CS 218

Homework, MIPS Asst. #3

Purpose: Become familiar with the MIPS Instruction Set, and the MIPS function calling

convention, and indexing for multiple dimension arrays.

Due: Wednesday (7/06)

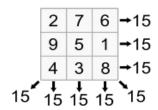
Points: 75

Assignment:

Write a simple assembly language function to check if a two-dimensional array is a *magic square*¹. The provided main calls the following functions as follows:

• Write a void function, chkMagicSqr(arr, order), that will check an (n by n) two-dimensional array to see if it is a magic square. In recreational mathematics, a magic square of order n is an arrangement of n^2 numbers, usually integers, in a square stored as a two-dimensional array, such that the n numbers in all rows, all columns, and both diagonals sum to the same value. A normal magic square contains the integers from 1 to n^2 .

For example:



This function must call the *prtMsg()* function to display the sums (each row, each column, and each diagonal).

- Write a void function, *prtMsg(str, num, sum)*, to display the row, column, or diagonal message, the row/col/diagonal number, and sum. Refer to the example execution for output formating.
- Write a void function, *prtSquare(arr, order)*, to display an (*n* by *n*) two-dimensional matrix. The numbers should be printed in a two-dimensional format (see example output). All numbers must be right justified (i.e., lined up on right side).

Array Implementation:

At the machine level, multi-dimension arrays are implemented as a large single dimension array. The formula for calculating two-dimensional array indexing is:

```
addr(row,col) = base_address + (rowindex * col_size + colindex) * element_size
```

You must use the formula to access matrix elements. **No score** will be provided for submissions that do not use this formula.

¹ For more information, refer to: https://en.wikipedia.org/wiki/Magic_square

Submission:

When complete, submit:

• A copy of the **source file** via the class web page by class time. *Assignments received after the start time of class will not be accepted.*

Example Output:

The following is the example output for the first data set:

```
MIPS Assignment #3
Program to check a Magic Square.
Possible Magic Square #1
        7
               6
   9 5 1
4 3 8
  Row #0 Sum: 15
   Row #1 Sum: 15
   Row #2 Sum: 15
  Col #0 Sum: 15
Col #1 Sum: 15
Col #2 Sum: 15
   Diag #1 Sum: 15
   Diag #2 Sum: 15
IS a Magic Square.
   [ ... output truncated for space ... ]
Possible Magic Square #3
   5 10 11 8
9 5 7 12
4 15 14 1
   Row #0 Sum: 34
   Row #1 Sum: 34
   Row #2 Sum: 33
  Row #3 Sum: 34
Col #0 Sum: 34
   Col #1 Sum: 33
  Col #2 Sum: 34
   Col #3 Sum: 34
  Diag #1 Sum: 34
   Diag #2 Sum: 33
NOT a Magic Square.
   [ ... output truncated for space ... ]
```

Note, not all data sets not shown.