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IASSL NEWSLETTER

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"The best thing about being a statistician is that you get to play in everyone's backyard"

John Tukey

Featured Segments

SURVEY ESTIMATIONS USING ALTERNATIVE METHODS

"Variance estimation is an important component of complex survey data analysis. This article provides a good review of these and more..."

15TH CENSUS OF POPULATION AND HOUSING IN SRI LANKA WILL BE IN 2024

"Sri Lanka is the first to conduct a population census among SAARC countries. The first scientific census was conducted in March, 1871 by then the Register General's Office. "

ANNOUNCEMENTS

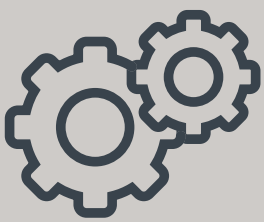
SUDOKU PUZZLE COMPETITION
UPCOMING EVENTS
UPCOMMING COURSES

WHY NOT SIMPLE RANDOM SAMPLING? (ONE-ACT-PLAY)

"Life is not simple and KISS principal does not work most of the time..."

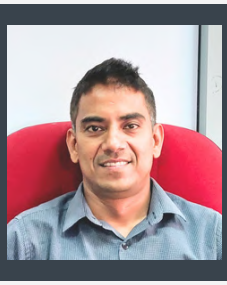
WAS UC, BERKELEY ACCUSED OF GENDER DISCRIMINATION IN THE 1970s?

"This story is used as the prime example by most universities around the globe when teaching an important statistical concept. It has been repurposed and reused for several years. In reality, the lawsuit never happened! "



NEWS IN BRIEF

From IASSL President's pen



It is with great pleasure that I present this message to current issue of IASSL newsletter as the 8th President of IASSL. I express my deepest gratitude to our outgoing President, Dr. Chitraka Wickramarachchi, for his exceptional leadership and invaluable contributions to IASSL during his tenure, as well as the members of the Executive Council 2022. I am truly inspired by their commitment to IASSL and all of their achievements. The growth of IASSL has been the collective effort of individuals, past presidents and the members of the IASSL. I am eager to continue this important work in fulfilling the mission of IASSL.

As we embark on a new chapter of growth and progress, I would like to take this opportunity to share some exciting updates and highlight the remarkable achievements of our Institute.

Promoting Excellence in Applied Statistics: At IASSL, our unwavering commitment to promoting excellence in the field of Applied Statistics remains at the forefront of our endeavors. We continue to provide a platform for our rigorous research, and driving advancements in statistical methodologies.

Empowering Research, planning, and Development: Our institute plays a vital role in supporting research, planning, and development initiatives across various sectors. Through collaborative partnerships with esteemed organizations, we have been instrumental in providing robust statistical insights that motivate evidence-based decision-making, leading to more effective policies and strategies. These collaborations enable us to exchange knowledge, share best practices, and collectively contribute to the advancement of Applied Statistics.

Strengthening Education and Training: Recognizing the importance of education and training, we have made significant strides in enhancing professional development opportunities for students, researchers and statisticians. By organizing workshop, seminars, webinars, we strive to equip statisticians and researchers with the latest tools, techniques, and knowledge to excel in their respective field.
I extend warm invitation to all researchers, statisticians and graduates in the field of Statistics to actively engage with our Institute, participate in our programs, and share your knowledge and experiences to extract valuable insights from the realm of Applied Statistics.

Thank you for your continued support, and I am eagerly anticipating the remarkable advancements we will achieve in the coming months.

Warm regards,

Dr. Niroshan Withanage
President, IASSL

Editorial

Prof. Vasana Chandrasekara
Editor/IASSL

It is indeed a great honour to be the Editor of IASSL and it is an immense pleasure to launch this first issue of the newsletter for the year 2023. In this issue, we will recount various events, projects and activities in which IASSL members were actively involved from the 1st of January 2023 until the 30th April 2023.

Basically this issue contains articles from senior academics and industry professionals in the field of Statistics, One-Act-Play article from an emeritus professor and Stat Undergrad Column with articles from undergraduates.

Further this issue comprises news in brief which cover all events of IASSL during the considered period of this newsletter including the details of 11th Annual General Meeting (AGM) of IASSL, Graduation ceremony 2023 and IASSL Annual Awards Ceremony 2023.

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Details of winners of the National Statistics Olympiad and Best Research Awards 2022 competitions are included under the segment IASSL Annual Awards Ceremony 2023. As usual, the puzzle completion is included for all readers to relish and win prizes and the winners of the puzzle competition of the last issue are announced in this issue. Finally, the upcoming events of IASSL are listed for your information.

A huge thank you to all the professors, industry professionals, IASSL members and undergraduates who contributed to writing the valuable articles for this issue. Moreover, I appreciate the support extended by the President, Secretory, all subcommittee chairpersons and executive council members of IASSL in providing information relating to the events conducted by them during the period January to April 2023. Last but not least, I would like to thank the editorial board members of IASSL for their immense support throughout the creation of this issue of the IASSL newsletter.

I invite all readers to submit articles and news to be consider in the Issue 2, 2023 of the IASSL newsletter (editor@iassl.lk) and hope you all will enjoy reading this issue.

One Act Play

This is a continuation of the dialogue between a statistician (SS) and Simpleman (SM). In the previous session the statistician explained why different types of means are needed in different situations. This time the problem bothering Simpleman is why simple random sampling cannot be used under all circumstances.

Professor Emeritus R.O. Thattil
Founder President
Applied Statistics Association of Sri Lanka (ASASL)

SM: I am confused why people talk about different sampling schemes, when a simple technique such as simple random sampling can be used

SS: Do you know the concept behind the use of simple random sampling (SRS)?

SM: Of course! Every unit in the population is given an equal chance of being included in the sample. This is a very simple idea and I am reminded of the KISS (Keep It Simple Statistician) principle.

SS: Unfortunately life is not simple and the KISS principle does not work most of time

SM: But, Sir! The idea behind democracy is that every eligible voter has equal weightage in voting, which is exactly the idea behind SRS.

SS: That is the problem with democracy. In a population containing a majority of idiots, people will vote other idiots into parliament!

SM: Can you give a better system of voting?

SS: I can. Suppose I give professionals 3 votes each, educated persons (beyond 'O' Levels) 2 votes each and others 1 vote each. It will be a better system than giving everyone 1 vote each. The only problem is a sociological problem, since the majority will not agree to this. I don't see a solution to this problem. Therefore, we take the path of least resistance by giving everyone one vote each.

SM: Are you implying that dictatorship is the solution?

SS: Of course not! A dictator himself can be an idiot. With all its faults there is no satisfactory alternative to democracy according to Winston Churchill

SM: In a typical sampling situation why will SRS fail?

SS: Let me take a simple situation of finding the average height of an adult in a village, where males and females are in equal proportion. If the sample is taken using SRS, and the sample has more males, will not the estimate of height be overestimated?

SM: Yes. Since on the average males are taller.

SS: Similarly if more females are present in the sample, the estimate of the average height will be underestimated, since on the average females are shorter than males. In either case the estimate will be biased.

SM: So what is the solution?

SS: Think about it. We know that males are on the average taller than females. This information is known even before we take the sample and should be used in the sampling scheme.

SM: Perhaps, we can subdivide the population into 2 sub populations (males and females) and take samples from both sub populations.

SS: Right on the money! Dividing the population into sub populations based on prior information is called stratification.The 2 strata are the male and female strata. Stratification can be done based on prior information and in many cases will depend on many variables not just gender alone.

SM: How do we decide on the sample size for each stratum?

SS: In our current example, the sample size within each strata can be decided on the proportion of males and females in the population. If the proportion of males to females is in the ratio 1 : 1 we can take equal sample sizes from each stratum, in other words proportional allocation.

SM: Can we take proportional allocation in all situations?

SS: No! We have also to consider the variability within the different strata of the variable of interest such as the height of the persons. In many cases the cost of sampling within each stratum should also be considered.When these aspects are also considered we can use the formula for optimal allocation is deciding the sample size within a stratum. At this point I do not want to go into formulae. But, the conceptual idea is good enough. A bigger stratum will require a larger sample. If the variability with a stratum is high, the sample size should be higher. If the cost of sampling within the stratum is high, it will necessitate a smaller sample size. This is the idea behind optimal allocation.

SM: Thank you for given me clear idea about stratification

SS: Anyway if you want to go into sampling schemes to obtain national estimate of paddy production and milk yield you need to set up multistage sampling schemes. Provinces can be the first stage. Within the provinces one can randomly select the districts in the second stage. The third stage can be random selection of villages within the selected districts and so on.

SM: I can now see that simple random sampling is not good enough in many occasions, unless there is homogeneity in the population.

Dr. A. P. G. S. De Silva

Former Senior Lecturer,
Department of Statistics, USJ;

Former DG,
Department of Census and Statistics, Sri Lanka.

Survey Estimations Using Alternative Methods

We use many sampling techniques in estimating parameters and their variances/standard errors in survey sampling under different survey designs. Most common random sampling techniques comprise of simple random sampling, stratified random sampling, cluster sampling and unequal probability of selection methods while they are also used in combination in considerably large populations which entails several characteristics in individual elements of the population.

Variance estimation is an important component of complex survey data analysis as well which allows for the calculation of accurate standard errors and confidence intervals (CIs) for survey parameters. To estimate the variance of a survey estimate, one needs to take into account the design features of the sampling design. In complex surveys, observations are often selected from a population using a probability sampling design, where each unit has a known, nonzero probability of being selected. However, these sampling designs can create dependencies among observations, such as within-cluster correlations in cluster sampling, which can inflate the variance of survey estimates.

There are several methods for variance estimation in complex surveys. The choice of variance estimation method depends on the complexity of the survey design and the characteristics of the data. In practice, software packages such as SAS, Stata, and R have built-in functions for variance estimation in complex surveys. Following is a brief account of some of the commonly described methods used in such surveys for variance estimation. Some methods involve Replicated sampling while other represent Re-sampling techniques.

1. Taylor Series Linearization: This method is based on the Taylor series expansion of the estimator and involves calculating the first and second order derivatives of the estimator with respect to the sampling design. The variance is then estimated using a weighted sum of the squared first and second order derivatives.

2. Random Group Methods - Replicating the Survey Design: Suppose the basic survey design is replicated independently R times. After each sample is drawn, the sampled units are replaced in the population so they are available for later samples.

Then the R replicate samples produce R independent estimates of the quantity of interest; the variability among those estimates can be used to estimate the variance of Θ. This was also called "replicated networks of sample units" and "interpenetrating sampling."

θ = parameter of interest

$\hat{\theta}_r$ = estimate of θ calculated from r^{th} replicate

$\tilde{\theta} = \frac{1}{R}\sum_{r=1}^{R}\hat{\theta}_r$

If $\hat{\theta}_r$ is an unbiased estimator of θ, so is $\tilde{\theta}$, and

$\hat{V}_1(\tilde{\theta}) = \frac{1}{R}\frac{1}{R-1}\sum_{r=1}^{R}(\hat{\theta}_r - \tilde{\theta})^2$

Dividing the Sample into Random Groups

In practice, subsamples are not usually drawn independently, but the complete sample is selected according to the survey design. The complete sample is then divided into R groups, so that each group forms a miniature version of the survey, mirroring the sample design. The groups are then treated as though they are independent replicates of the basic survey design.

If the sample is a SRS of size n, the groups are formed by randomly apportioning the n observations into R groups, each of size n/R. These pseudo-random groups are not quite independent replicates because an observation unit can only appear in one of the groups; if the population size is large relative to the sample size, however, the groups can be treated as though they are independent replicates.

In a cluster sample, the Primary Sampling Units (PSUs) are randomly divided among the R groups. The PSU takes all its observation units with it to the random group, so each random group is still a cluster sample. In a stratified multistage sample, a random group contains a sample of PSUs from each stratum. Note that if k PSUs are sampled in the smallest stratum, at most k random groups can be formed.

Random group methods are easy to compute and explain but are unstable if a complex sample can only be split into a small number of groups. Resampling methods treat the sample as if it were itself a population; we take different samples from this new "population" and use the subsamples to estimate the variance. All of the methods described here presumed to calculate variance estimates for a sample in which PSUs are sampled with replacement. If PSUs are sampled without replacement, these methods may still be used, but are expected to overestimate the variance and result in conservative CIs.

3. Balanced Repeated Replication (BRR): This is a method that involves creating a set of replicate samples that have the same sample size as the original sample but are drawn with different allocation probabilities. The method is suitable for complex sampling designs such as stratified cluster sampling. The variance is then estimated by calculating the variance of the replicate weights. Some surveys are stratified to the point that only two PSUs are selected from each stratum.

This gives the highest degree of stratification possible while still allowing calculation of variance estimates in each stratum.

4. Jackknife: The jackknife method is a resampling technique that involves repeatedly leaving out one observation or group of observations and estimating the variance of the survey estimate based on the remaining sample. This process is repeated for each observation or group of observations, and the results are combined to estimate the variance of the full sample. The jackknife method is often used for estimating the variance of estimates that are not unbiased designs, such as estimates from non-probability samples. The jackknife method, like BRR, extends the random group method by allowing the replicate groups to overlap. The jackknife was introduced as a method of reducing bias; proposed using it to estimate variances and calculate CIs

Advantages: The jackknife is an all-purpose method. The same procedure is used to estimate the variance for every statistic for which jackknife can be used. The jackknife works in stratified multistage samples in which BRR does not apply because more than two PSUs are sampled in each stratum. Methods such as the jackknife can be used to account for some of the effects of imputation on the variance estimates. Disadvantages: For some sampling designs, the jackknife may require a large amount of computation. The jackknife performs poorly for estimating the variances of some statistics that are not smooth functions of population totals.

For example, the jackknife does not give a consistent estimator of the variance of quantiles in a SRS.

5. Bootstrap: The bootstrap method is also a resampling technique that involves repeatedly drawing samples with replacement from the original sample and estimating the variance of the survey estimate based on the bootstrap samples. This process is repeated many times, and the results are combined to estimate the variance of the full sample. The bootstrap method is often used when the sampling distribution of the survey estimate is unknown or difficult to estimate analytically.

As with the jackknife, theoretical results for the bootstrap were first developed for areas of statistics other than survey sampling; summarize theoretical results for the bootstrap in complex survey samples. Suppose S is a SRS with replacement of size n. We hope, in drawing the sample, that it reproduces properties of the whole population. We then treat the sample S as if it were a population, and take resamples from S. If the sample really is similar to the population, i.e. if the empirical probability mass function of the sample is similar to the probability mass function of the population, then samples generated from the empirical probability mass function should behave like samples taken from the population. Advantages: The bootstrap will work for smooth functions of population means and for some non-smooth functions such as quantiles in general sampling designs.

Disadvantages: In some settings, the bootstrap may require more computations than BRR or jackknife, since R is typically a very large number. In other large surveys, however, for example if a stratified random sample is taken, the bootstrap may require fewer computations than the jackknife. The bootstrap variance estimate differs when a different set of bootstrap samples is taken.

6. Design-based approaches involve using the sampling design information to estimate the variance. This can be done using either the Taylor series linearization method or the replicate variance estimation method. The Taylor series linearization method involves approximating the estimator's variance using a Taylor series expansion, while the replicate variance estimation method involves generating multiple replicated samples from the original sample and computing the variance of the estimator based on these replicated samples. Model-based approaches involve fitting a statistical model to the survey data and using the model to estimate the variance. This can be done using either the Bayesian or frequentist approach. The Bayesian approach involves specifying a prior distribution for the model parameters and updating it based on the survey data, while the frequentist approach involves estimating the model parameters using maximum likelihood or another estimation method and then using them to estimate the variance.

Invitation to send noteworthy members' achievements to publish in MAY 2023 - AUG 2023 NEWSLETTER...

- Newsworthy achievements made by IASSL members during May 2023 - August 2023:

- Local/international awards, scholarships,
- Local/international research grants,
- Promotions and educational qualifications (MPhil and above).

Please send a brief description.

- Books/book chapters published by IASSL members during May 2023 - August 2023.

Please send a brief description and a photo of the cover page of the book.

15th Census of Population and Housing in Sri Lanka will be in 2024

Dr. W. A. Chandani Wijebandara

Director, Population Census and Demography Division,
Department of Census and Statistics, Sri Lanka.

A population census, which counts every citizen of a country without omission or duplication is the largest data collection program in any country. This massive enumeration project is conducted generally once in ten years in many countries of the world. The United Nations (UN) defines the essential features of population and housing censuses as,

"Individual enumeration, universality within a defined territory, simultaneity and defined periodicity", and recommends that population censuses be taken at least every ten years (UN, 2008).

Accordingly, some countries conduct the census in years ending with "0" while some countries in years ending with "1". In Sri Lanka a census occurs once in ten years, generally in years ending with one.

Censuses in Sri Lanka

Sri Lanka is the first to conduct a population census among SAARC countries. The first scientific census was conducted in March, 1871 by then the Register General's Office. Since then, censuses had been conducted in every ten years. A "Census Department" was initiated in 1940 under the Donoughmore Constitution specially to undertake census. However, due to various reasons the census sequence was disturbed. Such that the 1941 census was postponed to 1946 due to the World War II (see Figure 01).

In 1948 under the Soulbury Constitution the Department of Census and Statistics (DCS) was formed. DCS have been conducting censuses since then and from 1953 till 2012 five Population Censuses were conducted. The information on housing was added in 1981, since then named as Census of Population and Housing (CPH) (DCS, n.d.).

The DCS as the government authorized agency to provide official statistics, has made all arrangements to conduct 15th Census of Population and housing (CPH) in year 2024. Originally, the 15th CPH was planned to be conducted in year 2021. However, due to the prevailed conditions of the Covid 19 pandemic and subsequent economic recession, that has been postponed to year 2024.

Many countries of the world had to postpone or to extend the enumeration of their population censuses of the 2020th round due to the Covid 19 pandemic and related issues (UNSD, 2023).

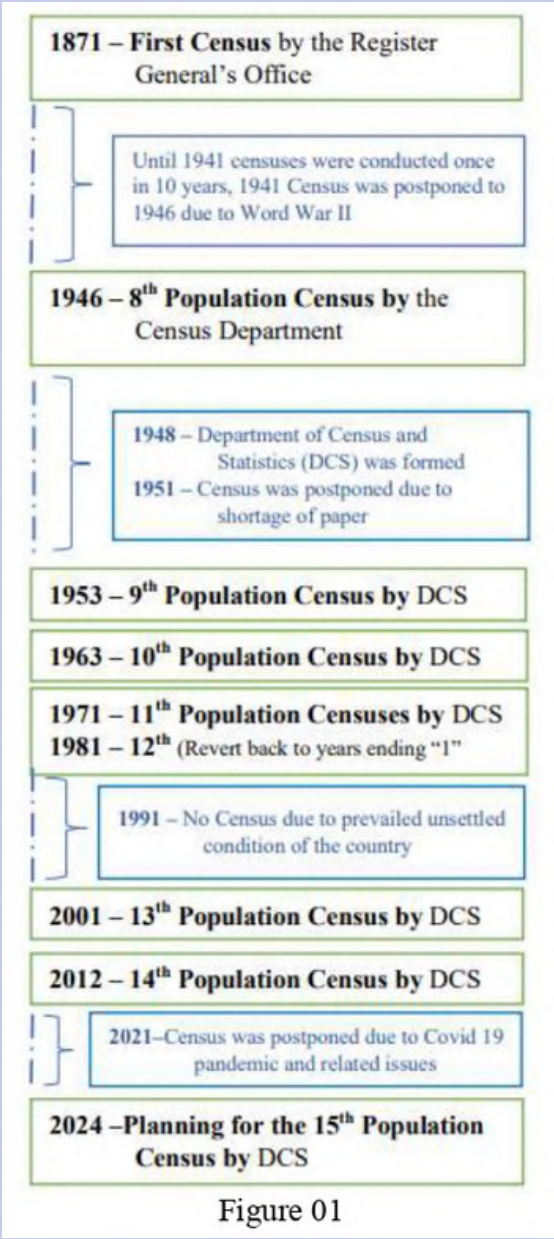
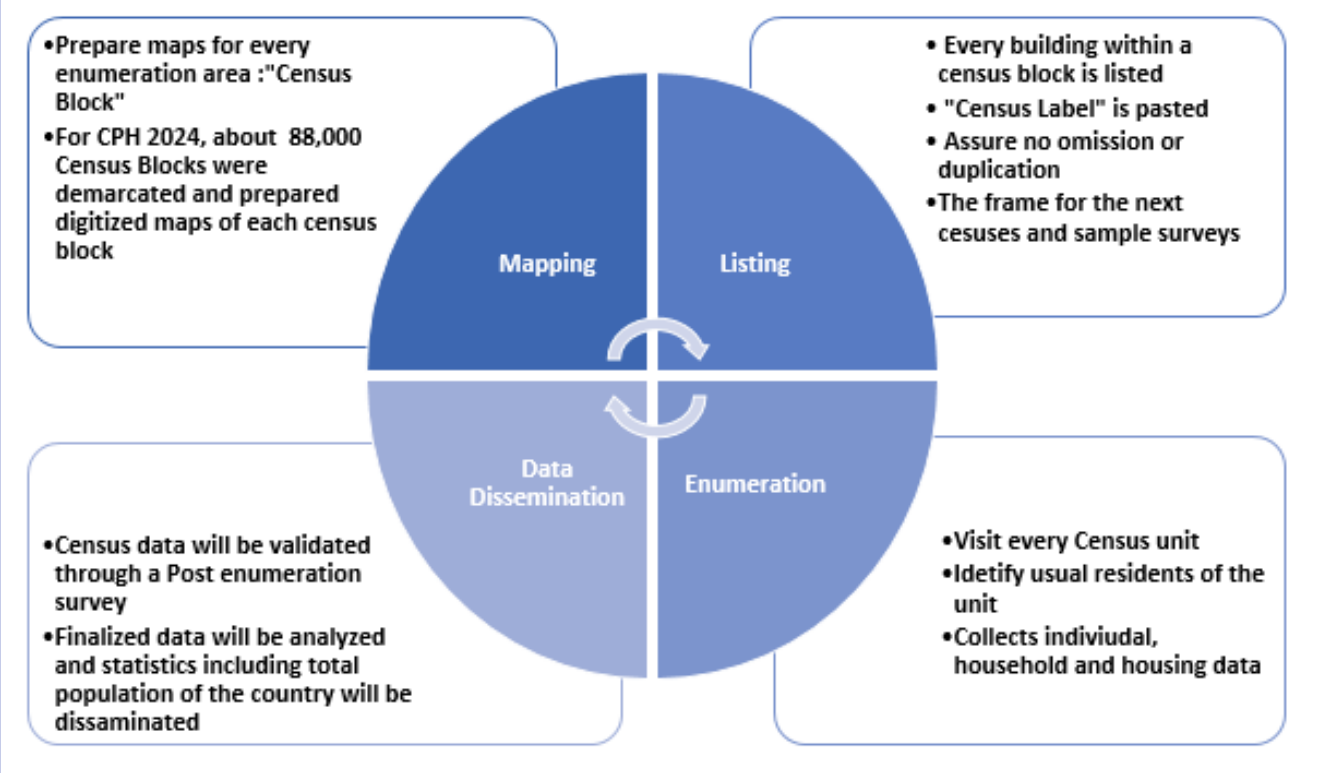


Figure 01

Population censuses in few countries are register based. Such countries are mainly Nordic countries such as Denmark, Finland, Norway, Sweden etc. These countries maintain very good administrative registers including population registers, therefore can publish population of the country using integrated data. However, majority of the countries in the world still conduct traditional censuses which has four main steps in general. These censuses can be identified as the most complex and massive peacetime exercises a nation undertakes.

A traditional Census maps the entire country, lists all buildings, enumerates all households and disseminate data. A census of population and Housing collects information on basic population characteristics including age, sex, marital status, household composition, family characteristics, household size and on housing conditions.

The Population Census process



Role of a Census of Population and housing

- Provide accurate and timely statistics up to the lowest administrative level (Grama Niladhari) which are needed for evidence-based policy making. This is the only source of data for small population groups without any sampling error.
- Results of the census is mainly used to ensure the fair distribution of government services such as allocation of government funds on education, health, etc. Hence, this is a main data source for public administration.
- Students, academia, researchers and international organizations use the census results for their analysis. Population projections is one of the main analytical outputs of the census data.
- Statistics provided through the census are considered as benchmarks for other statistical compilation and the census creates the sample frame for subsequent sample surveys.

The essential features of a Population Census

Census Objectives and Deciding its Contents and data Dissemination

With specific aims and objectives, the DCS plans, set standards and set benchmarks for the census. For this, previous census experiences and international guidelines are used. Early preparation for all these activities is a must and usually planning period of the DCS for census is three years.

- Specific objectives are there for a country depending on local needs and country situation
- By selecting the most important topics the census ensures the data requirements of the users.
- Since this is a massive project following are very important when deciding topics
  - Managing human resources including census staff
  - Less respondent burden
  - Time availability
  - Cost-effectiveness
- All the census operations need to be acceptable to the public and comply with the legal and ethical standards of the country.
- The Department of Census and Statistics conducts the Census of Population and Housing under the Census Act, this ensures all these standards and confidentiality of individual information.
- Finally, the collected data will be evaluated through a post census enumeration survey and the results will be published for use.

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Was UC, Berkeley accused of gender discrimination in the 1970s ?

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The liberation of women in the 1960s and 1970s in the United States of America had a domino's effect on the global female population. The "Second wave of feminism" was the milestone that allowed women to break into unconventional jobs and become electricians, plumbers, machine operators and many more. Becoming a doctor, engineer or an architect was not just another dream for young girls. It was their reality. This time period was more about equal rights and opportunities for women in comparison to the theme legal rights, which was the focal point during the "First wave of feminism".

During such a significant time period in American history, University of California in Berkeley, one of the oldest and most reputed universities of all time, was sued for gender discrimination in 1973. Out of the 2691 male applicants in the fall of 1973, 45% were admitted while only 35% of the 1835 female applicants were admitted into their graduate school (Bickel et al., 1975). The Odds Ratio (OR) of 1.84 implied that a male had approximately twice the chance a female had of getting admission to UC, Berkeley. The admissions were obviously biased against women. Ultimately these numbers led to UC, Berkeley becoming "one of the first universities to be sued for sexual discrimination". The lawsuit failed.

Table 1: Acceptance Rates of UC, Berkeley in the Fall of 1973 (Calculated via Berkeley Admissions Dataset)

Gender	Applicants	Admitted
Male	8442	44%
Female	4321	35%

This story is used as the prime example by most universities around the globe when teaching an important statistical concept. It has been repurposed and reused for several years. In reality, the lawsuit never happened!

What actually happened at Berkeley ?

The admission numbers were legitimate. However, the university was never accused of gender discrimination. Peter Bickel, a renowned professor in Statistics at UC, Berkeley clears this rumor at a Wall Street Journal interview and confirms that the university merely feared being sued. Such an event would have had grave consequences on the the goodwill of the university. Furthermore, they were intrigued by the story that was projected from the data. Therefore, a team of statisticians led by Bickel himself was given the responsibility of solving this riddle.

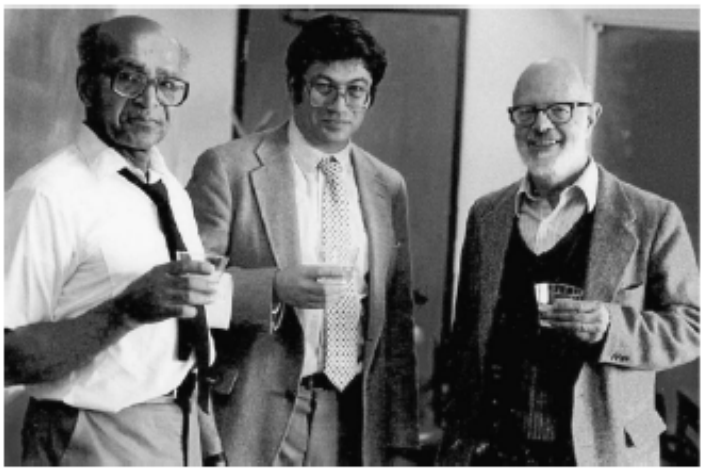

Figure 1: David Blackwell, Peter Bickel and Erich Lehmann at a party celebrating Peter's election to the National Academy of Science.
Source: Statistical Science, 2011, Vol. 26, No. 1, 150–159

The admission system depends on the Department of Study. Therefore, Bickel and his team examined the data related to each Department separately. What they inferred was that Berkeley had a selection bias. Not towards men, but towards women!

Table 2: Acceptance Rates of the six Largest Departments at UC, Berkeley (Calculated via Berkeley Admissions Dataset)

Department	Males		Females	
	Applicants	Accepted	Applicants	Accepted
A	825	62%	108	82%
B	560	63%	25	68%
C	325	37%	593	34%
D	417	33%	375	35%
E	191	28%	393	24%
F	373	6%	341	7%

According to Table 2, four of the six largest Departments (A, B, D and F) showed that they were biased towards accepting women. After some ground research to better understand these trends, it was found that women tend to apply to Departments with low acceptance rates such as Arts and Humanities while men were prone towards applying to Departments with higher acceptance rates such as Mechanical Engineering. On a different note, this example shows the difference in choice of career paths between the two genders at the time and not the preference of the university. Little did the world of academia know that this trend was about to change for a life time due to women fighting for their personal freedom and rights.

"Simpson's Paradox" is a phenomena where a trend or result in groups disappears or reverses when the given groups are combined. This is exactly what Bickel identified in Berkeley admission data. The trend disappears or reverses due to disregarding the effect of a hidden or confounding variable. In this case, the Department was the confounding variable as it had an effect on gender and acceptance rates. As Bickel's team changed their data view point, the conclusion regarding gender discrimination in favour of men flipped, and the true association between gender and acceptance rates were revealed.

OR is a crude summary measure and it was calculated for pooled data by disregarding the Departmental effect. However, the Mantel–Haenszel adjusted OR allows groups with more people to have a higher influence on the adjusted OR. Therefore, Bickel et al. (1975) considers Departments as a confounding variable and calculates a Mantel–Haenszel adjusted OR of 0.9 for Berkeley admission data. Hence, it was found that the

chance of a male being admitted to Berkeley was 20% less than that of a female getting admission. If there was ever a case of gender discrimination, it was against men. However, the team concluded that there was no selection bias towards men or women with respect to admission to graduate school as they had a clear picture on the intervention of the variable Department with respect to admissions.

Simpson's Paradox

The Simpson's paradox is often mistaken to have some sort of connection with the American animated sitcom "The Simpsons". The only commonality between the two is the coincidence of names. However, when one googles the paradox, every site that illustrates the paradox has a picture of the sitcom character Bart Simpson. This is merely a way of making the paradox memorable. The first indication of the concept was done by Karl G. Pearson and George U. Yule in 1899 and 1903 respectively. However, it was named as the "Simpson's Paradox" after the short paper "The interpretation of interaction in contingency tables" written by Edward H. Simpson in 1951. The paradox can be seen in multiple real life settings. The survival rates from the Titanic, on time flights of airlines and baseball batting averages are some of the classic examples where the Simpson's Paradox is seen. Contradictions and complete reversals of results in data with the inclusion of a new variable, often leaves people star struck and makes the paradox one of the most popular statistical paradoxes of all time.

A more recent example are the patterns seen in COVID-19 case fatality rates (CFRs). von Kügelgen et al. (2021) studies the CFRs in China and Italy and infers that that the CFRs in Italy is lower in comparison to that in China for every age group. However, overall when age groups are not considered the rates are higher in Italy. Such a pattern is visible due to demographic differences. This finding is used to introduce basic concepts of mediation analysis for the quantification of direct and indirect causal effects between different countries and time points. This study clearly uses the paradox for causal inference. Similarly, the paradox can be used in a plethora of statistical as well as non statistical research areas. Probability Theory, Non Experimental Studies, Biology, Discrimination Studies and Decision Theory are some such study areas.

"Simpson's Paradox can be seen only in categorical data." This is a common misconception. The beauty of the paradox is that it can be seen in any type of data. The analysis of SAT scores shows us the Simpson's Paradox in cardinal data. The average SAT scores in the United States of America rises from 1992 to 2002. However, the pattern reverses when SAT scores are observed separately for each GPA group. (Sprenger and Weinberger, 2021).

Dilemma behind the Simpson's paradox

Suppose UC, Berkeley was actually sued and the case did not fail, the decision would have been taken based on an incorrect conclusion. This would have tainted the university's reputation for generations to come while creating an unnecessary ruckus and incorrectly blaming the university for going against liberation of women considering the significance of the time period for women empowerment. Furthermore, millions of dollars and valuable time would have been wasted simply due to misinterpretation of data.

The dilemma occurs when the paradox reverses and the partial (confounding variable is considered) and marginal (confounding variable is not considered) associations between two variables have opposite signs.

Which association is correct? Should I consider the partial association for my conclusions? Why does the relationship change when a third variable comes into the picture? If the intervention of the confounding variable is known like in the Berkeley case, the reason for the reversal can be easily understood. Furthermore, if the sample mirrors the exact image of the population we can simply accept both partial and marginal associations.

We do not live in a perfect world and in most scenarios both associations cannot be true at the same time. Suppose a researcher wants to merely record the relationships in the data, it can be done easily. However, we are interested in the causal relationships between variables. In that case do we believe what is said by the overall view of the data or do we believe what the data says when it is divided into groups ? This is the real dilemma! The Berkeley case showed us that there was a bias towards women when Departments were considered. However, gender discrimination for either gender was ruled out because admission decisions were made by Departments, rather than the university itself. Ultimately the marginal association was considered as false.

Solving the paradox is a daunting task. The difficulty lies in the fact that there is no statistically accepted way of knowing the presence of the Simpson's Paradox in your data. We never know with certainty when it will occur. Data can be categorized using multiple mechanisms and the odds of missing that one categorization that reverses or eliminates the trend is high. Even if the trend is identified, we have no standard way of knowing if that trend is true. Some researchers say that the marginal association is always false. However, there are ample examples where the partial association has turned out to be the spurious one.

The Simpson's Paradox can be avoided in certain study types such as experimental studies by complete randomization of treatments. An effective randomization will eliminate the paradox irrespective of the relation of the co-variate with the outcome. However, this is not the same for non experimental studies due to the presence of uncontrollable variables that maybe never observed. Therefore, we cannot completely eliminate the paradox.

Understanding the paradox is crucial for making conclusions. Decision making has an added layer of difficulty in the presence of this phenomena. Furthermore, scrutinising, regrouping and re-sampling data can be done in multiple ways. Thereby, drawing different conclusions from different categorizations. However, this is not feasible due to time and cost constraints. Therefore, it is crucial that we strike a fine balance between what groupings to use and the understanding of the impact of hidden variables on the outcome supported by a solid base of research. We will encounter such problems until a standard method of identifying the paradox in data is introduced. Until then, the secret to working with mysterious datasets such as those that demonstrate the Simpson's Paradox is, knowing what you are looking at. Knowing what you are looking for and finally choosing the best data view point for a fair representation of truth.

References

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News in Brief

Courses conducted by IASSL during JAN - APR 2023

01. Modeling binary, ordinal & nominal outcome variables
02. Systematic Literature Review with Bibliometric Analysis - a way of manuscript writing- 1st Batch
03. Systematic Literature Review with Bibliometric Analysis - a way of manuscript writing 2nd Batch
04. Tableau for Business Analytics
05. Systematic Literature Review with Bibliometric Analysis - a way of manuscript writing 3rd Batch
06. Qualitative Analysis and Writing
07. Systematic Literature Review with Bibliometric Analysis - a way of manuscript writing - 4th batch
08. Business analytics using Power BI
09. Statistical Modelling with R

New life members

- **General Membership**
  - ★ **Life Members** - Mr. S. Santharooban
    - Miss. M. D. T. Sanduni
    - Miss. T. H. A. Memdis
    - Mrs. K. K. S. Peris
    - Dr. Neluka Devpura
    - Dr. Dushan Kumarathunga
  - ★ **Annual Members** - Mrs. K. N. Padhardhi
- **Associate Members** - Dr. Achini Tharanga Wijesekera

How to become a member?

Please visit http://www.iassl.lk

11th Annual General Meeting 2023

The 11th Annual General Meeting of the Institute of Applied Statistics Sri Lanka was held on 2nd April 2023 at the Auditorium of the Professional Centre (OPA). All the life Members were Invited for the occasion. The New Executive council was appointed at the AGM for the year 2023.

President/ IASSL
Dr. Niroshan Withanage
Department of Statistics,
Faculty of Applied Sciences,
USJ.

Immediate Past President/ IASSL
Dr. Chitraka Wickramarachchi
Department of Statistics,
Faculty of Applied Sciences,
USJ.

Vice President/ House & Finance Management Committee Chairperson/ IASSL
Prof. Kapila T. Rathnayake
Faculty of Applied Sciences,
SUSL.

Secretary/ IASSL
Dr. Rajitha M. Silva
Department of Statistics,
Faculty of Applied Sciences,
USJ.

Treasurer/ IASSL
Priyath De Silva
Vice President / OPA
Former Director Investments,
Ministry of Nation Bulting.

Editor/ IASSL
Prof. N. Vasana Chandrasekara
Department of Statistics &
Computer Science,
Faculty of Science,
UOK.

Assistant Secretary
Dr. Wasana Wijesuriya
Principal Research Officer,
Rubber Research Institute
of Sri Lanka.

Assistant Treasurer
Mrs. Padma Yatapana
(Retired)
Division of interdisciplinary
studies, Institute of Technology
UOM.

Associate Editor
Dr. Isuru Hewapathirana
Software Engineering Teaching
Unit, Faculty of Science,
UOK.

Chairperson/ Academic Training Committee
Mr. Sampath Hapuarachchi
Faculty of Applied Sciences,
SUSL.

Chairperson/ Statistics Popularization Committee
Prof. L.D.B. Suriyagoda
Department of Crop Science,
Faculty of Agriculture,
UOP.

Chairperson/ R & D Committee
Dr. A.P.G.S. De. Silva
Former Director,
Department of Census and
Statistics,
Sri Lanka.

Executive Council Member
Prof. C. D. Tilakaratne
Department of Statistics,
Faculty of Science,
UOC.

Executive Council Member
Prof. S. Samita
Department of Crop Science,
Faculty of Agriculture,
UOP.

Executive Council Member
Prof. T. Sivananthawerl
Department of Crop Science,
Faculty of Agriculture,
UOP.

Ex Officio
Department of Census and Statistics,
Sri Lanka.

Executive Council Member
Mrs. DABN Amarasekara
Department of Crop Science,
Faculty of Agriculture,
UOR.

Executive Council Member
Dr. Chathuri Jayasinghe
Department of Statistics,
Faculty of Applied Sciences,
USJ.

Executive Council Member
Dr. Priyadarshana Dharmawardena
Senior Statistician,
Department of Census and Statistics,
Sri Lanka.

Executive Council Member
Dr. Bashitha Kavinga
Department of Statistics & Computer Science,
Faculty of Science,
UOK.

2022 Executive Council of IASSL

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1. **Mr. Sampath Hapuarachchi (Chairperson)**, Faculty of Applied Sciences, SUSL.
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3. **Prof. Rupika Abeynayake**, Department of Agribusiness Management, Faculty of Agriculture and Plantation Management, WUSL; Dept. of Computing & Mathematics, Faculty of Science and Engineering, Manchester Metropolitan University, UK.
4. **Dr. Priyanga Talagala**, Department of Computational Mathematics, Faculty of Information Technology, UOM.
5. **Mr. Janaka Updendra,** Department of Business Management, ICBT Campus.
6. **Mr. K. Manimarrphan**, Hindu College, Colombo.
7. **Mr. S. Denny Jasotharan,** National Hospital of Sri Lanka.
8. **Mrs. DABN Amarasekara**, Department of Crop Science, Faculty of Agriculture, UOR.

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5. **Dr. Hasanthi Pathberiya**, Department of Statistics, Faculty of Applied Sciences, USJ.
6. **Dr. Chathuri Jayasinghe**, Department of Statistics, Faculty of Applied Sciences, USJ.

House & Finance Management Committee

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4. **Mrs. Padma Yatipana (Assistant Treasurer) (Ex Officio), (**Retired) Division of Interdisciplinary Studies, Institute of Technology, UOM.
5. **Prof. S. Samita**, Department of Crop Science, Faculty of Agriculture, UOP.
6. **Dr. A.P.G.S. De. Silva**, (Retired) Department of Census and Statistics, Sri Lanka.
7. **Dr. Wasana Wijesuriya**, Rubber Research Institute of Sri Lanka.
8. **Eng. S. Vaikunthan,** AMIE (SL).

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4. **Dr. Chathuri Jayasinghe**, Department of Statistics, Faculty of Applied Sciences, USJ.
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6. **Ms. Kithmini Peiris**, Group Risk Management, NDB.
7. **Mr. S. Santharooban**, Library, EUSL.
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3. **Dr. Chitraka Wickramarachchi**, Department of Statistics, Faculty of Applied Sciences, USJ.
4. **Dr. Hasanthi Pathberiya**, Department of Statistics, Faculty of Applied Sciences, USJ.
5. **Mr. D.C.A. Gunawardene,** (Retired) Department of Census and Statistics, Sri Lanka.
6. **Mr. Nandana Gunarathne,** ASMP (The World Bank Project).
7. **Ms. Desha Fernando,** Department of Clinical Medicine, Faculty of Medicine, UOC.
8. **Ms. Theja Sanduni**, Department of Statistics, Faculty of Applied Sciences, USJ.

Graduation Ceremony 2023

The Graduation Ceremony of the Institute of Applied Statistics Sri Lanka was held on 2nd April 2023 at the Auditorium of the Professional Centre (OPA). Diplomas in Applied Statistics and Higher Diplomas in Applied Statistics were conferred. As the chief guest Professor Emeritus R.O. Thattil, founder President of Applied Statistics Association of Sri Lanka (ASASL), graced the event. All life Members, graduates, and their parents were also Invited for the occasion. Congratulations on graduating and here's to your next adventure!

Diploma and higher diploma awardees with the distinguish lecture panel

IASSL Annual Awards Ceremony 2023

The Annual Awards Ceremony of the Institute of Applied Statistics Sri Lanka was held on 2nd April 2023 at the Auditorium of the Professional Centre (OPA). Best Research Awards competition 2022 winners and National Statistics Olympiad competition 2022 winners were awarded at the ceremony. The opportunity was given to present the work of the winners of the best research awards competition. All life Members, graduates, and their parents were too Invited for the occasion.

Best Research Awards 2022

"The Best Research Award-2022" Program was organized to encourage undergraduates, postgraduates, and researchers who have successfully completed their research studies during the year 2022 with a development or an application of Statistics/Applied Statistics. For this competition, eighteen (18) undergraduates and eleven (11) postgraduates who completed the degree requirements in Sri Lankan Universities, and for the open category, ten (10) research articles that were published in reputed journals or conferences during the period from 1st January 2022 to 31st December 2022 were considered.

Undergraduate Category

Winner
Ms. Nethmi Wijesinghe

1st Runner up
Ms. K.U.S. Kumaranathunga

2nd Runner up
Ms. J.D.T. Erandi

Merit awards

Ms. H. K. R. Rathnaweera

Ms. M.D.T. Sanduni

Mr. L.H.K. Dilshan

Ms. T.H.A. Mendis

Ms. H.L.A.Weerakoon

Best Research Awards 2022

Postgraduate Category

Winner
Mrs. A. S. G. Jayasinghe

1st Runner up
Mrs. P.T.M. Gunathilake

2nd Runner up
Ms. N.M. Hakmanage

Open Category

Winner
Dr. D. M. K. N. Seneviratna

1st Runner up
Prof. M. R Sooriyarachchi

2nd Runner up
Ms. B.R.P.M. Basnayake

National Statistics Olympiad 2022

The 9th National Statistics Olympiad, organized by the Institute of Applied Statistics Sri Lanka, was held on December 18, 2022, at the University of Sri Jayewardenepura as reported in the previous IASSL newsletter. The objective of this competition was to popularize statistics among schools and university students across the country. The National Statistics Olympiad is one of the major events organized by the IASSL to engage with the community and promote the use of statistics among students across the country.

The contest witnessed a fierce battle between outstanding young minds, and we are proud to announce that the top three scorers and the merit passes from this competition in each category (Junior and Senior) went on to participate in the 13th Statistics Olympiad - 2023 organized by the C. R. Rao Advanced Institute of Mathematics, Statistics, and Computer Science (AIMSCS) on January 29, 2023.

At the IASSL annual awards ceremony that was held on the second of April, 2023 at the auditorium of the Professional Centre (OPA), all prize winners and merit award winners in both junior and senior categories were awarded with medals and certificates.

Junior level winners

Gold Medal

Wijesinghe Arachchilage Kalshini Dulmitha

Silver Medal

Methuli Sinethma Abeyweera Gunasekara

Silver Medal

Madappuli Arachchige Vikum Dulara Fernando

Junior level merit awards

Sithuli Sumethma Abeyweera Gunasekara

Ganeshan Pranavi

Nawas Nihrath Nihma

Gimashi Devlini Weerathunga

Senior level winners

Gold Medal

Naveen Pathberiya

Silver Medal

Senadeerage Don Sashini Tharushika Senadeera

Bronze Medal

Sampathawaduge Chamudini Salumika Fernando

Senior level merit awards

Sandun Sankalpa Wanniarachchi

Suchith Tissera

Purani Rashmika Annasiwatte

Weliwitigoda Thivain Jayuka Wimaladharma

Dasanayaka Mudiyanselage Padmaja Maneesha Dasanayaka

Tharushi Hiranya Sarathchandra

Gamage Dona Nikini Prabhashi Maheshika Gamage

Withanage Pashindu Dilshan Perera

Senior level merit awards

Senarath Arachchige Hashini Dharshika

Chamathka Binuri Perera

Sanghapala Arachchige Sukhithi Chamali

Bodiya Baduge Yasiru Sahan Perera

Hapugala Arachchige Shanili Vinusha Seneviratne

Ranpati Hewage Ravindu Suranjana Nishshanka

Aluthge Ashini Madhuwanthi

Kavindu Jayodh Abeysinghe Jayawardana

Merengha Thisuri Tharindi Panditha Jayarathne

Madampe Appuhamilage Shashini Chamudika Siriwardhana

Ranasinghe Arachchige Thevin Manvindu

Kavindi Himaya Ranasinghe

Rajith Ekanayaka

Hadasha Randunubandara

Welipitiyage Niranjala Rantharu Rajamina

Members' Achievements

Awards

SILK Most Outstanding Sports Research Project of the Year award, The Statistics in Sports Research Group, USJ

The Statistics in Sports Research Group at the University of Sri Jayewardenepura has been awarded the SILK Most Outstanding Sports Research Project of the Year award at the 8th SILK SPORTS AWARDS 2022. Organized by SPORTSINFO, this prestigious event recognizes not only the achievements of Sri Lankan sports stars but also their contributors.

The USJ Statistics in Sports Research Group which is coordinated by **Dr. Rajitha M. Silva** of the Department of Statistics, USJ who is also a IASSL Exco member. It is the first research group in Sri Lanka that focus on conducting research related to sports analytics. It was formed with the aim of supporting university students interested in conducting various research related to sports analytics while promoting and popularizing sports analytics research in Sri Lanka.

To acknowledge the quality research work conducted by the USJ Statistics in Sports Research Group, the SILK Jury awarded the group the SILK Most Outstanding Sports Research Project of the Year award.

The group comprises of academics, postgraduate, and undergraduate students. For further information about the research group, visit them at http://science.sjp.ac.lk/sta/statistics-in-sports-research-group/

IASSL Exco members Dr. Chathuri Jayasinghe, Dr. Chitraka Wickramarachchi and Dr. Niroshan Withanage are also active members of this group.

Promotions

Prof. Chandima Tilakaratne (Chair Professor of Statistics)

Professor Chandima Tilakaratne hold BSc (1990) and MSc (in Applied Statistics, 1996) from the University of Colombo, and MIT (by Research, 2004) and PhD (2008) from the University of Ballarat, Australia. She is a fellow of the Institute of Applied Statistics, Sri Lanka. She joined the Department of Statistics & Computer Science (currently the Department of Statistics), University of Colombo in 1995. She was promoted to the post of Professor in the Department of Statistics in 2018 and appointed as the Professor of Statistics (Chair) of the same Department in September 2022. She is the first Chair Professor of the Department.

She has held several responsible positions including the Head/Department of Statistics, University of Colombo, Secretary/Applied Statistics Association Sri Lanka (now IASSL), President/Section E1 of the Sri Lanka Association for the Advancement of Science, Editor/Sri Lankan Journal of Applied Statistics, Chairperson/International Statistics Conference 2010 and Co-chair/International Statistics Conference 2011.
Prof. Tilakaratne has published many journal articles and full conference papers. Her research interests include predictive analytics, modelling time series data, spatio-temporal data analysis and data driven modelling. Moreover, she has reviewed several articles submitted to MDPI journals and currently serves as a reviewer of Mathematics and Statistics journal. Her current h-index is 11.

Prof. Vasana Chandrasekara (Professor in Statistics)

Vasana Chandrasekara is a Professor in the Department of Statistics & Computer Science at the Faculty of Science, University of Kelaniya. She acquired her primary education from Sirimavo Bandaranayake Vidyalaya, Colombo 7 and her secondary education from Devi Balika Vidyalaya, Colombo 8. She graduated from the Faculty of Science, University of Colombo in 2009 with a B.Sc. (Hons.) special degree in Statistics with Computer Science. Further, she obtained a B.Sc. (Hons.) in Computer Science from the British Computer Society in 2009 and holds MBCS. She completed a Master of Financial Economics from the University of Colombo in 2011.

She joined the Department of Statistics & Computer Science University of Kelaniya in February 2012 and promoted to the post of professor in February 2022.

She pursued her doctoral degree with one supervisor from the Department of Statistics, University of Colombo and another supervisor from Federation University Australia, and obtained the Ph.D. from the University of Colombo in 2018.

Her research interests include Data Mining, Predictive Analytics, Statistical Modeling and Deep Learning. She owns 87 publications, including 1 book chapter, 27 journal papers in indexed journals including Science Citation Index Expanded, Web of Science & Scopus, 16 full papers at national and international conference proceedings including IEEE and 43 abstracts and extended abstracts.

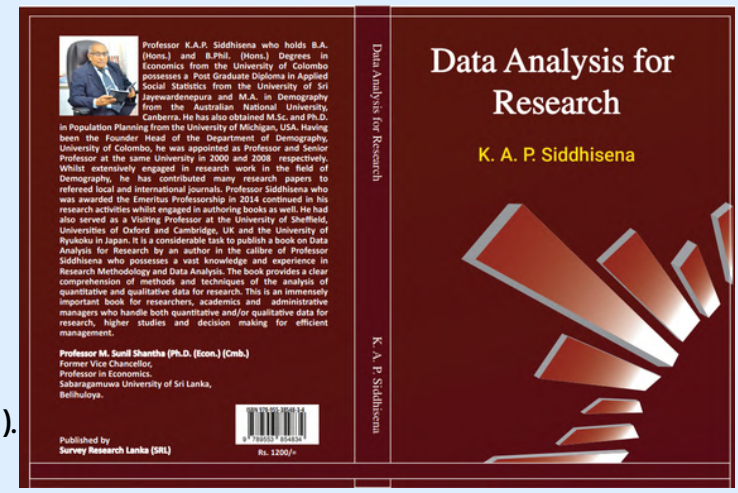
She won several awards including Vice Chancellors award for the outstanding early career researcher of the Faculty of Science 2022 (2nd place), outstanding researcher of the Faculty of Science 2021 (Merit), outstanding early carrier researcher of the Faculty of Science 2019 (2nd place) & Senate Honours for conducting high-quality research in the years 2022 (three), 2021, 2019 (two), 2017 (two), 2016 by the University of Kelaniya and SLAAS GRC Postgraduate Research Award 2018 Section E1 (Merit) awarded by the Sri Lanka Association for the Advancement of Science.

Moreover, she won Gold Medal for the Best Final Year Individual Research Project (Statistics with Computer Science) 2009, from the University of Colombo and Gold Medal for the best undergraduate statistics individual research project 2009 from the Applied Statistics Association of Sri Lanka (Currently the Institute of Applied Statistics, Sri Lanka).

She served as a scientific reviewer and has co-chaired national and international conferences and journals. She is the editor-in-chief of the Sri Lankan Journal of Applied Statistics, a member of the editorial board of the International Journal of data mining, modelling, and management, and a reviewer for Elsevier's Informatics in Medicine Unlocked. Further she is the Editor of the Institute of Applied Statistics (IASSL) and possesses the MIASSL. Currently, she is the youngest Statistics Professor in Sri Lanka and the first Statistics Professor at the Department of Statistics & Computer Science, University of Kelaniya.

Books

Data Analysis for Research
Author: Prof. K.A.P. Siddhisena



Year of Publication: 2023
ISBN: 978-955-38548-3-4

Published by: Survey Research Lanka (SRL).
Price: Rs. 1200/=

The book provides a clear comprehension of methods and techniques of the analysis of quantitative and qualitative data. The author, Professor Emeritus of Demography, University of Colombo and presently a Council Member, and a former Chairman of Research and Development Committee of the IASSL, has shown his vast experience and knowledge gained in conducting research and field surveys through handling and managing primary and secondary data and quantitative and qualitative data by citing appropriate examples to explain theoretical facts and figures.

The book consists of eight Chapters and made up of logical sequence underpinning from definition and differentiation of data to processing and analysis of data. The Chapters covers use and misuse of data, differences of types of data, methods of data collection, and processing of primary data, and appraise the secondary data and analysis of data. Thus this is an impressive and immensely important book for researchers, academics and administrative managers who handle both quantitative and/or qualitative data for research, higher studies and decision making for efficient management. Available at Department of Demography, University of Colombo. Call 011-2586111.

IASSL Collaborations in Jan 2023 - April 2023

Collaboration with the Department of Census and Statistics (DCS)

The Institute of Applied Statistics Sri Lanka (IASSL) and the Department of Census and Statistics (DCS) have joined forces in order to promote the advancement of Applied Statistics in Sri Lanka. The DCS, with their mission of providing accurate and timely statistics to contribute to the socio-economic development of the country, recognizes the value of collaboration with IASSL to further their goals. As part of this collaboration, IASSL was invited to conduct an awareness program at the DCS to share their objectives and benefits to members. The program was held on the 14th of February, 2023 at the DCS auditorium. IASSL's main objective is to promote and assist the advancement of Applied Statistics for research, development, education, training, and extension. IASSL also collaborates with governmental and non-governmental organizations, as well as national and international institutes engaged in work related to statistics, to promote research, development, education, training, and extension.

Signing a MoU with Almas Holdings

From left: IASSL past Presidents Dr. A.P.G.S. De Silva and Dr. Chitraka Wickramarachchi, Almas Group Director Risvi Abdul Majeed and Director Dr. Harshana Suriyapperuma.

The IASSL has come to a collaborative partnership with Almas Holdings. Almas Equities (former Assetline Securities) is one of the founding members of the Colombo Stock Exchange with a history spanning over 30 years. Both parties signed a memorandum of understanding on 2nd of February 2023 at the IASSL office.

Upcoming Courses and Events

For the Month of June

Certificate Course on STATA

Dr. M. G. Nuwan Indika.
Senior Lecturer, Department of Business Economics, University of Colombo.

Certificate Courses on Basic Statistics for Managers & Researchers

Prof. N. R. Abeynayake.
Department of Computing & Mathematics, Faculty of Science and Engineering, Manchester Metropolitan University, UK.

For the Month of July

Python Programming for Data Science

Dr. Kasun Kosala Jinasena, Department of Computer Science, USJ.
The purpose of introducing this certificate course is to establish a strong foundation for subsequent courses such as Data Analysis with Python, Data Visualization using Python, and Statistical Modelling with Python, etc.

Foundation Study in Probability and Statistics

This certificate course is designed to provide basic concepts of probability, descriptive statistics, probability distributions, inference, statistical modeling, and R programming. Students who have been selected for the university and are awaiting the commencement of their academic programs are expected to enroll in this course.

An awareness session on statistics for A/L students

The Institute of Applied Statistics Sri Lanka (IASSL) will be conducting a one day seminar at the Hindu College, Colombo for A/L School children. This is a voluntary service offered to school children by the IASSL and its members to improve their awareness in Statistics and educate them on the content of statistics in their A/L curriculum (Physical Sciences stream). The seminar will be held on Monday 22nd May from 8.30 am to 1.30 pm.

As the resource persons, Prof. T. Sivananthawerl from the University of Peradeniya and Mr. P. Dias from the University of Sri Jayewardenepura will lead the seminar while few other members of the IASSL will also take part in the session by providing necessary assistance to students.

If you wish us to arrange this kind of a session/seminar at your school/institution, feel free to contact the Chairperson, Statistics Popularization Committee of IASSL through an email to appstatsl@gmail.com. Please also note that this service is provided by the members of the IASSL is purely voluntary and free of charge. We as the IASSL, would like to thank the principal of the Hindu College Colombo for arranging a seminar for the students and inviting us to conduct this session.

CALL FOR PAPERS: SLJAS VOLUME 24

SLJAS is a two star, open-access, international, double-blind peer-reviewed journal published by the Institute of Applied Statistics, Sri Lanka (IASSL). The main purpose of the journal is to publish the results of original work on applications of Statistics and on theoretical and methodical aspects of Statistics. The journal also welcomes critical reviews including conceptual discussions, opinions and book reviews. Applications of Statistics in the area of Agriculture & Forestry, Medical, Dental and Veterinary Sciences, Natural, Physical Sciences, Social Sciences, Economics and Actuarial Science fall within the scope of the journal. The SLJAS publishes three issues annually.
Authors are warmly invited to submit their Original Research Articles, Review Articles, Methodology Articles, Case Studies for publication in **SLJAS Issues of volume 24.**

We also consider publishing of full conference papers as a Special Issue. Please inquire by sending an email to editor@iassl.lk.

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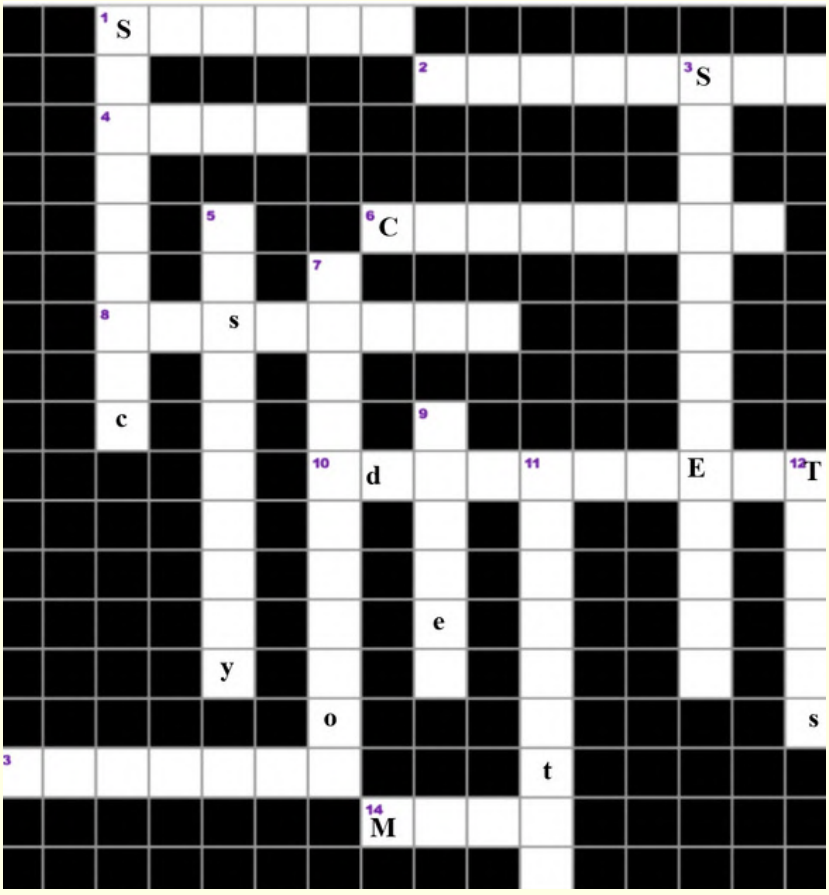
Author guidelines: Authors are encouraged to use latex when preparing the manuscript for submission.
Latex template: Please note that you will need to use overleaf as the text editor with this template. If you are new to overleaf please first create an Overleaf account (https://www.overleaf.com/) and get yourself registered. Then, log-in to your new (or existing) account. After logging-in, click on SLJAS template file. It will open the project file. Make a copy of this entire project by clicking here and rename it as you wish (e.g. your manuscript title). Use the copied (and renamed) file as the template to prepare your paper.
After acceptance the article needs to be formatted using latex if not prepared using latex at submission stage.

Please send your resume to become a Reviewer of SLJAS.

We look forward to receiving your valuable research article. We also request you to encourage your colleagues and students to contribute articles to SLJAS. Feel free to reach us for any query via editor@iassl.lk.

Sudoku Puzzle Competition



Please email your submission to appstatsl@gmail.com on or before 15th of September 2023. The draw will be held on the 30th of September, 2023. Correct submissions will be short listed and the winners will be selected considering the order of submission and will be announced in the Issue 2 2023 IASSL newsletter.

Across

1 In stratified sampling, the subpopulations are called.....
2 Provide an idea about the flatness of the curve.
4 A measure of central tendency with a mathematical base.
6 An event is said to be a ..... event, if it consists of two or more simple events.
8 The variable of interest to be measured using the outcome of an experiment.
10 For any event A, AUA = A and A∩A = A. The law is called as..... law.
13 This distribution is often used to model the frequency with which a specified event occurs during a particular period of time.
14 A measure of central tendency for qualitative data.

Down

1 If mean, median & mode of the distribution are the same then that distribution is .....
3 A measure of the average amount that the regression equation over or under predicts.
5 P(A)≥ 0 for all A in ε. This is known as the axiom of.....
7 A ..... is a selection of items from a collection, such that the order of selection does not matter.
9 Correlation coefficient describes the..... of the relationship using a single value.
11 A numerical term that summarizes or describes a population.
12 In a random experiment, observations of random variables are classified as:

Thank you Ansell Textile Lanka (pvt) Ltd for sponsoring Issue 1 2023 puzzle competition!!

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Ansell is a global leader in protection solutions. Ansell designs, develops and manufactures a wide range of hand and arm protection solutions and clothing. Industrial workers, healthcare professionals and patients, and consumers around the world invariably associate Ansell with premium quality, optimal protection and superior comfort.

If you or your institution wishes to sponsor the puzzle competition in the next issue of our newsletter, please send an email to editor@iassl.lk on or before 15th August 2023.

To appreciate your contribution, we will dedicate a full A4 page in our next newsletter which can be used for promoting your institution.

Congratulations!

Winners of Sudoku Puzzle Competition Newsletter Issue 3 - 2022

- 1st Place Ms. Taniya Fernando
- 2nd Place Ms. Tharuni Kavishka
- 3rd Place Ms. Tenushi Erandi

CONTRIBUTIONS TO THE MAY-AUGUST (ISSUE 2) 2023 NEWSLETTER:

If you have any submissions, comments, suggestions & feedback, please send them to editor@iassl.lk.

WE SINCERELY APPRECIATE ALL WHO CONTRIBUTED TO THIS ISSUE, AND THOSE WHO PARTICIPATED IN THE PREPARATION OF IT.

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