**Functionality**

You are to implement a statistical package using MIPS and test it on SPIM simulator. The following is a list of functions that your package will include. All vectors (1-dimensional matrices) are in single-precision floating-point number format and have a size of n. The elements are indexed 0 to n-1.

**SUM**
Calculate the sum of elements of a vector.

\[ \text{SUM}(X) = \sum_{i=0}^{n-1} x_i \]

**MAX**
Return the maximum value of single-precision floating-point vector.

\[ \text{MAX}(X) = x_k | x_k \geq x_i, \forall x_i \in X \]

**MIN**
Return the minimum value of single-precision floating-point vector.

\[ \text{MIN}(X) = x_k | x_k \leq x_i, \forall x_i \in X \]

**SORT**
This procedure will sort elements of a vector in ascending or descending order. Use the recursive Merge sort algorithm.

\[ \text{SORT}(X, \text{Asc|Des}) = \text{Sorted } X \]

**DUP**
Create an identical copy of vector X.

\[ \text{DUP}(X) = X \]

**ITOF**
Convert a 32-bit integer in 2’s complement representation into a single-precision floating-point number. Do not use the conversion instructions provided by MIPS.

**AVG**
Calculate the average of elements in the vector.

\[ \text{AVG}(X) = \frac{1}{n} \sum_{i=0}^{n-1} x_i \]

**COV**
Calculate the covariance of two vectors.

\[ \text{COV}(X, Y) = \frac{1}{n} \sum_{i=0}^{n-1} (x_i - x)(y_i - y) \]

where x is the average of X for this purpose.
**CORR**
Calculate the correlation of two vectors.
\[
CORR(X, Y) = \frac{COV(X, Y)}{\sqrt{VAR(X)\cdot VAR(Y)}} \quad \text{where} \quad VAR(X) = COV(X, X).
\]

**MSE**
Calculate the Mean Square Error between two vectors.
\[
MSE(X, Y) = \frac{1}{n} \sum_{i=0}^{n-1} (x_i - y_i)^2
\]

Implement the above function according to MIPS conventions register preservation. In addition, design and implement a main procedure to act as an interface to the library and data. The design of such interface is left to you, but a suggestion would be to create a table of procedure addresses of the above procedures and have a user select a procedure using the index of the procedure in the table. You can provide the user with another table of input vectors and output data location addresses.

In order to allow a sequence of these functions to be implemented, you are required to design and implement a simple scripting language to be used by users to run a sequence of functions on different data. Allow one word (32 bits) per script line to encode the function, operands, and results. Provide a full documentation for your design.

**Notes**
- Two teammates maximum per project. Please email me the members of your selected group by Monday 25\textsuperscript{th} of October.
- After the submission, a demonstration period will be assigned per group to run and test their program.
- You are required to submit a well-commented assembly code, and fully-document your design and implementation in a project report.