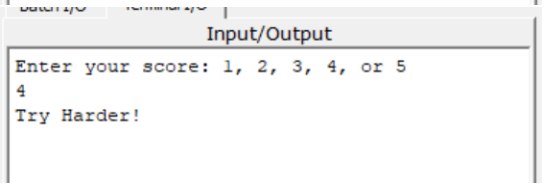
3.b

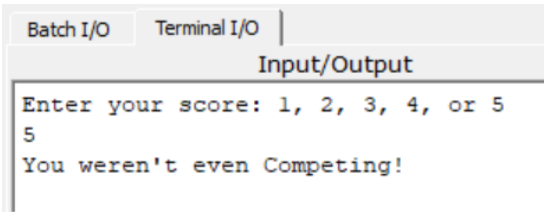
Run for each score and paste a screen shot of each of the PEP/8 Output area.





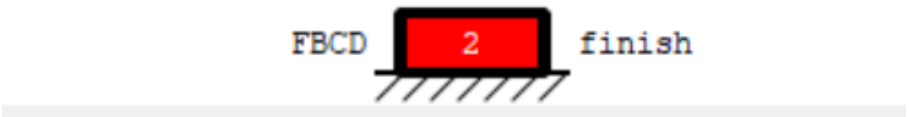






3.c

Step thru & Cut and paste the memory trace at any point.



Problem 4

Write a C++ program that inputs a lower case character, converts it to an upper case character using the function below and increments it to the next character (i.e. B will be changed to C). If Z is entered it should be changed to A. If a non-letter character is entered, it should not be changed.

- *A character that is not a letter should be returned as is.*
- *Character variables will need character trace tags.*
- *Hint: characters only use one byte of storage and should be manipulated with byte instructions.*
- *Add something to the output that makes this program uniquely yours.*
- *Then translate it to Assembly language.*

4.a

Cut and paste your C++ Source Code into your assignment document.

```
/*
CSC - Homework 4 - Problem 4
Author: Brandon Hosley
Date: 2018 10 13
*/

#include "pch.h"
#include <iostream>
using namespace std;

char uppercase(char ch) {
        if ((ch >= 'a') && (ch <= 'z'))
        {
                return ch - 'a' + 'A';
        }
        else
        {
                return ch;
        }
}

char increment(char ch)
{
        if (ch == 'z' || ch == 'Z')
    {
                return 'A';
    }
        else
    {
                return ++ch;
    }
}
```

```
int main()
{
        char ch;
        cout << "Please input character:" << endl;
        cin >> ch;
        ch = uppercase(ch);
        ch = increment(ch);
        cout << ch;
        return 0;
}
```

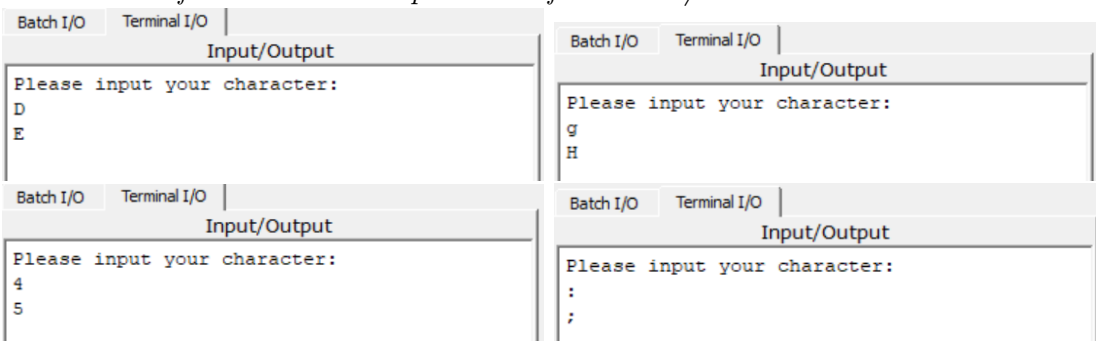
4.b

Comment lines of the source code to trace the C++ code. Cut & paste the Assembly Source Code Listing into your assignment document.

```
                br          main
;
;*****          uppercase(char ch)
upcase:         LDBYTEA     ch,d        ;if (
                CPA         'a',i       ;ch >= 'a'
                BRLT        endUpper
                LDBYTEA     ch,d
                CPA         'z',i       ;ch <= 'z'
                BRGT        endUpper    ; )
                LDBYTEA     ch,d
                SUBA        32,i        ; ch = ch - 'a' + 'A'
                STBYTEA     ch,d
endUpper:       RET0
;
;*****          increment(char ch)
incr:           LDBYTEA     ch,d        ;if(
                CPA         'Z',i       ; ch == 'Z'
                BREQ        else
                LDBYTEA     ch,d
                CPA         'z',i       ; ch == 'z'
                BREQ        else
                ADDA        1,i         ;++ch
                STBYTEA     ch,d
                br          endIncr
else:           LDBYTEA     'A',i       ; ch = 'A'
                STBYTEA     ch,d
                endIncr:    RET0
;
;*****          main()
ch:             .EQUATE     0           ;local variable #1c
main:           SUBSP       1,i         ;allocate #ch
                STRO        msg,d       ;cout « "Please input your character:"
                CHARO       '/n',i      ;cout « endl
                CHARI       ch,d        ;cin » ch
                CALL        upcase,i    ;upcase(ch)
                CALL        incr,i      ;increment(ch)
                CHARO       ch,d        ;cout « ch
;
                ADDSP       1,i         ;deallocate #ch
                STOP
;*****          Constants
msg:            .ASCII      "Please input your character: /x00"
                .END
```

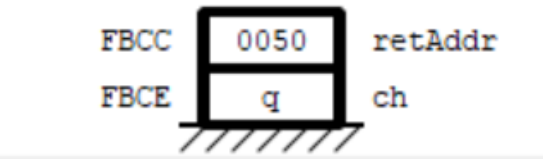
4.c

Run for 3 inputs: one uppercase, one lowercase, & one non-letter and paste a screen shot of each in the Output area of the PEP/8.



4.d

Step thru & Cut and paste the memory trace at a point when in ***uppercase*** *subroutine.*



References

Warford, J. (2009). *Computer systems* (4th ed.). Jones and Bartlett.