```
            ResultXY resultXY = new ResultXY();
            resultXY.setKey(Combination.combinations[i]);
            resultXY.setSumOfCombinationsValues(sumOfCombinationsValuesSquare);
            resultXY.setSumOfCombinationsValuesSquare(sumOfCombinationsValuesSquare);
            resultXY.setSumOfGPAs(sumOfGPASquares);
            resultXY.setSumOfGPASquares(sumOfGPASquares);
            resultXY.setSumOfMultiplyOfCombinationsValuesAndGPA(sumOfMultiplyOfCombinationsValuesAndGPA);

            double resultForRxy= ((sumOfMultiplyOfCombinationsValuesAndGPA)-((sumofGPAs *
                      sumOfCombinationsValues)/(studentList.size())))
                      / Math.sqrt( ((sumOfCombinationsValuesSquare ) – ( Math.pow(sumOfCombinationsValues,2) / (studentList.size()) ))
                      * ((sumOfGPASquares) - ( Math.pow(sumOfGPAs,2) / (studentList.size()) ))    );

            resultsForCombinations.put(stringValOf(Combination.combinations[i]), resultForRxy);
            resultXY.setResult(resultForRxy);
            results.add(resultXY);
```

Frame 1

The program was written with Java programming language to find the set of optimal coefficients for the larger data. This program has the ability to connect data directly with a .csv file (comma separated values). We were thus able to calculate the optimum coefficients for the other faculties too.

Notations and Definitions

In this section necessary notations and definitions were given. To find correlation between the weighted four input variables of the NUEE in 2007-2008 academic years and GPA of the final students of the two faculties of IBSU in 2010-2011 academic years, first mathematical illustration was done.

Correlation Analysis is to measure the strength or degree of linear association between two variables. You cannot say that one of them "causes" the other. Correlation tells you that as one variable changes, the other seems to change in a predictable way. A single summary number that gives you a good idea about how closely one variable is related to another variable (Higgins J., 2005).

This number is important to explain the situation between the GPA and the column vector of the weighted averages which are suggested below. In our sample to find the optimum distribution of the coefficients, the following matrices were used.

$$A = [a_{ik}] \ (1 \le i \le 69 \ and \ 1 \le k \le 4) ,$$

$$B = [b_{kj}], (1 \le k \le 4 \ and \ 1 \le j \le 24)$$

Matrix A defined by the scalars a_{ij} is called matrix representation of entry scores of our sample. In the matrix $A=[a_{ij}]$ the first column a_{i1} shows grades of Georgian Language, second column a_{i2} represents Logic grades, a_{i3} shows English Language marks and the last column a_{i4} indicates grades of Mathematics of the students after the NUEE in Georgia (2007).

Matrix $B=[b_{kj}]$ is called matrix of coefficients which is denoted as permutations of the set {1,2,3,4}. $P(4,4)=4!/(4-4)!=24)$ is the number of the column of matrix B and we use 24 different permutations of set {1,2,3,4} as elements of matrix B.

The product of A and B, denoted AB is the 69 × 24 matrix such that

$$X = [x_{ij}] = (AB)_{ij} = \sum_{k=1}^{4} A_{ik} B_{kj} \ for \ 1 \le i \le 69 , 1 \le j \le 24$$

The values of GPA is represented as column vector

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_i \end{bmatrix} \ 1 \le i \le 69 \ \text{and new product matrix } X=[x_{ij}]$$

is represented as :

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1j} \\ x_{21} & \cdots & x_{2j} \\ \cdot & \cdots & \cdot \\ \cdot & \cdots & \cdot \\ x_{i1} & \vdots & x_{ij} \end{bmatrix} \ 1 \le i \le 69, 1 \le j \le 24$$

To indicate linear dependence between each column of $X=(AB)_{ij}$ matrix and vector Y , first each column of matrix X is rearranged with the following way:
$X=[X_1 \ X_2 ......X_{24}]$
The first column is rewritten as below:

$$X_1 = \begin{bmatrix} x_{11} \\ x_{21} \\ \vdots \\ x_{i1} \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_i \end{bmatrix}, \ i = 69$$

We used the same way respectively for the $X_2, X_3, ..., X_{24}$ to assign x_{ij} values to xi . In the last step we obtain the last column vector

$$X_{24} = \begin{bmatrix} x_{1j} \\ x_{2j} \\ \vdots \\ x_{ij} \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_i \end{bmatrix} i = 69, j = 24$$

Using vector X_1 the first correlation coefficient is calculated by the general Pearsons' correlation coefficient formula. For the Faculty of CT&E the formula is applied

```
public static void main(String[] args) {
        // TODO Auto-generated method stub
        //File inFile = new File("C:\\input.csv");
    try {
        // args[0] -> "E:\\Dev\\allWorkspaces\\GPACalculator\\data.csv"
        if (args.length<=0)
            throw new Exception();
        BufferedReader reader = new BufferedReader(new FileReader(args[0]));
        List<Student> studentList = new ArrayList<Student>();
```

Frame 2

in the following way:

$$r_k = \frac{\sum_{i=1}^{69} x_i y_i - \frac{\sum_{i=1}^{69} x_i \sum_{i=1}^{69} y_i}{n}}{\sqrt{\left(\sum_{i=1}^{69} x_i{}^2 - \frac{(\sum_{i=1}^{69} x_i)^2}{n_x}\right)\left(\sum_{i=1}^{69} y_i{}^2 - \frac{(\sum_{i=1}^{69} y_i)^2}{n_y}\right)}} \quad ; \quad 1 \le k \le 24$$

It is easy to use the same formula for the B&M Faculty too. We gave the mathematical view of our sample in the previous descriptions. Using the above formula we wrote Java code to calculate the correlation for the larger data. A part of that code which calculates the correlation coefficient is given in (frame1)

In the following frame 2 we connected data.csv files with Java code to insert input data. This application is fast enough to have the results and compare them for the other faculties too.

MATLAB calculations and the above Java code showed that the set of optimal weights is [4, 1, 3, 2] since r2=0.56 is the largest correlation between weighted input entry scores and output GPA for the Faculty of B&M. Also [1, 2, 4, 3] gives the best correlation r1=0.39 between weighted input entry scores and output GPA in Faculty of Engineering.r1=0.39 is the best choice between 24 correlation coefficients in engineering faculty. Unfortunately this result suggests that there is low correlation among weighted entry exam values and GPA scores of students of Engineering faculty. On the other hand r2= 0.56 is the largest correlation coefficient in Faculty of Business and Management. In two cases it is clear that there is positive correlation between input values and GPA.

Both input and output are not independent .Because If X and Y are statistically independent , the correlation coefficient between them is zero, but if r=0 , it does not mean that two variables are independent. In other words zero correlation does not necessarily imply independence [Gujarati D.N., 2005].

In our case study r1 is closer to zero than r2 but not zero. The closer a correlation coefficient is, the weaker the relationship is and the less you are able to tell exactly what happens to one variable based on knowledge of the other. Regression Analysis gives us detailed information for both faculties.

Results of regression analysis for the Faculty of Computer Technologies and Engineering are suggested in Table 1a, 1b and Table 2a, 2b.

Regression Analysis Results and Its Interpretation

The multiple regression method was used to extract ideal relation between the NUEE scores and final university GPA. In the regression analysis α level was chosen 0.05 and our model, as a whole, is a significant fit to the data since in both table1b and table 2b significance was lower than 0.05.

In table 1a, R square=0.15 which implies that only 15% of the GPA scores can be explained by variables of NUEE. From table 2a, R square=0.37 and it is clear that 37% of the GPA scores can be explained by the independent variables of NUEE.

In our multiple linear regression method, there are 4 Explanatory variables. These were Georgian Language (GL), Logic (L), English Language (EL) and Mathematics(M).

The theoretical model was given in equation1 (Orlow M.L.,1996):

$GPA = \beta_0 + GL*\beta_1 + L*\beta_2 + EL*\beta_3 + M*\beta_4$

(eq.1)

According to the matrix of entry marks $A = [a_{ik}] \ (1 \le i \le 69, 1 \le k \le 4)$ estimated equation for the CT&E Faculty is given in equation2:

$\ddot{Y}_i = 31.1 + 0.009*a_{i1} + 0.15*a_{i2} + 0.22*a_{i3} + 0.15*a_{i4} \ ; (1 \le i \le 69)$

(eq.2)

For the B&M Faculty our estimated equation was given in equation3:

$\ddot{Y}_i = -45.15 + 1.15*a_{i1} - 0.32*a_{i2} + 0.23*a_{i3} + 0.43*a_{i4} \ ; (1 \le i \le 91)$

(eq.3)

Table 1A: Regression statistics results of CT&E Faculty

Regression Statistics-CT&E Faculty	
Multiple R	0.39
R Square	0.15
Adjusted R Square	0.10
Standard Error	11.80
Observations	69

Table 1B: ANOVA

Engineering	df	SS	MS	F	Significance F
Regression	4	1657.79	414.44	2.97	0.026
Residual	64	8916.66	139.322		
Total	68	10574.4			

Dependent variable: GPA

Independent variables (Predictors): Georgian Language, Logic, English Language, Mathematics

Table 2A: Regression statistics outputs for the B&M Faculty

Regression Statistics- B&M Faculty	
Multiple R	0.60
R Square	0.37
Adjusted R Square	0.34
Standard Error	14.78
Observations	92

Table 2B: ANOVA

Business	df	SS	MS	F	Significance F
Regression	4	10967.7	2741.926	12.54283	4.23E-08
Residual	87	19018.64	218.605		
Total	91	29986.34			

Dependent variable: GPA

Independent variables (Predictors): Georgian Language, Logic, English Language, Mathematics

It was found that in the table 1a $r3=0.39$ and in the table 2a $r4=0.60$. r3 and r4 shows the correlation coefficient between entry scores (not weighted) and graduated students university GPA.

Table 3: Descriptive Statistics of Data

The Faculty of Business and Management								
Categories of NUEE	Georgian Language	Logic	English	Math	Total	Dm.	Not finish.	IBSU GPA (2007-2011)
Mean	81	77.41	91.31	74.38	1752.14	9	7	75.01
The Faculty of Computer Technologies and Engineering								
Categories of National Entry Exam	Georgian Language	Logic	English	Math	Total	Dm.	Not finish.	IBSU GPA (2007-2011)
Mean	66.16	64.93	81.1	66.75	1660.7	30	13	70.01

Table 4: Correlation Analysis results for two faculties:

Correlation Analysis (NUEE) Scores	B&M F. IBSU GPA	CT&E F. IBSU GPA	for first 20 students	B&M F. IBSU GPA	CT&E F. IBSU GPA
TOTAL	0.40	0.39		0.45	0.60
ENGLISH L.	0.19	0.25		0.19	0.28
MATH	0.33	0.33		0.39	0.55
LOGIC	0.18	0.31		0.46	0.33
GEORGIAN L.	0.53	0.12		0.27	0.27

Conclusion

The correlation analysis result shows that when we compare weighted entry inputs with GPA $r1=0.39$ and $r2=0.56$ for the CT&E and B&M faculties respectively. This study suggested that there is positive low correlation between the NUEE scores and the university GPA of the faculty of CT&E. This relation increases for the B&M Faculty of the IBSU. There is 43.5% differences between $r1=0.39$ and $r2=0.56$. The total average of NUEE of B&M.F is 5.5% higher and average university GPA is 7% higher than CT&E faculty. The multiple regression analysis results implies that $r3=0.39$ and $r4=0.60$ for the CT&E and B&M faculties. We can say that higher entry results increases the success of the students. This situation shows the importance of the entrance behavior (scientific background). Entrance behavior is consisted of the abilities that a learner should have acquired before starting an educational level. What the learner has learned before which is considered as prerequisite for learning the new materials and also all of the positive and negative experiences resulted from previous taught which are effective in instructing new materials are called as entrance behavior. Though it may be assumed as an evident, the preparedness of the learner is very important. In many cases, the learner cannot behave in the way that the teacher expects. It should be recalled that if the learner is not prepared for learning the materials, the instructor will not succeed in teaching them. (Farahani A., 2001).

As we explained there is not high positive correlation between university entrance scores and GPA. The correlation between weighted entry averages and GPA is also low. Selecting students with the help of coefficients does not affect significantly on GPA scores. But to choose best group of students set of optimal coefficients should be considered with other factors too. The relationship/interactions between the factors cannot be ignored.

This study indicates that, in the engineering faculty 30% of 100 students dropped out of university. A bulk of literature on the prediction of academic success and retention among first year university students showed that most students, despite the academic, social, emotional and other challenges, successfully complete the transition period and achieve academic success (e.g. DeBerad, Julka & Spielmans, 2004). Others do not manage these challenges and are forced to leave their study at its early stage. According to Tinto (1993), the majority of students (75%) leave college during the first years (57%) of them do so without graduation. And first year first semester GPA is one of the major responsible factors for early drop-out from college (McGrath & Braunstein, 2007). In our sample, the university entrance scores of these kind of students indeed are not low. But first year university GPA is very low. The difficulties of the lectures in the engineering faculty show the

need for prior academic preparedness. The reasons for the dropouts should be searched in another study. On the other hand the problem is less in the B&M Faculty. We can say that at the beginning of the university education the level of B&M students are 5.5% better than the CT&E students. The quantitative thinking is the most significant predictor for the CT&E. This important point should be considered mainly when we choose students of CT&E Faculty.

Eventually the results of the first twenty students indicate that the students are able to have higher GPA when they start with high entrance scores. The correlation between these students' entrance scores and GPA is higher than other students (see table 4).

Finally according to Olani A. (2009) for the higher academic success in institutions, prior academic achievement measures (preparatory school grade average point(GPA), aptitude test scores, university entrance scores) and psychological variables (achievement motivation and academic self-efficacy) should be examine together. The NUEE scores only, are not enough to explain background education deposit and to show real picture. This study should be developed to have better education success.

References

Damodar N. Gujarati, (2004) , Basic Econometrics, [Electronic version] . Published by McGraw-HiII/lrwin, New York , Retrieved from http://www.miroslav-verbic.si/uploads/gujarati.pdf

Farahani , A. (2001), A Comparison Between Educational Self-concept and Entrance Behavior of Humanities Students in Distance and Conventional Education Systems of Iran, [Electronic version]. Payame Noor University Tehran, I.R. Iran, Retrieved from asiapacific-odl.oum.edu.my/C25/F530.doc

Higgins, J.(2005), The Radical Statistician, Correlation Coefficient, (chapter 2) [Electronic version]. Biddle Consulting Group, Retrieved from http://www.biddle.com/documents/bcg_comp_chapter2.pdf

Olani Aboma, Predicting First Year Student Academic Success, Electronic Journal of Research in Educational Psychology, University of Groningen, Netherlands, 7(3),1053-1072.2009(no 19).ISSN:1696-2095 , retrieved from http://www.investigacion-psicopedagogica.org/revista/articulos/19/english/Art_19_376.pdfOrlov M.L.(1996), Multiple Linear Regression Analysis Using Microsoft Excel, Oregon State University, retrieved from http://www.chem.orst.edu/courses/ch361-464/ch464/RegrssnFnl.pdf

Tranmer, M. & Elliot, M. (2007), Multilevel Modelling Course Book CCSR Teaching Paper 2007-03 , The University of Manchester, retrieved from http://www.ccsr.ac.uk/publications/teaching/mlr.pdf