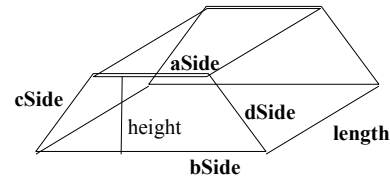


## CS 218 – MIPS Assignment #2

Purpose: Become familiar with RISC Architecture concepts, the MIPS Architecture, and SPIM (the MIPS simulator).  
Points: 50

### Assignment:

Write a MIPS assembly language program to calculate the total surface area of each three dimensional trapezoid in a series of trapezoids.



The total surface area of a three dimensional trapezoid is computed as follows:

$$\begin{aligned} \text{surfaceAreas}[n] = & \text{aSides}[n] \times (\text{lengths}[n] \times \text{heights}[n]) + \\ & \text{bSides}[n] \times (\text{lengths}[n] \times \text{heights}[n]) + \\ & \text{lengths}[n] \times \text{cSides}[n] + \text{lengths}[n] \times \text{dSides}[n] \end{aligned}$$

Once the values are computed, the program should find the minimum, maximum, middle value, and average for the computed total surface areas.

The program should display the results to the console window. The output should look like the following ,with the correct answers displayed. The numbers should be displayed with two (2) spaces before each number, and 5 numbers displayed per line. There should be one (1) blank line before the numbers and one (1) after the numbers. The instructions to display the headers and answers are included in the template.



Of course, you will need to calculate the correct answers first.

```
MIPS Assignment #2
3D Trapezoid Total Surface Areas Program:
Also finds minimum, middle value, maximum,
sum, and average for the surface areas.

3876255  5944478  5378724  6346388  4267454
4715891  5316165  8480070  6917925  8121600
[ ... truncated for space ... ]

Surface Areas Minimum = ?
Surface Areas Middle  = ?
Surface Areas Maximum = ?
Surface Areas Sum     = ?
Surface Areas Average = ?
```

### **Submission:**

- All source files must assemble and execute with QtSpim/SPIM MIPS simulator.
- Submit source file
  - Submit a copy of the program source file via the on-line submission
- Once you submit, the system will score the project and provide feedback.
  - If you do not get full score, you can (and should) correct and resubmit.
  - You can re-submit an unlimited number of times before the due date/time.
- Late submissions will be accepted for a period of 24 hours after the due date/time for any given lab. Late submissions will be subject to a ~2% reduction in points per an hour late. If you submit 1 minute - 1 hour late -2%, 1-2 hours late -4%, ... , 23-24 hours late -50%. This means after 24 hours late submissions will receive an automatic 0.

### **Program Header Block**

All source files must include your name, section number, assignment, NSHE number, and program description. The required format is as follows:

```
# Name: <your name>
# NSHE ID: <your id>
# Section: <section>
# Assignment: <assignment number>
# Description: <short description of program goes here>
```

Failure to include your name in this format will result in a reduction of points.

### **Scoring Rubric**

Scoring will include functionality, code quality, and documentation. Below is a summary of the scoring rubric for this assignment.

Criteria	Weight	Summary
Assemble	-	Failure to assemble will result in a score of 0.
Program Header	3%	Must include header block in the required format (see above).
General Comments	7%	Must include an appropriate level of program documentation.
Program Functionality (and on-time)	90%	Program must meet the functional requirements as outlined in the assignment. Must be submitted on time for full score.

## MIPS Assignment #2 – Data Declarations

Use the following data declarations:

```
aSides:      .word    10,    14,    13,    37,    54
              .word    31,    13,    20,    61,    36
              .word    14,    53,    44,    19,    42
              .word    27,    41,    53,    62,    10
              .word    19,    28,    14,    10,    15
              .word    15,    11,    22,    33,    70
              .word    15,    23,    15,    63,    26
              .word    24,    33,    10,    61,    15
              .word    14,    34,    13,    71,    81
              .word    38,    73,    29,    17,    93
bSides:      .word    233,   214,   273,   231,   215
              .word    264,   273,   274,   223,   256
              .word    244,   252,   231,   242,   256
              .word    215,   224,   236,   275,   246
              .word    213,   223,   253,   267,   235
              .word    204,   229,   264,   267,   234
              .word    216,   213,   264,   253,   265
              .word    226,   212,   257,   267,   234
              .word    217,   214,   217,   225,   253
              .word    223,   273,   215,   206,   213
cSides:      .word    125,   124,   113,   117,   123
              .word    134,   134,   156,   164,   142
              .word    206,   212,   112,   131,   246
              .word    150,   154,   178,   188,   192
              .word    182,   195,   117,   112,   127
              .word    117,   167,   179,   188,   194
              .word    134,   152,   174,   186,   197
              .word    104,   116,   112,   136,   153
              .word    132,   151,   136,   187,   190
              .word    120,   111,   123,   132,   145
dSides:      .word    157,   187,   199,   111,   123
              .word    124,   125,   126,   175,   194
              .word    149,   126,   162,   131,   127
              .word    177,   199,   197,   175,   114
              .word    164,   141,   142,   173,   166
              .word    104,   146,   123,   156,   163
              .word    121,   118,   177,   143,   178
              .word    112,   111,   110,   135,   110
              .word    127,   144,   210,   172,   124
              .word    125,   116,   162,   128,   192
heights:     .word    117,   114,   115,   172,   124
              .word    125,   116,   162,   138,   192
              .word    111,   183,   133,   130,   127
              .word    111,   115,   158,   113,   115
              .word    117,   126,   116,   117,   227
              .word    177,   199,   177,   175,   114
              .word    194,   124,   112,   143,   176
              .word    134,   126,   132,   156,   163
              .word    124,   119,   122,   183,   110
              .word    191,   192,   129,   129,   122
lengths:     .word    135,   226,   162,   137,   127
              .word    127,   159,   177,   175,   144
              .word    179,   153,   136,   140,   235
              .word    112,   154,   128,   113,   132
              .word    161,   192,   151,   213,   126
              .word    169,   114,   122,   115,   131
              .word    194,   124,   114,   143,   176
              .word    134,   126,   122,   156,   163
              .word    149,   144,   114,   134,   167
              .word    143,   129,   161,   165,   136

surfaceAreas: .space    200

len:         .word    50

saMin:       .word    0
saMid:       .word    0
saMax:       .word    0
saSum:       .word    0
saAve:       .word    0
```

Note, the `.space 200` directive reserves 200 bytes which will be used to store 50 words.