

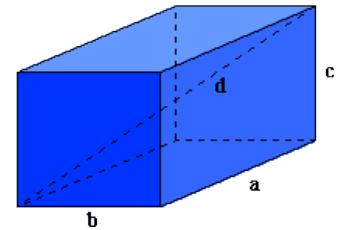
CS 218

Homework, MIPS Asst. #2

Purpose: Become familiar with the MIPS stack and standard calling conventions.
Due: Monday (7/03)
Points: 70

Assignment:

Use the provided MIPS assembly language main program and write the following functions:



- Write a MIPS assembly language function, **surfaceAreas()**, to calculate the surface areas for each of the rectangular parallelepipeds in a set of rectangular parallelepipeds. The formula for the surface of a rectangular parallelepiped is as follows:

$$\text{surfaceAreas}[n] = 2(\text{asides}[n] * \text{bsides}[n] + \text{asides}[n] * \text{csides}[n] + \text{bsides}[n] * \text{csides}[n])$$

- Write a MIPS assembly language function, **bubbleSort()**, to sort a list of surface areas into ascending order (small to large). To sort the numbers, use the following bubble sort¹ algorithm:

```
for ( i = (len-1) to 0 ) {  
    swapped = false  
    for ( j = 0 to i-1 )  
        if ( lst(j) > lst(j+1) ) {  
            tmp = lst(j)  
            lst(j) = lst(j+1)  
            lst(j+1) = tmp  
            swapped = true  
        }  
    if ( swapped = false ) exit  
}
```

You **must** use the above Bubble Sort algorithm (i.e., do **not** use a different sort). *Note*, the algorithm assumes array index's start at 0. As necessary, you can define additional variables. **Submissions not based on this algorithm will not be scored.**

- Write a MIPS assembly language function, **printAreas()**, to display the array of surface areas. The numbers should be printed five (5) per line, left justified (see example output).
- Write a MIPS assembly language function, **surfaceAreasStats()**, that will find the minimum, median, maximum, sum, and floating point average. You should find the minimum, median, and maximum after the list is sorted. The average should be calculated as a floating point value.
- Write a MIPS assembly language function, **printStats()**, to print the surface areas statistical information (minimum, maximum, median, sum, average) in the format shown in the example.

¹ For more information, refer to: http://en.wikipedia.org/wiki/Bubble_sort

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.
- ***Submissions not based on the full/complete cocktail sort algorithm will not be scored.***

Example Output:

The program must display the results to the console window. The output should look something like the following (with all of the correct answers displayed for all data sets):

```
Assignment #2
Surface Areas Program

-----
Data Set #1
Length: 20

Unsorted Surface Areas:

        6698        6184        5622        6190        5608
        6766        6184        7038        6904        6758
        5008        174        18480       5240        6976
        7864        4760        6118         88       183800

Sorted Surface Areas:

        88         174        4760        5008        5240
        5608        5622        6118        6184        6184
        6190        6698        6758        6766        6904
        6976        7038        7864       18480       183800

Surface Areas Min = 88
Surface Areas Med = 6187
Surface Areas Max = 183800
Surface Areas Sum = 302460
Surface Areas Ave = 15123.00000000

-----
Data Set #2
Length: 77

Unsorted Surface Areas:

        304188       345742       380984       344290       336520
        339660       318010       343150       322120       311830

[...truncated for space...]
```

Note, the example output above may appear slightly different than the console output on the screen.