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Name:
Number:

Date: 03 January 2013

EENG410/INFE410 - MICROPROCESSORS I
Final Exam

Instructor: *Dr. Hasan Demirel*

Read the Following Instructions Carefully:

1. *The duration of the exam is 150 minutes.*
2. *Answer each question to a separate sheet on your answers booklet.*

QUESTIONS

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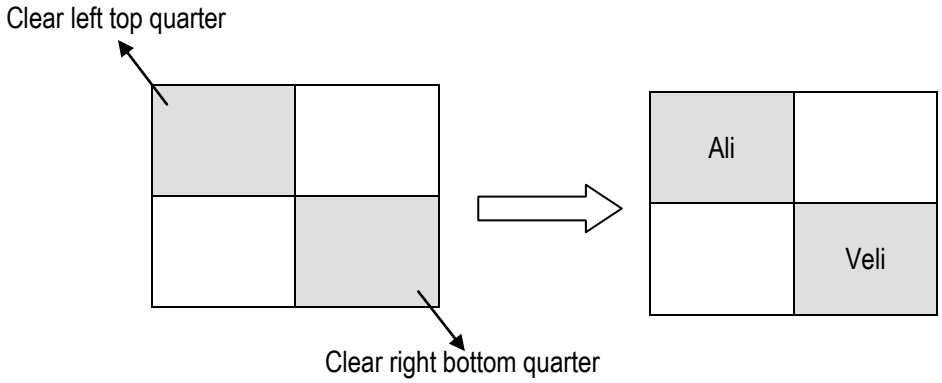
1. **(%25)** Write an assembly language program which asks the user to enter his/her name and surname through the keyboard. After the entry:
   - The program clears the left top quarter of the screen and displays the name at the center of that quarter.
   - Similarly the program clears the right bottom quarter of the screen and displays the surname at the center of that quarter.

For example: If your name and surname are "Ali" and "Veli", the following is required.



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2. **(%25)** Given a set of signed numbers in the data segment below, write an assembly language program to calculate the average of the negative and positive numbers. The program should save the averages into the data segment. Ignore the remainders.

```
.DATA
NUMBERS     DB    -45, +32, -37, -99, -85, +11, +93, +57, -57, +87, -68, +83
            ORG   10H
NEG_AVE     DB     ?    ; average of the negative numbers
            ORG   20H
POS_AVE     DB     ?    ; average of the positive numbers
```

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3. **(%25)** Write the definition of a macro which counts the number of 1's in all of the members of a given array of bytes. Note that the macro has three arguments. The first argument is an input argument which is the ***name*** of the array. The second argument is another input argument which is the ***size*** of the array. The last argument is the output argument, which is the resulting ***count***.

   For example: If an array is given as follows: 24H, 7AH, 8FH
   (00100100B, 01111010B, 10001111B)

   The macro will return 12 as the count of the number of 1's.

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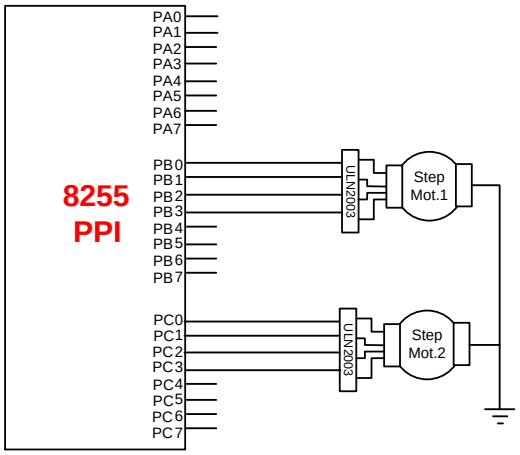
4. **(%25)** Assume that two stepper motors are connected to Port B and Port C of 8255 PPI controller as illustrated below. The PPI is at address 0440H and each motor has a stepping angle of 4^{o}. Write an assembly language program to rotate the Stepper Motor 1 with 250 *rpm* when '1' is pressed from the keyboard. Similarly, rotate the Stepper Motor 2 with 500 *rpm* when '2' is pressed. The user presses 'X' to terminate the program. Assume that a delay subroutine, *WAITF*, is available for delay management.



Hints:
- INT 10H, AH= 06 scroll up window (clear) with CX to be left top corner and DX to be right bottom corner.
- INT 10H, AH= 02 sets cursor location and assumes row in DH and column in DL.
- INT 16H, AH=01H checks if a key pressed. ZF=0, if a key pressed, ZF=1 if there is no key press.
- INT 16H, AH=00H provides the ASCII code of the pressed key in AL if a key is pressed.
- INT 21H, AH= 09 displays the string on the screen.
- INT 21H, AH= 02 outputs a character to the monitor. Assumes the character in DL (ASCII)