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Reliability Measures of Academic Performance

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Abstract

One of the factors that determines the class of the degree that a student has after academic programme is the first year result. This is a general claim and was investigated in this study. Data used for the investigation were the results of graduating students in the Faculty of Science in University of Ilorin, Nigeria in 2012. The data were analysed with R GUI, although a program was written for the tau statistic since it is not available in it. The aim was to study the proportion of students that will graduate with the classification of degree they started with. The objectives are to predict future occurrences for students and study the trend of performance for students. Agreement index of tau statistic was used to determine agreement level of first year results with final year results. Department of Physics had the lowest agreement. Even at that, it was significantly high.

Keywords: R GUI; performance; tau statistic; agreement index; significant.

1.0 INTRODUCTION

The poor performance of graduates in Nigeria tertiary institutions has been a subject of speculation for stakeholders in the education sector every year, especially in view of the nation's goal to be one of the world's top 20 economies by 2020 (www.naij.com/649525-nigeria-now-world-s-22nd). Recent statistics released by examinations bodies showed that good performance is very rare while average performance is on the increase. This study examined the reliability between first year results and final year results (that is results at graduation). The first year performance represented the class of degree that the students who started from 100 level started with and students who started from 200 level, the final year result was the class of degree at graduation.Reliability tools were used to measure the degree of consistency between first year and final year so that we can know the reliability coefficient between them. Agreement is a special case of association and not the other way round, it reflects the extent to which observers classify a given subject identically into the same category, while measure of association reflect the strength of the predictable relationship between the ratings of the two observers or raters. In other to assess the psychometric integrity of different ratings, we

can compute interrater reliability or interrater agreement. Interrater reliability coefficient reveals the consistency of the pattern of responses or the rank ordering of responses between two or more raters, independently of the level of magnitude of those ratings. Jolayemi (1986,1990) proposed a statistic for agreement measures that uses the Chi – square distribution. The statistic was initiated from the background of the coefficient of determination R^2 which is an index for the explained variability of the regression model which was then extended to the square contingency table.

2.0 MATERIALS AND METHODS

The data were collected from the Faculty of Science, University of Ilorin, Ilorin, Nigeria for the year 2011/12 academic session. The spread sheet of each student was checked to know the category of class of degree they started with in 100 level for students who were admitted with University Matriculation Examination and 200 level for students who were admitted with direct entry. The appropriate class of degree for each student was recorded and was equally checked to know the class of degree that he or she later graduated with.

2.1 Strength and Limitations

This study was limited to first year results and final year results of graduating students in Faculty of Science, University of Ilorin, Ilorin, Nigeria for the year 2011/12 academic session.

2.2 Jolayemi TauStatistic (τ Statistic)

Jolayemi (1986, 1990) proposed a statistic for agreement measure, which uses the Chi - square distribution. The statistic was initiated from the background of R^2, the coefficient of determination, which is an index for the explained variability of regression model, which was then extended to the square contingency table. The author proposed a theorem which was also proved that consider a I x I (square) contingency table obtained by classifying the same N subjects into one of possible I outcomes by two raters. Then the Pearson Chi – square ($\boldsymbol{\chi}^2$) statistic for independence is at most (I — 1) N. He then proposed a statistic for the measure of agreement, denoted by $\boldsymbol{\tau} = \sqrt{\boldsymbol{\lambda}}$,—**1 < τ < 1**

where**λ** which is an R^2 type statistic (1986) is defined by

$$\boldsymbol{\lambda} = \frac{\chi^2}{\max(\chi^2)}$$

and max (χ^2) has been proved to be (I — 1)N , Jolayemi (1990); Adejumo et al. (2001) .

Thus $=\frac{\chi^2}{(I-1)N}$. The advantage of this statistic over kappa is that ($\boldsymbol{\lambda}=\tau^2$), one may make inference on τ also through **λ** which estimates the explained variability exhibited by the configuration of the table. The author also proposed some arbitrary division on the range of | τ | with the respective strength of agreement as Landis and Koch has also proposed for Cohen Kappa statistic.

2.3 Range of Tau Statistic with the Respective Strength of Agreement

| τ | statistic	Strength of agreement
0.00 — 0.20	Poor
0.21 — 0.40	slight
0.41 — 0.60	moderate
0.61 — 0.80	substantial
0.81 — 1.00	almost perfect

When τ< 0, the agreement is negative.

2.40 Data Analysis

The data were analysed with R GUI, although a program was written for the Jolayemi tau statistic since it is not available in it.

```
>science=matrix(c(6,5,0,0,0,6,122,67,0,0,0,87,309,61,2,0,6,127,175,48,0,0,0,74,65),nrow=5,byrow=T)
>dimnames(science)=list(firstyr=c("1st class","2nd class upper","2nd class lower","3rd
class","pass"),finalyr=c("1st class","2nd class upper","2nd class lower","3rd class","pass"))
>chisq.test(science)
```

Pearson's Chi-squared test
data: science
X-squared = 1185.054, df = 16, p-value < 2.2e-16
> x1science=ncol(science)-1
> x2science=sum(science)
>tauscience=sqrt(84.1843/(x1science*x2science))
>tauscience
[1] 0.1346966
>barplot(science,main ="Bar plot for Faculty of Science ",xlab="Classification of degree ",col=c("blue","yellow","grey80","green","red"),legend=rownames(science))
The process was repeated for each department.

2.50 Confidence Bound for the tau statistic for Faculty of Science

The 95% confidence is defined as

$$\tau \pm Z_{1-\alpha/2} se(\tau)$$

$$\tau \pm Z_{1-\alpha/2} \sqrt{\frac{\tau(1-\tau)}{n}}$$

$$0.1347 \pm 1.96 \sqrt{\frac{0.1347(1-0.1347)}{1160}}$$

0.1347±0.01965

(0.1151, 0.1544)

Interpretation: We were 95% confident that the reliability coefficient for the Faculty of Science lies between 11.51% and 15.44%.

3.0 SUMMARY OF RESULTS

Department	**Jolayemi tau statistic**	**Interpretation**
Chemistry	0.6816207	Substantial
Biochemistry	0.6541712	Substantial
Mathematics	0.6474594	Substantial
Statistics	0.6292878	Substantial
Geology and Mineral Science	0.5445267	Moderate
Zoology	0.4664010	Moderate
Plant Biology	0.4515494	Moderate
Microbiology	0.4416263	Moderate
Physics	0.1204167	Poor

The values of Jolayemi tau statistics were recorded in descending order.

For **Biochemistry**, about 65% of the variation was accounted for, the remaining 35% was due to the variance of the first year even when the final year was taken into account, about 65% of the students would end up with the class of degree they started with .For **Mathematics**, about 65% of the variation was accounted for ,the remaining 35% was due to the variance of the first year even when the final year was taken into account, about 65% of the students would

end up with the class of degree they started with .For **Statistics**, about 63% of the variation was accounted for ,the remaining 37% was due to the variance of the first year even when the final year was taken into account, about 63% of the students would end up with the class of degree they started with. For **Geology and Mineral Science**, about 54% of the variation was accounted for the remaining 46% was due to the variance of the first year even when the final year was taken into account, about 54% of the students would end up with the class of degree they started with. For **Zoology**, about 47% of the variation was accounted for, the remaining 53% was due to the variance of the first year even when the final year was taken into account, about 47% of the students would end up with the class of degree they started with.

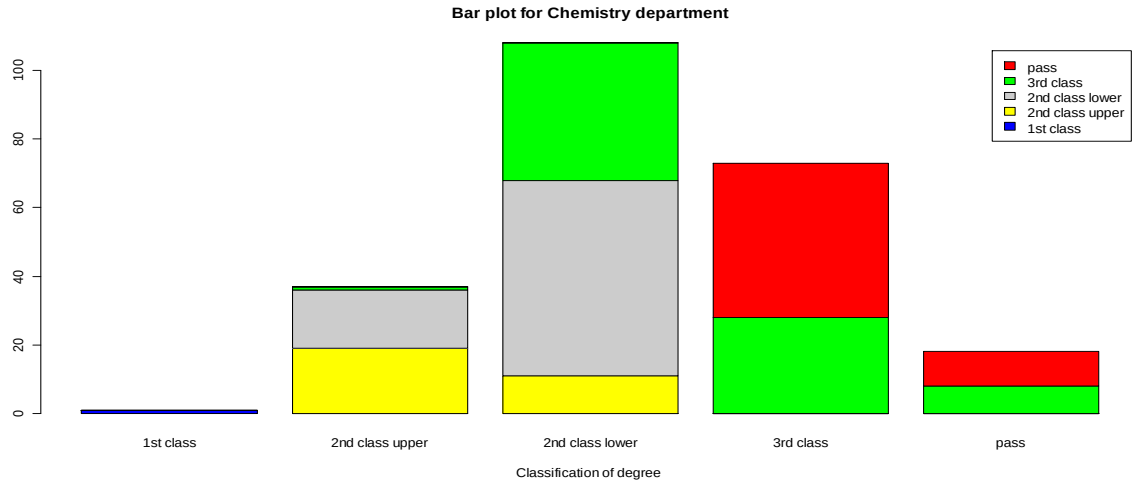

Figure 1: Bar Plot for Chemistry Department.



Figure 2: Bar Plot for Statistics Department.

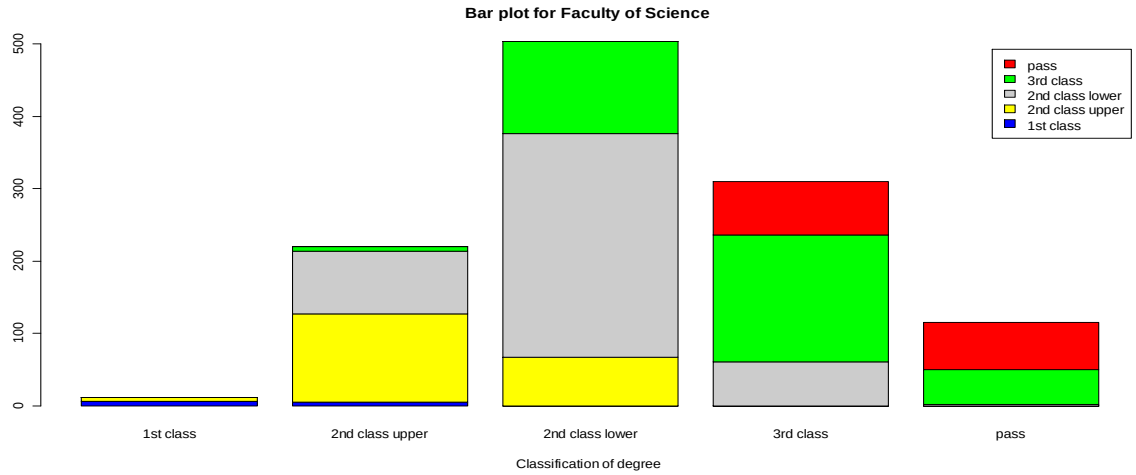

Figure 3: Bar Plot for the Faculty of Science.

4.0 CONCLUSION

The analysis showed that the relationship between first year and final year in the department of Chemistry, Biochemistry, Mathematics and Statistics were substantial. The department ofGeology and Mineral Science, Zoology, Plant Biology and Microbiology were moderate. Physics department was the only one that was poor. For**Chemistry**,about 68% of the variation was accounted for, the remaining 32% was due to the variance of first year even when the final year was taken into account, about 68% of the students would end up with the class of degree they started with. For **Plant Biology,** about 45% of the variation was accounted for, the remaining 55% was due to the variance of the first year even when the final year was taken into account, about 45% of the students would end up with the class of degree they started with.For **Microbiology**, about 44% of the variation was accounted for,the remaining 56% was due to the variance of the first year even when the final year was taken into account, about 44% of the students would end up with the class of degree they started with.For **Physics**, about 12% of the variation was being accounted for, the remaining 88% was due to the variance of the first year even when the final year was taken into account,that is about 12% of the students would end up with the class of degree they started with.For **Faculty of Science**, about 14% of the variation was accounted for,theremaining 86% was due to the variance of the first year even when the final year was taken into account, about 14% of the students would end up with the class of degree they started with. We were 95% confident that the reliability coefficient for the Faculty of Science lies between 11.51% and 15.44%.

5.0 RECOMMENDATIONS

i. Students should study very hard in their first year since it affected their final year result.
ii. Orientation of freshers should be done on time.
iii. Students should invest much of their time in reading than using it on social networks and watching of football.
iv. Students should cultivate the habit of reading in library and using of library books.
v. Students should use internet facilities to do research on their courses.

6.0 ACKNOWLEDGEMENTS

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