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Application of $\bar{X}$ and S Control Charts to Investigate Students' Performance

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Abstract

This paper is coined to investigate the performance of students based on two semesters' examination scores. The objective of this discussion is to determine whether the performance of students is based on each examination taken or performance is based on each semester. Being a variable data, we applied the $\bar{X}$ and S control charts to determine the performance of each student. The $\bar{X}$ and S control charts are practicable to determine students' performance. The analysis revealed that an observation exceeding the upper control limit indicates that the student is an exceptional student in terms of the average. The contrary is also true for a student with an average below the lower control limit. In this case, a student whose average is below the lower control limit should be invited by the level adviser or the institutions counseling unit for counseling and possibly inquiry on his/her predicament, this will enable the analyst to proffer advise that will assist the student to overcome his/her academic challenges and possibly improve. In general, the analysis based on the control charts revealed that students' performance fluctuates from semester to semester.

Keywords: Control charts; mean; standard deviation; test score; performance.

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1 Introduction

In conventional time, quality of product is every organization's pride. However, the converse is not true. Every organization is keen on quality inputs to obtain quality output, hence the goal of the management team of any organization is to produce quality products [1,2]. Actually, quality can be viewed in two aspects, quality of design and quality of conformance. Based on the above, the control charts was introduced to monitor the quality of materials or products being produce. Walter Shewhart in the 1920's introduced this concept. Though, Shewhart was a statistician at the AT&T Bell laboratories who coined the control chart and designed the rules of interpretation [3,4]. This technique has gained universal acceptance due to its pictorial representation of the data set based on the centerline, upper and lower control limits. The data set reveals the behavior with respect to information on variability, stability and consistency of the products or materials produced by the system. Control charts are applied to identify and distinguish process variations. Although, variations maybe due to common or special causes.

It presents a pictorial presentation to reveal when the process is stable or otherwise. Basically, the objective of control chart is to assist to obtain process stability. Process stability implies a state in which the system has revealed certain characteristics of consistency in the past and process stability is expected to extend to the future. Thus, the consistency depends on the data set or the mean value lying below or above the centerline. The data set are typically obtained from the production industry or service firms, see [5].

In order to evaluate the performance of a system, data set are collected to evaluate the stability and capabilities of the system. On this note, we are interested to investigate if the system is performing at a maximum or minimum capacity. If the contrary is the case, based on the information inferred from the data set, the analyst provides professional advice on the possibility of stabilizing or improving the system. In most service providing firms, data set is often collected to evaluate the performance of their products or services rendered. Suppose, for the private sector, customer service is responsible to entertain/monitor the performance of customers' satisfaction or equipment performance. Often, as the case maybe for the telecommunication firms in Nigeria, dedicate numbers are often used by the customer service unit to monitor the quality of service rendered to their subscribers. For instance, the Nigeria government established at all level of government the SERVICOM unit to monitor clients' satisfaction, entertain complain and otherwise based on services rendered by staffs. This process can be termed quality assessment of services rendered.

The control chart technique has been applied to investigate soil quality and land evaluation by [6]. Moameni and Zinck applied the control chart to investigate variability in soil properties. Larson and Pierce revealed that control chart is a vital statistical tool to investigate variability [7,4]. Nelson et al. applied the control chart to investigate blood pressure measurement variability in the primary care setting [8]. The control chart was applied to monitor the product of swat pharmaceutical company [4]. It was also applied to health care and public health surveillance [3,9,10]. De Vries and Reneau applied the control chart to monitor the changes in animal production. This procedure has been applied to animal production system, say: poultry, swine, dairy, feeding practice, water intake, milk production, growth monitoring, disease incidence and beef production system [11]. It has also been applied to evaluate students' teaching procedure [12,13,14,15] and grading evaluation procedure [12,16,17]. The control chart was also applied to identify students that used performance enhancing drugs during major baseball league [18]. The control chart has been applied to mining to analyze Al_2o_3% and Sio_2% [2]. The control chart was also applied to food tasting or organoleptic food testing [19]. It is used as a measure to access food quality based on well established standard using well trained food tasters and experience judges. Bakir and McNeal applied the control chart to monitor students' cumulative grade point average (GPA) [20]. Milton et al. observed that students' cumulative GPA have been applied to evaluate the students' performance overtime [21]. Other techniques that has been applied to investigate students' GPA and graduation time and prediction of academic success were discussed by [22,23].

However, deferment of admission is considered as a special cause of variation which may not allow a student to graduate at the specific session. We also categorized extension as a common cause which can also affect the student's graduation; this is true because failing causes repeatedly is at the instance of the student's will of performance. The former is distinguished from this because the student may not have attempted the subject at the instant of enrolment. This discussion focuses on the performance of students' with respect to examinations taken for one academic year.

The rest of this paper is organized as follows. Section 2 contains students' performance using control chart analysis. The $\overline{X}$ and S control charts are described in Section 3, while data collection is contained in Section 4. Section 5 contains results and discussions. Finally, Section 6 concludes.

2 Students' Performance Using Control Charts Analysis

Generally, the application and analysis of control charts with respect to industry/manufacturing sectors, telecom sectors, agricultural sectors, transport sectors and health care sectors differ significantly compared to the analysis and interpretation gained when applied to educational sector to determine students' performance. On the upside, the form is based on either out of control due to common causes or special cause variations. The later interprets the out of control concept (above upper control limit) in industrial as not acceptable limit but out of control in this concept implies exceptional performance by the students'. On the downside, the out of control (below lower control limit) of the student signifies poor performance or on the negative direction. Loosely speaking, process instability can easily be remedied in the above sectors mentioned except in the medical sector because a patient recovering depends on the body system and hence improvements maybe slow. If such remedy based on the problem is adopted and is discovered to improve the performance of the system, such causes of variation can either be attributed to common or special causes. Applying control charts to investigate the performance of students' can be tasking because the common or assignable causes are hiding, hence the services of specialist students cancelling is required, this is only possible if the student test scores are obtained and questioned based on time spent on his/her academic work, class understanding and the relationship with the teacher, etc.

This discussion is centered on student's performance using the $\overline{x}$ and s control charts. Though, the conventional quality control procedure is frequently attributed to investigate the quality of products. This technique is specifically attributed to investigate if the product is in control or out of control. If the process is in control or out of control the common or special cause variation is considered as the major causes of variations. In this study, the common or special cause variation with respect to student's performance may be attributed to lag attitude towards academic work, not attending classes and or financial, psychological, health problem, emotional or enrolling some courses without interest or improper guidiance. In general, the objective of using the control chart is to investigate the behavior of the system and to ascertain the characteristics that are keeping the process in positive or negative directions. Suppose that the students' performance is very poor on the respective courses for the examination taken, the repair procedure is for the staff adviser to invite the student for interaction and possibly identify the causes of his or her poor performance, the contrary is true. In this case, the invitation of the student by the staff adviser is based on the mean value below the lower control limit. If the performance of the student is below the lower control limit consistently, such a student may be required to withdraw from the course of study.

3 Methods

The concept of $\overline{x}$ and s control charts based on statistical quality control is considered. The $\overline{x}$ control chart is often applied to continuously monitor the process based on data set collected in order to determine variation or causes of variation [24,25,26]. The control charts help to identify the primary source of quality variation, this will avail the practitioner the opportunity to effect corrections. Control charts are categorized as variable and attribute [12,27]. The $\overline{x}$ and the s control charts are variable control charts [12,28,29]. Control chart specifically consists of data set plotted in time order and horizontal lines called control limits [30]. The $\overline{x}$ chart is categorized as a vital control chart. The $\overline{x}$ chart consists of the upper and lower control limits. These limits described the extent of performance in either positive or negative directions. The control limits of plus or minus three standard deviations are specially crafted to evaluate the performance of the observations from the overall mean. The upper control limit (UCL) and lower control limit (LCL) can be computed as follows:, that is $\bar{\bar{x}} \pm 3s,$

$$\bar{\bar{x}} + 3s, \tag{3.1}$$

$$\bar{\bar{x}} - 3s, \tag{3.2}$$

This computation may look like that of the C chart but actually it differs because we applied a pooled version of the variance and then compute the standard deviation. The data set used to compute the above limits is assumed to be normally distributed and statistically independent. The three standard deviations in both Equation (3.1) and Equation (3.2) are suitable for the upper and lower control limits; this is so because the probabilities are not known. The following variables are well defined for easy understanding;

$$\bar{\bar{x}} = \frac{\sum_{i=i}^{n} \bar{x}_i}{n}, \tag{3.3}$$

$$\bar{x} = \frac{\sum_{j=i}^{m} x_j}{m}, \qquad s_i^2 = \frac{\sum_{i=1}^{m} (x_i - \bar{x})(x_i - \bar{x})}{m-1}, \tag{3.4}$$

$$s_{pooled=} \sum_{i=1}^{mk} (m_i - 1) s_i^2 \,/ \sum_{i=1}^{mk} (m_i - 1),$$
$$S = \sqrt{s_{pooled}}.$$

The above equations are simply the estimates of the mean and standard deviation, respectively. However, the design of the control chart is based on the data set which is assumed to be normally distributed. Relying on the construction of the control chart, it is assumed that the probability of out of control data is assumed small [6].

The $\bar{X}$ control chart for variable data can be computed as follows:

$$UCL = \bar{S} + 3(\bar{S}/c_4)\sqrt{n},$$
$$LCL = \bar{S} - 3(\bar{S}/c_4)\sqrt{n},$$
$$A_3 = (3/c_4)\sqrt{n},$$

Based on the above computation, the upper control limit is:

$$UCL = \bar{\bar{x}} + A_3 \bar{S}, \tag{3.5}$$

while the lower control limit and the centerline is given as follows:

$$LCL = \bar{\bar{x}} - A_3 \bar{S}, \tag{3.6}$$

$$CL = \bar{\bar{x}}. \tag{3.7}$$

The S control chart for variable data is derived as follows;

$$UCL = \bar{S}\left[(1 + (3/c_4)\sqrt{1 - c_4^2})\right],$$

$$LCL = \bar{S}\left[(1 - (3/c_4)\sqrt{1 - c_4^2})\right],$$

$$UCL = \bar{S} + 3(\bar{S}/c_4)\sqrt{1 - c_4^2},$$

$$LCL = \bar{S} - 3(\bar{S}/c_4)\sqrt{1 - c_4^2},$$

$$B_4 = 1 + (3/c_4)\sqrt{1 - c_4^2},$$

$$B_3 = 1 - (3/c_4)\sqrt{1 - c_4^2}.$$

From the above derivations, the upper control limit, lower control limit and the centerline are given as follows:

$$UCL = B_4\bar{S}, \tag{3.8}$$

$$LCL = B_3\bar{S}, \tag{3.9}$$

$$CL = \bar{S}. \tag{3.10}$$

Practically, this procedure is well established. In this respect, the probability of observing out of control observation when the system is stable and consistent is 1 in 369 [31].

4 Data Collection

The data set collected is based on careful observations of students' test scores on different subjects. The data set consists of seven test scores (i.e 100 batches of seven observations) from different subjects for two semesters. The purpose of this investigation is to apply the control charts to study the pattern of test scores obtained by each student in different subjects and to use the mean score to determine the general performance of each student. In Tables 1 and 2, the mean, the range and the standard deviation of each student are reported, see Appendix.

5 Results and Discussion

Based on the data set reported in Tables 1 and 2, the data set revealed that students with small range performed better, that is, the student performance is stable and consistent. On the other hand, students with large range implies that such category of students performed poorly, that is, the students performance is unstable and inconsistent. The contrary is true if a student performed better in one subject and due to common cause or special causes the student to performed poor. Loosely speaking, low range may be attributed to uniform test scores, say high or low in uniform order. Based on Equations (3.1) and (3.2), the following observation is reported.

The analyses in Fig. 1 and Fig. 2 revealed that if a student's mean score is greater than the upper control limit it implies that the student's performance is exceptional. Also, if a student's mean score is approaching the upper control limit, such student is categorized to be a second class upper grade, whereas the student whose mean score value is equal to the overall mean score is categorized as a second class lower category. On the other hand, if a student's average score is little below the overall mean score such a student is categorized as a third class category. Finally, students whose mean scores are below the red lines in both Fig. 1 and Fig. 2 are categorized as students with pass or fail. Fig. 3 indicates that the mean score for each semester is fluctuating. In general, the analysis showed that the average mean scores for the students fluctuate in increasing or decreasing order per examination taken. Though, we are quick to conclude loosely, that this procedure should not be mistaken for the cumulative grade point system. This technique only indicates the student's performance and to predict the likelihood of each student's performance.

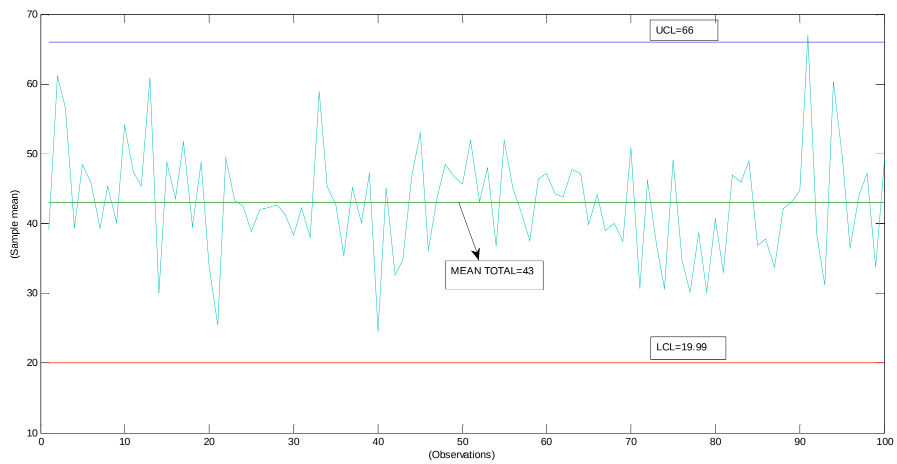

Fig. 1. The mean score for the first test scores

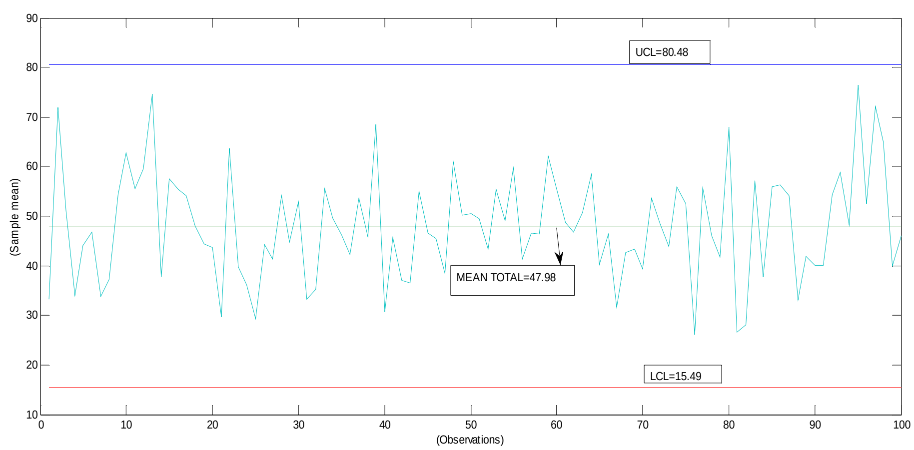

Fig. 2. The mean score for the second test scores

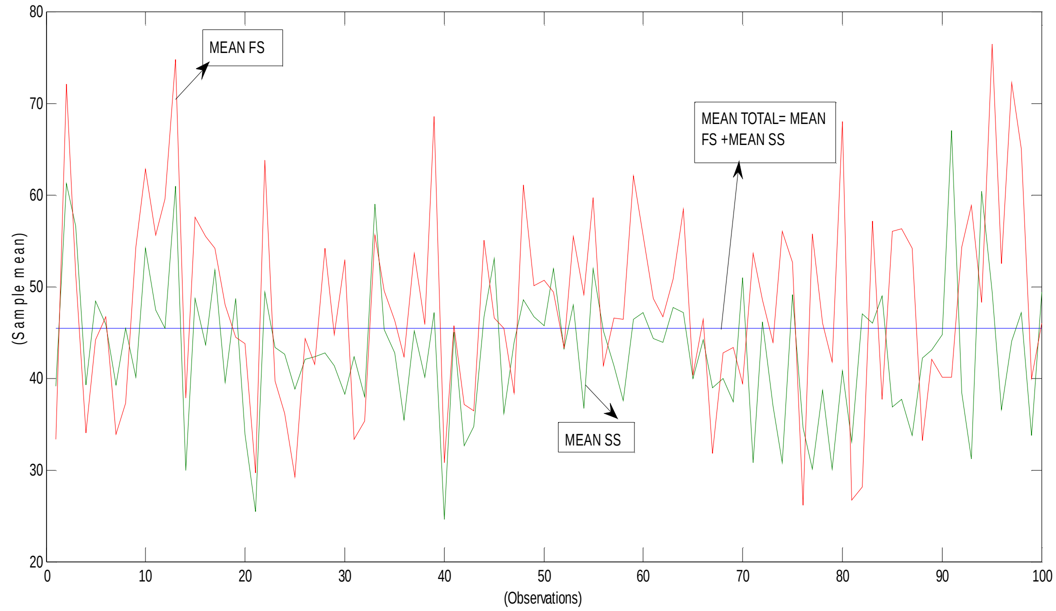

Fig. 3. Comparative mean scores

Using Equations (3.5) – (3.7) we observed that both procedures produced the same result. In both figures, we observed an exceptional performance (observation 90). However, observation 40 performance is below the minimum performance criteria, see Fig. 4.

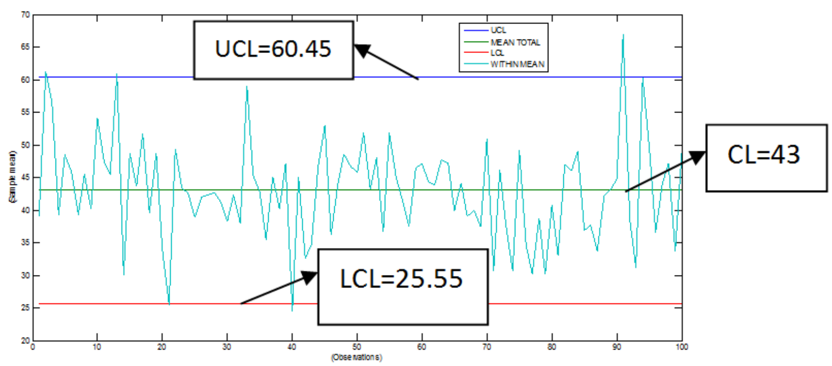

Fig. 4. The mean score for the first test scores

The performance analysis for the second test scores using Equation (3.5) – (3.7) revealed that the student's performance based on each examination taken. However, the control chart in Fig. 5 indicates some level of consistency and fluctuation. We have to deduce if this analysis is true. See Fig. 5.

Well, we termed a very poor performance, that is the mean below the lower control limit as extremely poor as shown in Fig. 5 for some student's, and this can be referred to as out of control. Similar analysis was given by [20]. In Fig. 6, the mean obtained for the first and second semester scores differs; this implies that student performance is semester based due to performance fluctuation in their mean scores.

The performance analysis based on the S control chart see Equation (3.8)-(3.10) is given below. See Fig. 7 and Fig. 8. The analysis based on the S control chart revealed that the performance of the students is moderate. Though, Fig. 7 also showed exceptional performance of students does exist but both charts indicate that no score is below the lower control limits. In general, exceptional performance does exist in the first test scores, but same is not true for the second test scores. Although, this may be due to different reasons or causes.

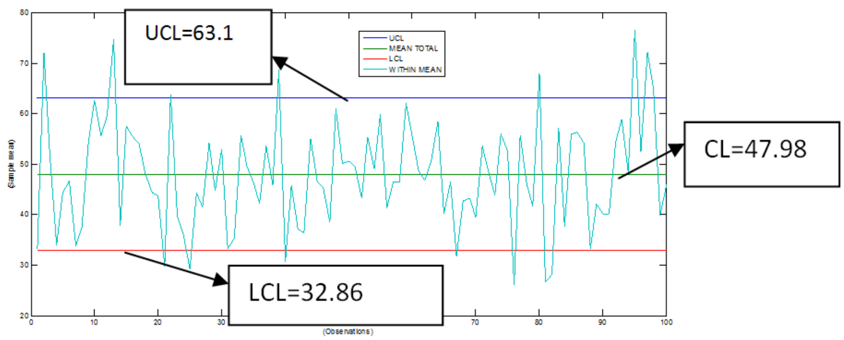

Fig. 5. The mean score for the second test scores

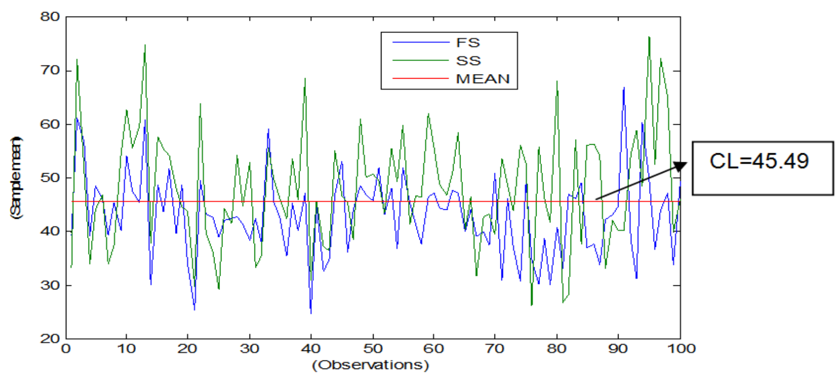

Fig. 6. Comparative mean performance

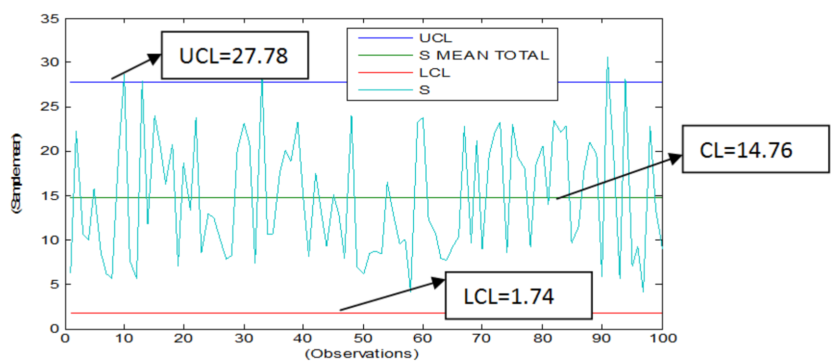

Fig. 7. The S control chart for the first test scores

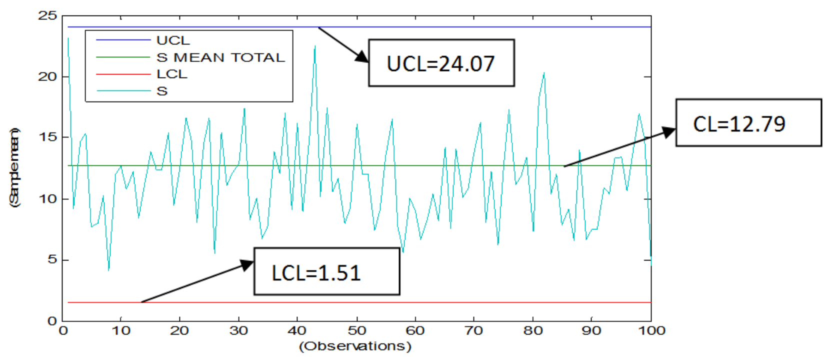

Fig. 8. The S control chart for the second test scores

6 Conclusions

This study revealed that the control charts can be applied to monitor students' academic performance. The different control charts employed showed the pictorial performance of students. We deduced from this study that students' performance depends on the examination taken and performance is semester dependent. Although, the comparative analysis showed that some students' academic performance is consistent and stable, but this is not always the case. The study allowed us to conclude that student's performance do fluctuates due to common or assignable causes. A positive variation improves the overall performance of the student while negative variation has negative effect on the overall performance. We are quick to state that unlike the industrial application with respect to out of control being a negative performance indicator, in this application, out of control implies exceptional academic performance. This study also reveals pictorially a non-graduating student or the class of graduation. We conclude that this technique can be applied in higher institution to assist in determining and monitoring students' academic performance. This will allow the course adviser(s) or the student support unit or counseling unit to render professional advice to encourage a student facing assignable cause such as emotional disorder, psychological and financial predicament. In general, this procedure will equally be of help to the student's support unit or counseling unit. The study showed that student with small range is stable and consistent (large scores or lower scores) while student with large range indicates that the student is unstable and inconsistent with academic performance. This implies that such student may score high in some causes and lower score in other cases.

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Competing Interests

Authors have declared that no competing interests exist.

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Appendix

Table 1. The first test scores

X1	X2	X3	X4	X5	X6	X7	Mean	Range
50	40	31	41	40	32	40	39.142857	19
87	60	50	82	61	68	20	61.142857	36
66	64	40	59	64	43	60	56.571429	24
50	41	22	40	30	46	46	39.285714	35
50	46	50	78	44	24	47	48.428571	36
57	40	34	55	40	50	45	45.857143	67
50	40	41	31	33	40	40	39.285714	28
40	46	53	40	45	41	53	45.428571	28
56	50	32	60	41	42	0	40.142857	31
82	60	52	87	55	43	0	54.142857	32
60	56	45	40	44	41	46	47.428571	26
50	41	40	47	55	40	45	45.428571	27
77	75	60	82	62	70	0	60.857143	31
41	26	24	40	45	17	17	30	22
47	51	50	76	67	50	0	48.714286	27
54	60	40	60	47	44	0	43.571429	28
73	60	40	54	45	25	65	51.714286	39
70	50	40	40	37	40	0	39.571429	20
60	45	54	52	42	40	48	48.714286	21
42	27	25	45	58	0	40	33.857143	22
46	21	18	36	34	13	10	25.428571	54
40	68	55	57	58	68	0	49.428571	33
40	55	46	49	28	45	40	43.285714	41
50	42	21	47	31	47	60	42.571429	28
50	29	34	46	50	17	46	38.857143	26
46	40	24	45	40	59	40	42	23
50	42	37	55	40	32	40	42.285714	35
55	43	30	51	40	40	40	42.714286	31
60	51	33	44	48	53	0	41.285714	34
56	45	33	46	48	40	0	38.285714	33
64	45	35	50	45	57	0	42.285714	19
40	40	25	41	48	32	40	38	23
77	46	70	84	63	73	0	59	24
54	40	29	62	40	46	46	45.285714	24
51	40	27	46	30	51	54	42.714286	51
51	42	25	43	47	40	0	35.428571	13
56	53	50	56	50	51	0	45.142857	25
60	45	42	45	49	40	0	40.142857	22
71	40	50	62	49	60	0	47.428571	30
40	21	13	25	40	33	0	24.571429	30
56	40	45	54	45	43	32	45	28
48	40	22	50	28	40	0	32.571429	27
45	50	19	40	29	20	40	34.714286	20
60	51	46	55	40	42	33	46.714286	45
64	43	65	66	49	25	59	53	16
50	51	24	42	40	20	26	36.142857	44
54	40	48	45	30	40	50	43.857143	23
72	55	56	61	50	46	0	48.571429	20
60	51	43	47	40	45	41	46.714286	23
54	43	34	48	48	45	48	45.714286	15
60	57	41	48	42	62	53	51.857143	20

X1	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**Mean**	**Range**
50	40	31	42	31	58	50	43.142857	29
45	40	40	54	42	53	62	48	21
44	40	40	50	42	41	0	36.714286	39
79	50	45	46	45	40	58	51.857143	17
62	45	32	40	43	52	42	45.142857	15
40	45	20	41	51	47	45	41.285714	23
42	40	40	40	31	37	33	37.571429	22
67	42	40	50	68	58	0	46.428571	38
76	65	45	48	46	50	0	47.142857	27
65	43	30	56	40	33	43	44.285714	23
53	34	31	40	45	42	62	43.857143	20
41	40	62	45	47	45	54	47.714286	28
50	50	42	62	45	41	40	47.142857	33
40	40	20	44	40	47	48	39.857143	22
46	40	24	58	45	48	48	44.142857	47
50	45	34	46	40	58	0	39	18
50	43	20	40	40	40	47	40	29
66	50	40	45	21	40	0	37.428571	27
63	43	50	56	40	44	60	50.857143	10
53	29	27	52	40	14	0	30.714286	20
60	62	40	50	63	48	0	46.142857	31
51	28	31	75	29	45	0	37	20
40	21	20	32	26	40	36	30.714286	26
70	56	60	60	54	44	0	49.142857	39
60	41	28	48	40	25	0	34.571429	16
47	31	24	53	20	40	0	30.714286	20
48	42	33	41	21	40	46	38.714286	48
40	40	20	26	40	45	0	30.142857	33
63	50	41	57	34	40	0	40.714286	6
46	22	18	31	20	54	40	33	30
60	45	56	76	44	48	0	47	35
60	42	51	69	46	54	0	46	21
60	51	52	72	58	50	0	49	20
40	40	27	32	41	25	53	36.857143	20
45	21	24	40	40	54	40	37.714286	31
50	21	25	40	27	62	11	33.714286	33
64	40	34	50	51	56	0	42.142857	13
61	46	50	52	47	45	0	43	33
50	40	42	40	40	46	55	44.714286	31
88	79	71	82	73	76	0	67	11
54	40	34	51	46	44	0	38.428571	27
33	29	22	34	28	32	40	31.142857	19
76	68	73	85	54	66	0	60.285714	19
60	40	50	46	48	45	57	49.428571	28
45	45	24	42	31	26	43	36.571429	25
45	45	35	45	48	45	45	44	36
64	55	50	70	50	41	0	47.142857	31
50	27	20	45	40	14	40	33.714286	29
51	41	40	58	40	60	56	49.428571	20
							43.00	27.38

Table 2. The second test scores

X1	X2	X3	X4	X5	X6	X7	Mean	Range
57	18	24	45	65	24	0	33.285714	47
80	76	65	63	61	74	85	72	40
56	45	30	36	58	68	66	51.285714	27
45	22	31	25	40	60	15	34	19
45	40	40	35	41	50	58	44.142857	40
55	40	40	41	53	40	58	46.714286	24
45	23	45	40	20	36	28	33.857143	43
40	40	40	29	36	40	36	37.285714	48
55	45	45	46	48	65	76	54.285714	22
75	51	63	45	58	66	81	62.714286	50
60	58	50	47	47	50	77	55.571429	38
60	52	62	50	58	50	85	59.571429	28
85	73	80	79	68	60	78	74.714286	45
45	25	32	36	45	55	27	37.857143	30
51	57	50	40	55	67	83	57.571429	30
45	40	64	57	46	61	75	55.428571	45
63	42	51	50	50	45	78	54.142857	42
64	42	53	20	41	52	64	48	27
53	27	40	44	45	46	56	44.428571	26
45	52	24	34	61	40	50	43.714286	35
12	22	20	40	14	48	52	29.714286	23
77	63	72	35	61	60	78	63.714286	41
40	25	40	40	40	40	53	39.714286	50
40	16	23	45	28	43	58	36.142857	34
45	16	16	54	40	21	13	29.285714	20
48	40	40	52	40	40	50	44.285714	18
40	40	54	40	50	10	56	41.428571	12
50	45	56	42	51	60	75	54.142857	28
46	25	40	50	40	47	65	44.714286	21
54	41	56	40	43	60	76	52.857143	30
32	32	40	12	13	42	62	33.285714	25
40	25	40	26	29	45	42	35.285714	46
60	45	45	45	65	64	65	55.571429	34
48	42	41	50	51	55	60	49.571429	35
48	51	41	36	40	58	50	46.285714	21
54	50	17	46	41	32	56	42.285714	11
54	50	61	34	51	51	74	53.571429	33
53	22	40	40	45	43	78	45.857143	22
78	62	60	57	68	78	77	68.571429	29
45	20	34	40	14	10	52	30.714286	40
45	40	40	36	46	63	50	45.714286	31
40	18	30	36	28	66	42	37.142857	40
40	56	15	31	60	53	0	36.428571	25
45	65	50	50	46	57	72	55	36
60	60	10	46	43	57	50	46.571429	21
56	40	30	40	40	58	54	45.428571	36
46	17	29	45	41	40	51	38.428571	30
76	55	60	67	54	60	55	61	48
58	41	46	40	47	54	65	50.142857	41
58	40	61	43	44	78	30	50.571429	24
58	40	54	40	42	41	71	49.428571	30
40	40	47	40	25	46	65	43.285714	50
53	51	65	50	56	47	66	55.428571	31
53	40	46	40	42	58	65	49.142857	37

X1	X2	X3	X4	X5	X6	X7	Mean	Range
72	67	64	41	51	47	76	59.714286	32
54	27	40	70	28	25	45	41.285714	35
50	40	40	40	45	50	61	46.571429	20
48	53	40	45	40	45	54	46.428571	40
64	45	60	57	61	76	71	62	25
60	40	50	56	53	67	63	55.571429	29
60	50	53	42	50	45	41	48.714286	25
46	41	40	40	44	54	62	46.714286	20
55	60	45	32	46	62	55	50.714286	19
72	58	46	55	54	64	60	58.428571	40
46	24	25	57	40	32	58	40.285714	37
50	40	41	45	48	40	61	46.428571	30
40	15	40	40	22	50	15	31.714286	19
45	22	40	41	50	50	51	42.714286	25
40	48	41	46	40	62	26	43.285714	18
46	25	40	36	28	66	35	39.428571	43
60	40	45	40	40	77	73	53.571429	43
50	51	45	36	43	61	54	48.571429	14
50	41	49	45	40	61	21	43.857143	35
60	52	46	52	58	60	64	56	35
52	40	45	56	40	60	75	52.571429	31
40	29	10	18	45	41	0	26.142857	35
71	52	47	47	47	54	72	55.714286	39
60	27	51	34	44	50	56	46	45
46	18	45	33	54	50	46	41.714286	35
74	73	74	56	67	60	72	68	32
45	19	31	28	12	52	0	26.714286	36
40	25	26	26	65	15	0	28.142857	40
63	64	54	41	47	60	71	57.142857	21
46	40	40	40	43	44	11	37.714286	25
54	56	56	47	47	65	67	56	51
60	50	56	42	58	56	72	56.285714	44
57	55	50	42	57	55	63	54.142857	56
46	12	21	31	40	52	30	33.142857	14
45	41	30	40	40	47	51	42	33
41	40	45	52	28	40	35	40.142857	46
41	40	45	52	28	40	35	40.142857	29
55	40	54	50	64	45	72	54.285714	21
68	60	56	53	48	50	77	58.857143	31
54	27	40	40	51	64	62	48.285714	36
93	76	78	84	82	50	72	76.428571	10
53	45	45	42	58	51	73	52.428571	37
88	59	81	74	48	75	80	72.142857	38
38	59	81	74	48	75	80	65	27
46	43	28	40	60	48	14	39.857143	18
50	40	41	48	43	50	50	46	26
							47.982857	31.99

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