M.Sc. (STATISTICS) PROJECT REPORT

"STATISTICAL ANALYSIS ON INDIAN PREMIER LEAGUE (IPL)"

project report submitted in partial fulfilment of Requirements

BY

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Certificate

This is to certify that, Ms. Kalyani Ravindra Nikam, Ms. Manjusha Dinesh Patil, Ms. Shubhangi Rajendra Patil are the student of M.Sc. Statistics (with specialization in Industrial Statistics) at Pratap College, Amalner have successfully completed their project entitled **"Statistical Analysis on Indian Premier League"** under my guidance and supervision during the academic year 2020-2021.

Place: Amalner
Date:

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ACKNOWLEDGEMENT

We would like to express our sincere thanks to Prof. J.B. Jain, Head of the Department of Statistics, Pratap College, Amalner for seeking us the desire permission for this project.

We take this opportunity to express our sincere of gratitude to our project guide Prof. Kalyani Deshmukh for her valuable guidance, kind suggestion, cooperative and constant encouragement, which enable us to immense support, motivation and encouragement, which we could complete our project work successfully.

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Chapter 1. Introduction

1.1 Motivation

Being students of M.Sc. (Statistics) with specialization in Industrial Statistics, we were interested in knowing sports Statistics. As IPL is quite popular in India and lot of data is available. Also, we got opportunity to analyse cricket data and how to apply statistical tool on the cricket data.

1.2 Introduction to India Premier League (IPL)

The Indian Premier League (IPL) is a professional league for Twenty20 cricket championship in India. It was initiated by the Board of Control for Cricket in India (BCCI), headquartered in Mumbai and is supervised by BCCI Vice President Rajeev Shukla, who serves as the league's Chairman and Commissioner. It is currently contested by nine teams, consisting of players from around the world. It was started after an altercation between the BCCI and the Indian Cricket League

In 2010, IPL became the first sporting event ever to be broadcast live on YouTube in association with India times. Its brand value is estimated to be around US$2.99 billion in fifth season.

The IPL works on a franchise-system based on the American style of hiring players and transfers. These franchises were put for auction, where the highest bidder won the rights to own the team, representing each city. The auction for the same took place on January 24, 2008 and the total base price for the auction was $400 million. The auction went on to fetch $723.59 million.

The Mumbai franchise owned by Mukesh Ambani ‘s Reliance Industries Limited (RIL) was the most expensive franchise - fetching $111.9 million closely followed by Vijay Mallya’s United Breweries which paid $111.6 million for the Bangalore franchise. Media house Deccan Chronicle won the Hyderabad chapter of the IPL for $107 million, while India Cements Chennai franchise cost $91 million.

Bollywood also made its presence felt with two of its leading stars bagging the ownership of their respective teams - Shah Rukh Khan and Juhi Chawla ‘s Red Chillies Entertainment buying out Kolkata for $75.09, while Preity Zinta and herbeau Ness Wadia bought the Mohali team for $76 million.

GMR, the infrastructure development group which who are involved in a project for revamping the Delhi airport, bagged the ownership of the Delhi team for $84 million and the Emerging Media, consisting of its CEO Fraser Castellino, Manoj Badale and Lachlan Murdoch and other investors won the rights for the Jaipur franchise for $67 million.
On 21 March 2010, Pune and Kochi were unveiled as the two new franchises for the fourth edition of the Indian Premier League. The base price was $225 million. While Pune was bought by Sahara Adventure Sports Group for $370 million, the Kochi franchise was bought by Rendezvous Sports World Limited for $333.3 million. The process was to have been completed on 7 March but was postponed by two weeks after many bidders and the BCCI objected to stiff financial clauses. The second franchise auction fetched total $703 million.
Over 200 million Indian viewers, 10 million international viewers, 4 million live spectators: the Indian Premier League (IPL) is a sports and entertainment revolution in the making, surpassing all records of viewership on ground and on media. Advertising revenue and ticket sales have exceeded all expectations, making IPL highly profitable for the organizers, broadcasters and successful team owners. Zealous fan following—even hostility for visiting teams—shows local loyalties are building up faster than anyone expected.

1.3 IPL Teams

CHENNAI SUPER KINGS:

Chennai Super Kings (often abbreviated as CSK) is a franchise cricket team based in Chennai, Tamil Nadu that plays in the Indian Premier League. Founded in 2008, the team is currently captained by Mahendra Singh Dhoni and coached by Stephen Fleming, a former New Zealand cricketer. The team's home ground is the M. A. Chidambaram Stadium (often referred to as Chepauk) located in Chennai. Chennai Super Kings is the most successful team in the Indian Premier League team so far. The team has won the IPL title twice in succession (2010 and 2011) and reached the play-offs every season. They were also the first Indian team to have won the Champions League Twenty20.

DECCAN CHARGERS:

Deccan Chargers known in short as DC is a cricket franchise based in the city of Hyderabad in the Indian Premier League. They, after finishing last in the first season of the IPL, won the second season held in South Africa in 2009, under the captaincy of former Australian wicketkeeper batsman Adam Gilchrist. Gilchrist was the captain of the team for the first three seasons of the IPL. From the fourth season, Kumar Sangakkara has been leading the team and Cameron White has been playing as his deputy. The team is coached by Darren Lehmann, former Australian cricketer. The Deccan Chargers franchise is owned by the Deccan Chronicle Holdings Limited.

DELHI DAREDEVILS:

Delhi Daredevils is the Delhi franchise of the Indian Premier League in cricket. The franchise is owned by the GMR Group. Founded in 2008, the team is currently captained by Virender Sehwag and coached by former South African cricketer Eric Simons. They play all their home matches at the historic Feroz Shah Kotla Ground. Virender Sehwag has been accorded the icon player status in the Delhi Daredevils team and was also the captain of the side during the first two seasons. However, he resigned and passed on the leadership to his opening partner Gautam Gambhir for the 2010 season. But after Gambhir left the team for Kolkata Knight Riders in the fourth edition, Sehwag was once again given the duty to captain the team. Delhi Daredevils renamed as Delhi Capitals, Shreyas Iyer was captain in IPL 2019.

KINGS XI PUNJAB:

Kings XI Punjab is a cricket franchise based in Mohali, Punjab in the Indian Premier League. It is Captained by Ravichandran Ashwin. KXIP finished 6th in the IPL and did not qualify for the playoffs. The team plays its home matches at the PCA Stadium, Mohali. Since 2010 IPL, they have been playing some of their home games at Dharamsala. The first owners of the franchise included Preity Zinta, Karan Paul (Apeejay Surendera Group) and Mohit Burman (Dabur).

KOLKATA KNIGHT RIDERS:

Kolkata Knight Riders (often abbreviated as KKR) is a cricket franchise representing Kolkata in the Indian Premier League and owned by Bollywood actor Shah Rukh Khan's company Red Chillies Entertainment in partnership with actress Juhi Chawla and her husband Jay Mehta from the Mehta Group. The team was captained by Dinesh Karthik and coached by Jacques Kallis. The bowling legend, Wasim Akram is the team's bowling consultant and mentor. Sourav Ganguly, who was the team's Icon Player for the first three seasons, captained the side in the first and third seasons of the tournament while Brendon McCullum led the team in the intervening period. The team won its first title in 2012 by defeating defending champions Chennai Super Kings by 5 wickets at their home ground in Chennai. The official theme of the team is Korbo, Lorbo, Jeetbo Re (We will do it, Fight for it, win it) and the official colours are purple and gold.

MUMBAI INDIANS:

Mumbai Indians is a franchise cricket team representing the city of Mumbai in the Indian Premier League. The team is one of the eight founding members of the IPL in 2008. Mumbai Indians is currently led by Rohit Sharma and coached by Mahela Jayawardene. They are one of the main teams in the city, together with clubs like the Mumbai cricket team and football club Mumbai FC. The team is owned by India's biggest conglomerate, Reliance Industries, through its 100% subsidiary India Win Sports.

PUNE WARRIORS INDIA:

Pune Warriors India is a franchise cricket team that plays in the Indian Premier League (IPL) representing the city of Pune, Maharashtra. The team is one of two new franchisees added to the Indian Premier League (IPL) for the 2011 season, alongside the Kochi Tuskers Kerala. On 21 March 2010, Sahara Adventure Sports Limited made the winning bid of $370 million (approximately Rs 1900 crore) for the Pune franchise. The bid is the highest bid by any company in the short history of IPL. The Videocon Group lost the bid for the Pune IPL Team. Sourav Ganguly, the former captain of Pune warriors India, serves as the mentor of the team. Former South African pacer Allan Donald is the bowling coach of the team. The team's home ground is the newly-constructed Subrata Roy Sahara Stadium in Pune.

RAJASTHAN ROYALS:

Rajasthan Royals is an Indian Premier League franchise based in the city of the Jaipur. It was captained by former captain Steve Smith. They won the inaugural edition of the Indian Premier League under the captaincy of former Australian spin-legend Shane Warne. In 2010, they were terminated by the BCCI for a brief period for violations in terms of agreement but were allowed to play in the league soon after the Board lost the case in the Supreme Court. Rajasthan Royals were the least active franchise during the players' auction. The team didn't have a designated icon player, which saved a lot of cap space for the franchise.

ROYAL CHALLENGERS BANGALORE:

Royal Challengers Bangalore (often abbreviated as RCB) is a cricket team based in Bangalore that plays in the Indian Premier League. The team is led by Virat Kohli and coached by Gary Kristen. The team is owned by Vijay Mallya, through his flagship firm UB Group. The director of the team is Siddharth Mallya. The team won only 4 matches in the inaugural season, losing 10 matches and finishing second from the bottom in the table. RCB plays all its home matches at the M. Chinnaswamy Stadium.

KOCHI TUSKERS KERALA (NOW DEFUNCT):

Kochi Tuskers Kerala was a franchise cricket team that played in the Indian Premier League (IPL) representing the city of Kochi, Kerala. The team was one of two new franchisees added to the Indian Premier League (IPL) for the 2011 season, alongside the Pune Warriors India. The team franchise was owned by Kochi Cricket Pvt Ltd., which was a consortium of multiple companies. On September 19, 2011, the BCCI announced that the Kochi Tuskers Kerala IPL franchise was terminated for breaching its terms of agreement.

Rising Pune Supergiant:

Rising Pune Supergiant was a franchise cricket team based in Pune, Maharashtra, that played in the IPL in 2016 and 2017. It was the second team representing Pune after Pune Warriors. The team along with Gujrat Lions featured as two-season replacements for Chennai Super kings and Rajasthan Royals, who were suspended due to their involvement in illegal betting by their respective owners. The Rising Pune Supergiant franchise is owned by RP-Sanjiv Goenka Kapoor controlled by Sanjiv Goenka The team name was announced (as *Rising Pune Supergiant*) on 18 January 2016 by Goenka in Kolkata and Raghu Iyer was appointed CEO. The owners changed the team name to *Rising Pune Supergiant* on 26 March 2017. The team lost the 2017 IPL final to Mumbai Indians by 1 run, which was the team's last game in the IPL

Sunrisers Hyderabad:

Sunrisers Hyderabad are a franchise cricket team based in Hyderabad, Telangana, India, that plays in the IPL. The franchise is owned by Kalanithi Maran of the SUN Group and was founded in 2012 after the Hyderabad-based Deccan Charges were terminated by the IPL. The team is currently captained by Kane Williamson and coached by Trevor Bayliss Their primary

home ground is the Rajiv Gandhi International Stadium, Hyderabad which has capacity of 55,000. The team made their first IPL appearance in 2013, where they reached the playoffs, eventually finishing in fourth place. The Sunrisers won their maiden IPL title in the 2016 season, defeating the Royal Challengers Bangalore by 8 runs in the final. The team has qualified for the play-off stage of the tournament in every season since 2016. In 2018, the team reached the finals of the Indian Premier League, but lost to Chennai Super Kings.

Gujarat Lions:

Gujrat Lions was a franchise cricket team based in the city of Rajkot, that represented Indian state Gujrat in the IPL. The team played in the IPL for 2 years (the 2016 and 2017 seasons) as one of the replacements for Chennai Super Kings and Rajasthan Royals, who were both suspended for two seasons due to illegal betting by their respective owners. The franchise was owned by Intex Technologies.

1.4 History and Background of Formation of the IPL

Kerry Francis Bullmore Packer, AC (17 December 1937 – 26 December 2005), was an Australian media tycoon whose family company owned controlling interests in both the Nine television network and leading Australian publishing company Australian Consolidated Press. Packer was best known for founding World Series Cricket. In 1977 the Nine Network cricket rights deal led to a confrontation with the cricket authorities, as top players from several countries rushed to join him at the expense of their international sides. Packer‘s aim was to secure broadcasting rights for Australian cricket, and he was largely successful. Many of the well-known cricketers of that period left their national team to play in Kerry Packer‘s World Series cricket. Some of our legendry cricketers also contacted to play in that series. But due to some controversies, mainly with Australian board due to television rights, this league could not be successful.

On the background of this idea, Zee Entertainment Enterprises organized a league called Indian cricket league. The **Indian Cricket League** (**ICL**) was a private cricket league funded by Zee Entertainment Enterprises that operated between 2007 and 2009 in India. In Its two seasons included tournaments between four international teams (The World XI, India, Pakistan and Bangladesh) and nine domestic teams notionally located in major Indian cities as well as the champions Lahore Badshah’s who were based in Lahore, Pakistan. The matches were played in the Twenty20 format. Zee T.V owner Subhash Chandra founded this league in the response of BCCI‘s some of working style. Many times, Subhash Chandra give bid for television rights but every time he was rejected even if his bid was the highest. This results in formation of Indian Cricket League (ICL). But due to some reasons this league could not be successful. Some of reasons are commercial factors, lacking of the support of the BCCI and ICC.

The ICL was set up with a billion-dollar Indian Rupee corpus, and was to initially comprise six teams playing Twenty20 cricket, with plans to expand to sixteen teams within three years and to eventually move to 50-over matches. These plans, if they had been realised, would have made the ICL the richest professional league in India. On 24 July 2007, some famous international names were announced to have signed to play in the ICL, including highest innings record-holder Brian Lara.
The BCCI refused to recognise the ICL as a cricket league, and criticised Kiran More and Kapil Dev for joining the ICL. On August 21, 2007 Kapil Dev was sacked from his NCA post. The International Cricket Council gave a statement through its chief executive, Malcolm Speed, that the ICC would not recognize the ICL unless the BCCI chooses to recognise it

Faced with the threat of young players joining the ICL, the BCCI jacked up prize money for winners, runners-up and losing semi-finalists across all tournaments. An average domestic cricketer can hope to make around Rs 35,000 per match day from the season of 2007-08: more than double the Rs 16,000 they got in 2005-06. The BCCI has also planned to do away with honorary selectors, who will be paid professionals from September 2008 onwards.
Then BCCI started its own international Twenty20 league. The official league, which was launched in April 2008, was called the Indian Premier League Twenty20.

1.5 Objectives

The project study tends to follows and achieve following objective:

1. To study the factors responsible for the winning or loosing
2. Estimating Winning and losing Proportions for each team
3. To give ranking to all batsman and bowlers of IPL
4. Season wise comparison of IPL seasons
5. Impact of toss decision/Home ground on match result

1.6 Scope of project

The project was conceived with the objective of understanding to check the performance of players and teams and to choose player according to ranking based on previous performance with the help of this information teams choose any one player in next season.

Chapter 2. Data Description

2.1 Introduction

We have collected the information with the secondary information source information of the IPL (www.kaggle.com/datasets) and from www.iplt20.com. We have tried best level for doing various analyses for making the project effective with available data. Extensive research was carried out for the successful completion of this project. Secondary data were collected from various sources. The secondary data in this study is collected from various websites. Analysis and others parts are done on the basis of these secondary data and knowledge collected from the Internet.

In this project, past 13-year data (2008-2020) of IPL. The data containing the players information such as match details, team details, record details etc.

2.2 Parameters

For Batsman

1. **Runs:** The total number of scored by a player in the IPL 2008 to 2020 seasons. Higher values indicate stronger performance.

2. **Batting Average:** The total number of runs a batsman has scored divided by the total number of times he has been called out in the IPL 2008 to 2019 seasons. Higher values indicate stronger performance. However, for a batsman with several “not out “cases, this number overrates the batsman, which is weakness in this measure, and this is why it should not be used as the only variable for batting performance analysis.

3. **Batting Strike rate (SR=(Runs/Balls) *100):** The batting strike rate is defined as the number of runs scored per 100 balls faced by a batsman in the IPL 2008 to 2019 seasons. Again, higher values indicate stronger performance. An aggressive batting style is always helpful in shorter versions of limited - overs cricket matches like Twenty20. However, a high strike rate accompanying a low batting average is not desirable.

4. **Economy rate (Econ=Runs/(overs bowled):** The average number of runs conceded per over . Lower values are preferred since this is the run – rate against a specific bowler for a batting team. Therefore, the bowler's aim is to keep this measure as small as possible.

5. **Wickets:** The number of wickets taken by bowler. There are ten possible wickets for an inning and there should be at least five bowlers, each of whom can bowl a maximum of four overs. A bowler's goal is to take the maximum number of wickets from the overs that he bowls, so taking a large number of wickets from batsmen is one performance measure for bowlers. However, like the total number of runs statistic for a batsman, the number of wickets taken is not sufficient to measure the quality of bowler. The goal of bowler is to get the maximum number of wickets by using a minimum number of balls while simultaneously conceding a minimum number of runs.

Some of the team composition rules are

- Minimum squad strength of 16 players plus one physio and a coach.
- No more than 11 foreign players in the squad and maximum 4 foreign players should be in the playing 11.
- Minimum of 14 Indian players must be included in each squad.
- A minimum of 6 players from the BCCI under-22 pool in each squad.
- At least seven bowlers will be there for completing the 20 overs of match.
- Of the seven bowlers in the game, six bowl 3 overs and seventh one will bowl the remaining 2 overs.
- For a match to be declared complete, full 40 overs should have been bowled and batted on.
- The batting team can all of their extra players to bat, till the end of 20^{th} over. However, only the first 11 players have the right to bowl and field.
  The batting team can continue to bat till end of the over, even if it has reached the Winning target.

IPL games utilize television timeouts, hence there is no time limit for teams to complete their innings. However, there may be a penalty if the umpires find teams misusing this privilege at their own choice. Additionally, each team is awarded two strategic timeouts of 2:30 each per innings—the teams can take the timeout when instructed, but is necessary to take it from 6th to 9th and 13th to 16th over.

Chapter 3. Graphical Analysis

3.1 Introduction

Exploratory analysis and others parts are done on the basis of these secondary data.

Table 3.1 Teams involve in IPL and their short forms

Team	Short form
Chennai Super Kings	CSK
Delhi Capitals	DC
Gujarat Lions	GL
Kings XI Punjab	KXIP
Kochi Tuskers Kerala	KTK
Kolkata Knight Riders	KKR
Mumbai Indians	MI
Pune Warriors	PW
Rajasthan Royals	RR
Rising Pune Supergiant	RPS
Royal Challengers Bangalore	RCB
Sunrisers Hyderabad	SRH

- In 2017, “Rising Pune Supergiant’s” name change as “Rising Pune Supergiant”.
- In 2019, “Delhi Daredevils” name change as “Delhi Capitals”.

```
In [1]: import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        import numpy
        import seaborn as sns
        import random
        data=pd.read_csv("C:\\Users\\shubh\\Desktop\\Project\\matches.csv")
        data
```

```
In [10]: data.team1.replace({"Rising Pune Supergiant":"Rising Pune Supergiants"},inplace = True)
         data.team2.replace({"Rising Pune Supergiant":"Rising Pune Supergiants"},inplace = True)
         data.team1.unique()
         data.team2.unique()

Out[10]: array(['Royal Challengers Bangalore', 'Rising Pune Supergiants',
                'Kolkata Knight Riders', 'Kings XI Punjab', 'Delhi Daredevils',
                'Sunrisers Hyderabad', 'Mumbai Indians', 'Gujarat Lions',
                'Rajasthan Royals', 'Chennai Super Kings', 'Deccan Chargers',
                'Pune Warriors', 'Kochi Tuskers Kerala', 'Delhi Capitals'],
               dtype=object)
```

```
In [12]: data.team1.replace({"Delhi Daredevils":"Delhi Capitals"},inplace = True)
         data.team2.replace({"Delhi Daredevils":"Delhi Capitals"},inplace = True)
         data.team1.unique()
         data.team2.unique()
```

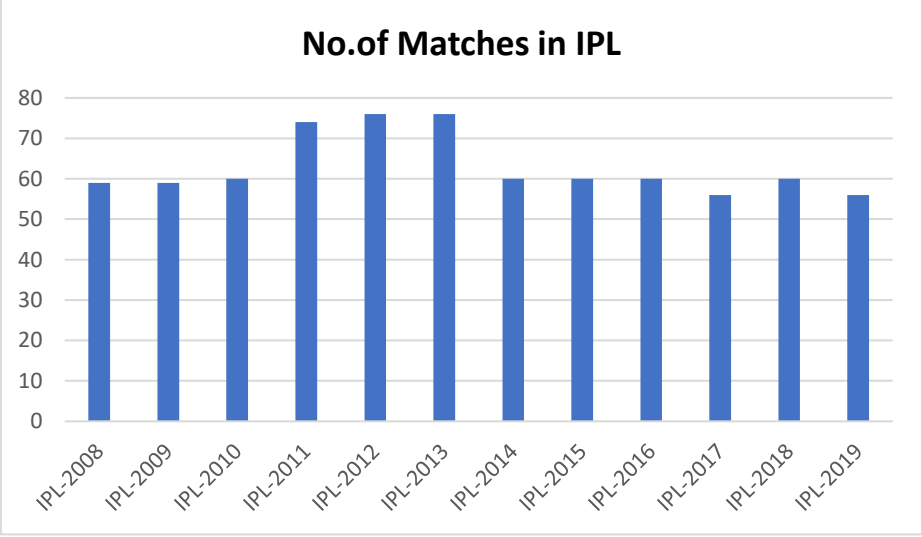
```
Out[12]: array(['Royal Challengers Bangalore', 'Rising Pune Supergiants',
                 'Kolkata Knight Riders', 'Kings XI Punjab', 'Delhi Capitals',
                 'Sunrisers Hyderabad', 'Mumbai Indians', 'Gujarat Lions',
                 'Rajasthan Royals', 'Chennai Super Kings', 'Deccan Chargers',
                 'Pune Warriors', 'Kochi Tuskers Kerala'], dtype=object)
```

In all Analysis we use recent name of teams only.

Table 3.2

Season	Matches
IPL-2008	59
IPL-2009	59
IPL-2010	60
IPL-2011	74
IPL-2012	76
IPL-2013	76
IPL-2014	60
IPL-2015	60
IPL-2016	60
IPL-2017	56
IPL-2018	60
IPL-2019	56
Total Matches	**756**

Fig.3.1



Conclusion: In Fig 3.1 shows that the no. of matches played from season 2008 to 2019 is 756 and also added that in season 2012 and 2013 highest no. of matches played that is 76.

Table 3.3 teams and their total wins

Team	Wins
MI	109
CSK	98
KKR	92
RCB	83
KXIP	81
RR	75
DD	66
SH	56
DC	29
RPS	15
GL	13
PW	12
DC	10
KTK	6
Total Matches	**745**

In [27]:
```
most_no_of_wins = data.groupby('winner').apply(lambda x: x).reset_index()
most_no_of_wins = most_no_of_wins.groupby('winner').count()
most_no_of_wins = most_no_of_wins.city.reset_index(name='No_Of_Wins')
most_no_of_wins = most_no_of_wins.sort_values(by='No_Of_Wins',ascending=False)

plt.title("Most Number Of Wins")
plt.bar(most_no_of_wins.winner , most_no_of_wins.No_Of_Wins)
plt.xlabel("Teams")
plt.ylabel("No of  Wins")
count = 0
for i in most_no_of_wins.No_Of_Wins:
    plt.text(count-0.2,i-4,str(i))
    count+=1
plt.xticks(rotation = 90)
plt.yticks()
plt.show()
```

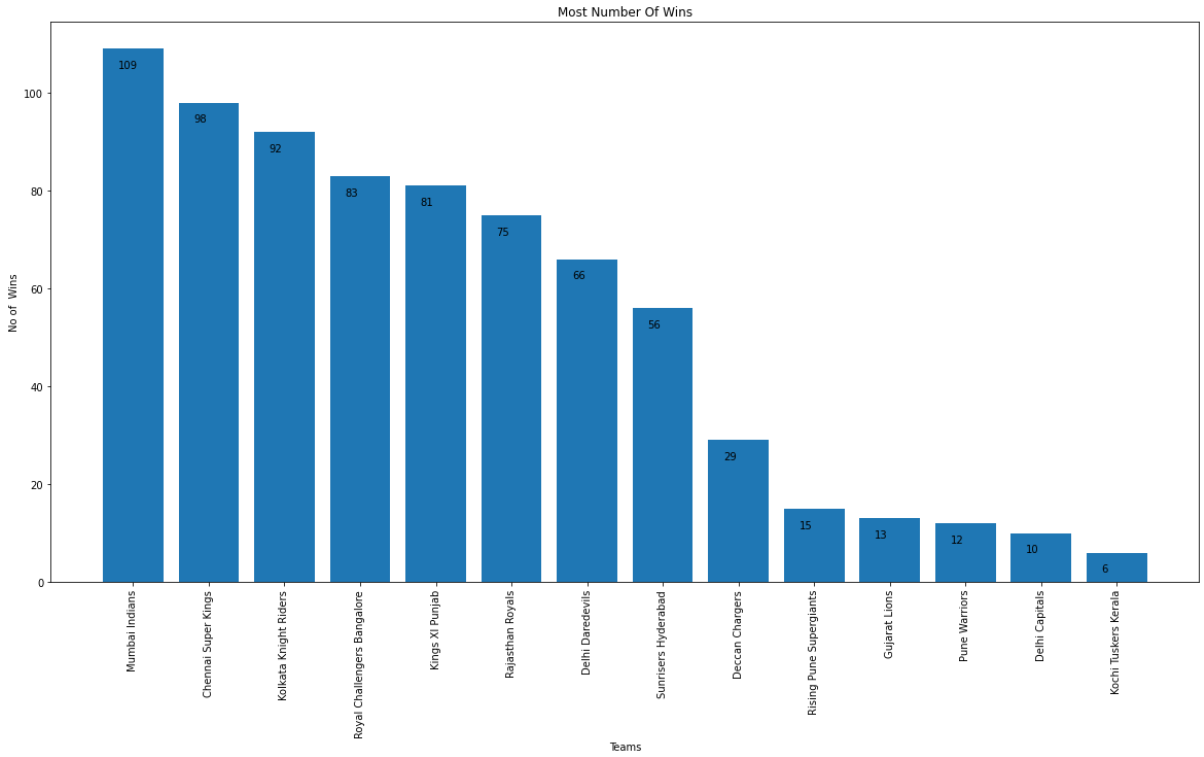


Fig.3.2

Conclusion: In Fig 3.2 clearly say that in season 2008-19 Mumbai Indians win highest matches is 109 and Kochi Tuskers Kerala win lowest is 6.

Venues that host the most number of matches

```
In [21]: plt.rcParams["figure.figsize"] = (20, 10)
         plt.title('Venues that hosted the most number of matches', size =30)
         plt.xlabel('Venues',size =25)
         plt.ylabel('Number of matches',size =25)
         plt.xticks(rotation=90,size = 15)
         plt.yticks(size = 15)
         count = 0
         for i in req_values['Match Counts']:
             plt.text(count,i+1,str(i),color='black',size=15)
             count+=1
         plt.bar(req_values['city'],req_values['Match Counts'])
         plt.show()
```

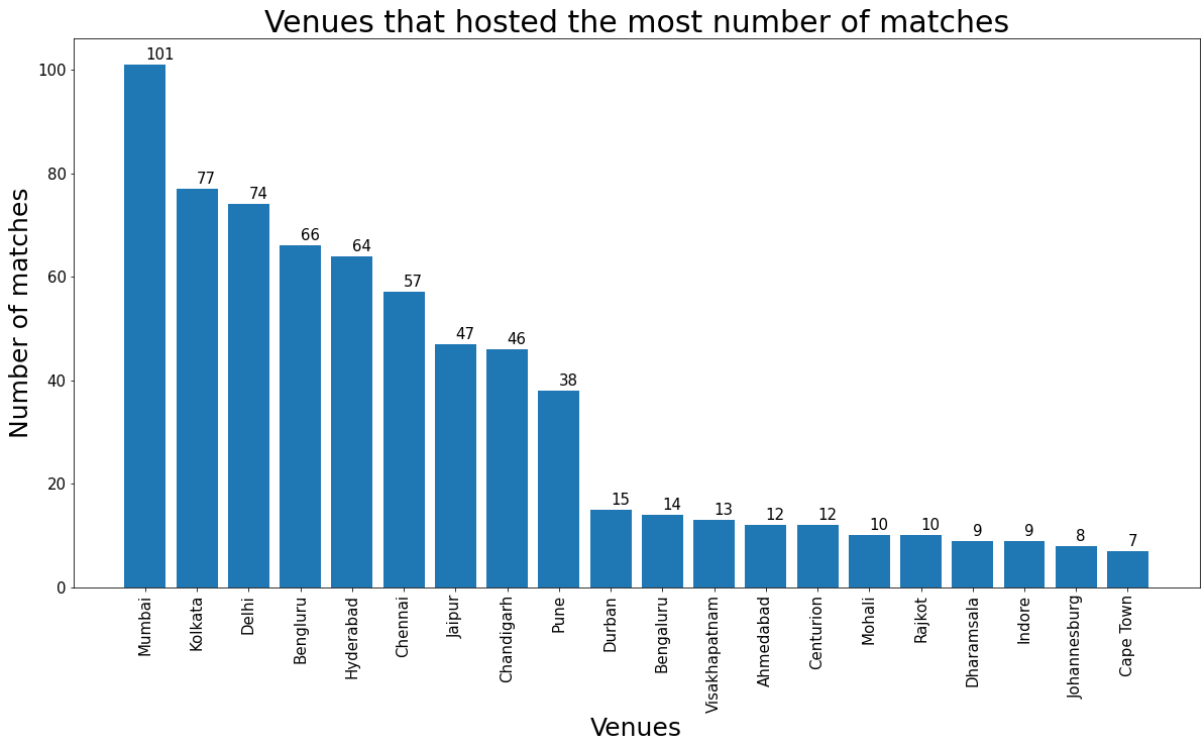


Fig.3.3

Conclusion: From Fig.3.3 clearly says that most number of matches hosted in Mumbai and less in Cape Town.

Table 3.4 total matches played by each team and their win and lost probabilities.

Team	CSK	DC	GL	KXIP	KTK	KKR	M1	PW	RR	RPS	RCB	SH
Matches	164	177	30	176	14	178	187	46	147	30	180	108
Win	100	77	13	82	6	92	109	12	75	15	84	58
Lost	64	100	17	94	8	86	78	34	72	15	96	50
Winning Proportion	0.61	0.44	0.43	0.47	0.43	0.52	0.58	0.26	0.51	0.50	0.47	0.54
Lossing Proportion	0.39	0.56	0.57	0.53	0.57	0.48	0.42	0.74	0.49	0.50	0.53	0.46

Conclusion: In this Fig 3.3 the winning probability of CSK is 61 % and second is MI is 58 %, similarly losing probability of PW is 74 % is most.

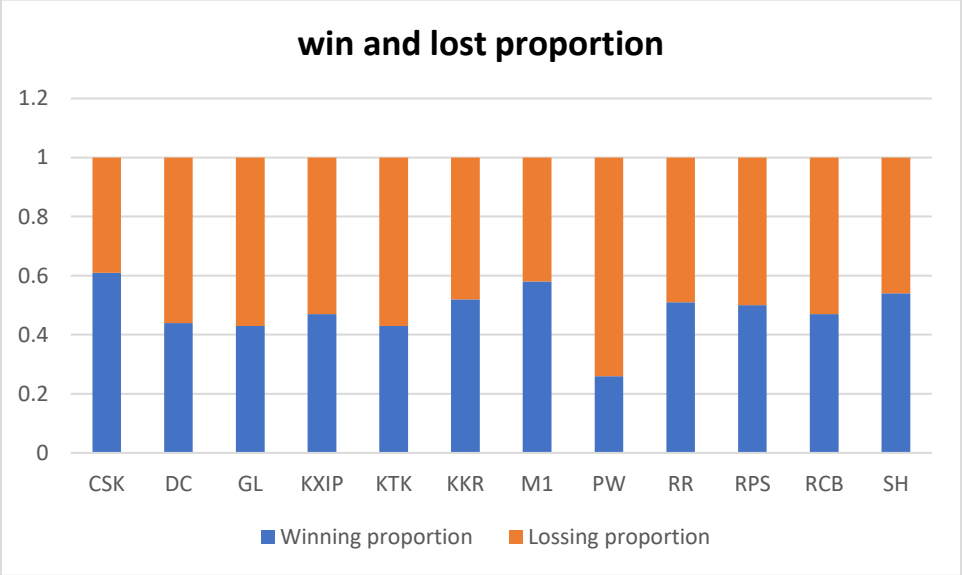


Fig.3.4

```
In [19]: data1 = pd.read_csv('C:\\Users\\shubh\\Desktop\\Project\\files\\deliveries.csv')
         data1.head()
```

	match_id	inning	batting_team	bowling_team	over	ball	batsman	non_striker	bowler	is_super_over	...	bye_runs	legbye_runs	noball_runs	penalty_ru
0	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	1	DA Warner	S Dhawan	TS Mills	0	...	0	0	0	
1	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	2	DA Warner	S Dhawan	TS Mills	0	...	0	0	0	
2	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	3	DA Warner	S Dhawan	TS Mills	0	...	0	0	0	
3	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	4	DA Warner	S Dhawan	TS Mills	0	...	0	0	0	
4	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	5	DA Warner	S Dhawan	TS Mills	0	...	0	0	0	

5 rows × 21 columns

```
In [26]: # Best Fielder
bf = data1.groupby('fielder').apply(lambda x : x).reset_index()
bf = data1.groupby('fielder').count()
bf = bf.dismissal_kind.reset_index(name='Dismissals')
bf = bf.sort_values(by='Dismissals',ascending=False)
bf = bf[0:10]

plt.title("Best IPL Fielders")
plt.bar(bf.fielder , bf.Dismissals)
plt.xlabel("Best Fielders")
plt.ylabel("No of  Dismissals")
count = 0
for i in bf.Dismissals:
    plt.text(count-0.2,i-4,str(i))
    count+=1
plt.xticks(rotation = 90)
plt.yticks()
plt.show()
```

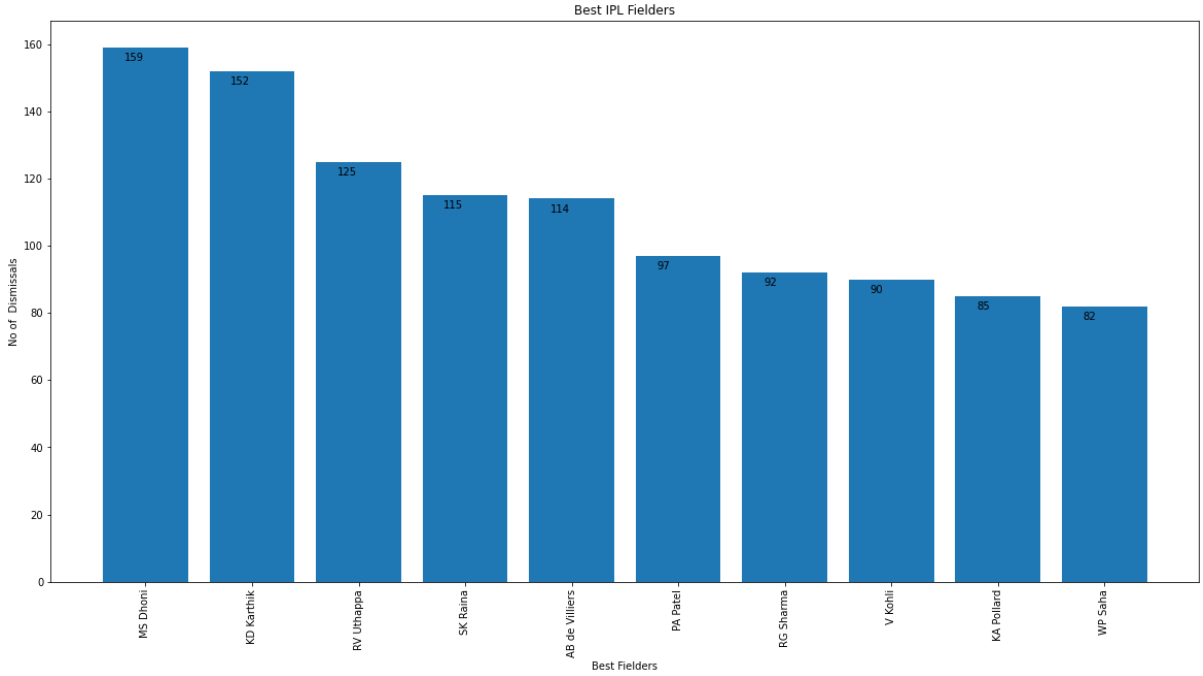


Fig.3.5

Conclusion: In Fig.3.4 the best fielder is MS Dhoni with 159 Dismissals and second KD Karthik with 152 Dismissals.

Table 3.5 Players with Number of times man of match award

Players	Country	Players Roll	No. of times man of the match
CH Gayle	West Indies	Batsman	21
AB de Villiers	South Africa	Batsman/wicket keeper	20
DA Warner	Australia	Batsman	17
MS Dhoni	India	Batsman/wicket keeper	17
RG Sharma	India	Batsman	17
YK Pathan	India	All Rounder	16
SR Watson	Australia	All Rounder	15
SK Raina	India	All Rounder	14
G Gambhir	India	Batsman	13
AM Rahane	India	Batsman	12
MEK Hussey	Australia	Batsman	12
V Kohli	India	Batsman	12
A Mishra	India	Bowler	11
AD Russell	West Indies	All Rounder	11
DR Smith	West Indies	Batsman	11
V Sehwag	India	Batsman	11
JH Kallis	South Africa	All Rounder	10
KA Pollard	West Indies	All Rounder	10

In [29]:
```
#man of the match#MOM#
mom = data.groupby('player_of_match').apply(lambda x: x).reset_index()
mom = mom.groupby('player_of_match').count()
mom = mom.city.reset_index(name='No_Of_Awards')
mom = mom.sort_values(by='No_Of_Awards',ascending=False)
mom = mom.head(18)

plt.title("Most Number Of MOM Awards")
plt.bar(mom.player_of_match , mom.No_Of_Awards)
plt.xlabel("Name")
plt.ylabel("No of  Awards")
count = 0
for i in mom.No_Of_Awards:
    plt.text(count-0.2,i,str(i))
    count+=1
plt.xticks(rotation = 90)
plt.yticks()
plt.show()
```

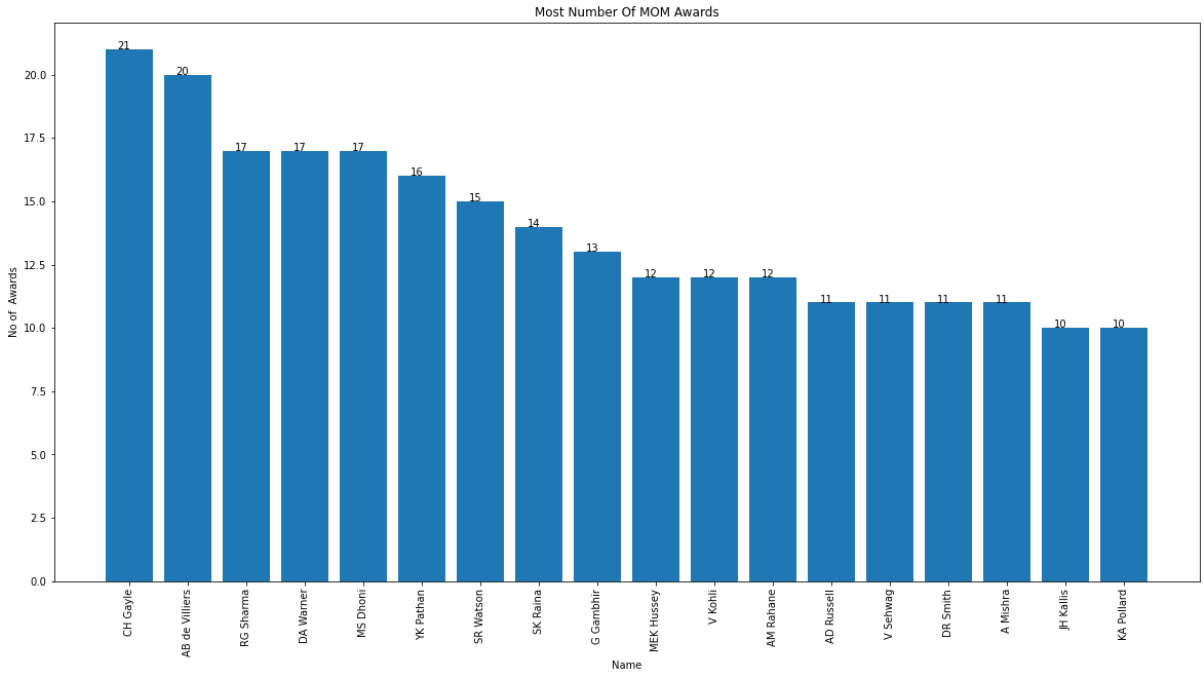


Fig.3.6

Conclusion: The maximum number of times man of the match is CH Gayle (21) second most is AB de Villiers (20).

Table 3.6 season wise winner of the IPL

Season	Team 1	Team 2	Winner	Totals
IPL-2008	RR	CSK	RR	1
IPL-2009	SH	RCB	SRH	1
IPL-2010	MI	CSK	CSK	1
IPL-2011	CSK	RCB	CSK	2
IPL-2012	CSK	KKR	KKR	1
IPL-2013	CSK	MI	MI	1
IPL-2014	KKR	KXIP	KKR	2
IPL-2015	CSK	MI	MI	2
IPL-2016	SRH	RCB	SRH	2
IPL-2017	RP	MI	MI	3
IPL-2018	CSK	SRH	CSK	3
IPL-2019	MI	CSK	MI	4

Fig.3.7

Conclusion: In this Fig.3.4 the Mumbai Indians is the highest win IPL season that is 4 out of 12 seasons. after that second no. is Chennai super kings that is 3.

Chapter 4. Statistical Technique

4.1 Principal component analysis

Introduction

Principal component Analysis (PCA) is a nonparametric variable reduction technique well – suited for correlated data that can be effectively used in context. One objective of principal component analysis is to collapse a set of correlated variables into fewer uncorrelated variables as linear combinations of the original variables. Readers can find excellent introductions to Principal Component Analysis in the works of Johnson and Wichern (2007), Dawkins (1989), and Watnik and Levine (2001). PCA is particularly useful when data on a number of useful variables has been gathered, and it is plausible that there is some redundancy in those variables. Here, redundancy the take to mean that our cricket performance variables are correlated with one another because, in some unknown sense, they might be measuring similar player performance attributes. PCA aims to reduce the observed variables down to a smaller number of principal components, sometimes called auxiliary variables, which account for most of the variation occurring in the originally observed variables. Briefly, given a random vector X= (X1, X2, ……, XP)^t consisting pf p random variables, having covariance matrix Σ and eigen value-eigen vector pairs (λ_1,e_1), (λ_2,e_2),….,(λ_p,e_p), Where $\lambda_1 \geq \lambda_2 \geq \lambda_p \geq 0$,the i^{th} principal component, say Li = $e_i^t x = e_i^t x_1 + e_{i2}x_2 + \ldots E_{ip}x_p$ for i =1,2,…., p Where (e_{i1},e_{i2},…..e_{ip}) are the components of eigen vector e_i^t. From this, it can be seen that the principal components are linear combinations of the original random variables of interest.

A principal component analysis is concerned with explaining the variance covariance structure of a set of variables through a few linear combinations of these variables. In general objects are i) Data reduction ii) Interpretation

We take reference from Journal of **Statistics Education volume 21, Number3 (2013), by Ananda B.W. Manage and Stephen M.** This analysis includes all batsmen who have played at least 90 innings and scored at least 1550 runs. Total 50 batmen Average (Ave), Batting strike rate (SR), fours, sixes, 100's, 50's are the variable taken for this analysis.

Now, the variables taken for study are measured on very diff. scales so they must standardize before PCA analysis.

For the given data for bowlers and batsman instead of varibles name we use short form of variables:

- Number of Mathches Mats
- Number of Innings inngs
- Runs conced Runs
- Average of batting/bowling Avg
- Strike Rate batting SR
- Number of Centuries 100s
- Number of Fifties 50s
- Number of Fours and sixes 4s and 6s
- Number of Wickets taken wkts
- Economy of bowlers Ecno

Principal components analysis for Batting

Table 4.1 includes all batsmen who have played at least 90 innings and scored at least 1550 runs. Total 50 batmen Average (Ave), Batting strike rate (SR), fours, sixes, 100's, 50's are the variable taken for this analysis.

Batman	**Mats**	**Inn**	**Runs**	**Ave**	**SR**	**100s**	**50s**	**4s**	**6s**
V Kohli	192	184	5878	38.16	130.73	5	39	503	201
SK Raina	193	189	5368	33.34	137.11	1	38	493	194
DA Warner	142	142	5254	42.71	141.54	4	48	510	195
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Williamson	52	52	1619	39.48	134.8	0	15	136	54
NV Ojha	94	94	1554	20.72	118.35	0	6	121	79

Histogram of Runs, Ave, SR, 100,50,4s,6s

Histogram of Runs, Ave, SR, 100,50,4s,6s

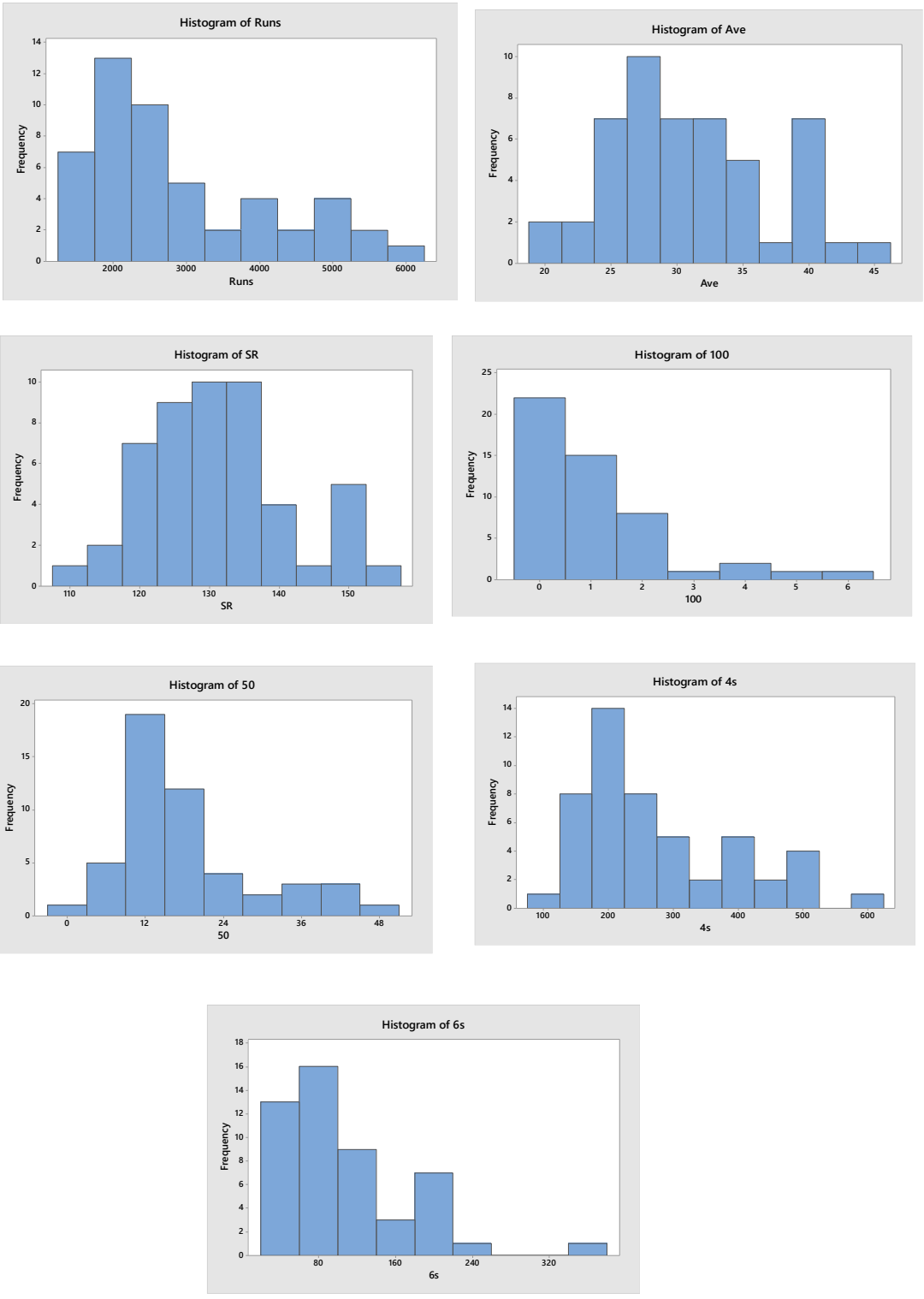


Fig.4.1

Matrix plot of Runs, Ave, SR, 100, 50, 4s, 6s

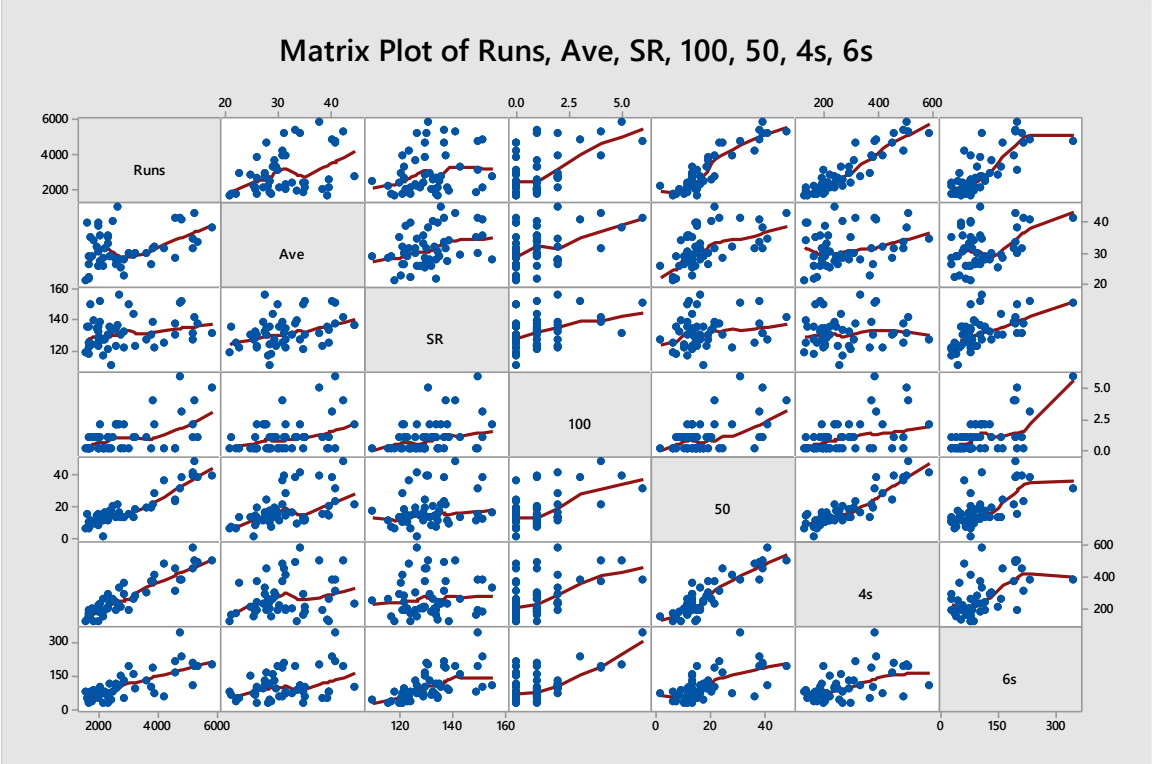


Fig.4.2

Scree plot for Runs, SR, 100,50,4s…

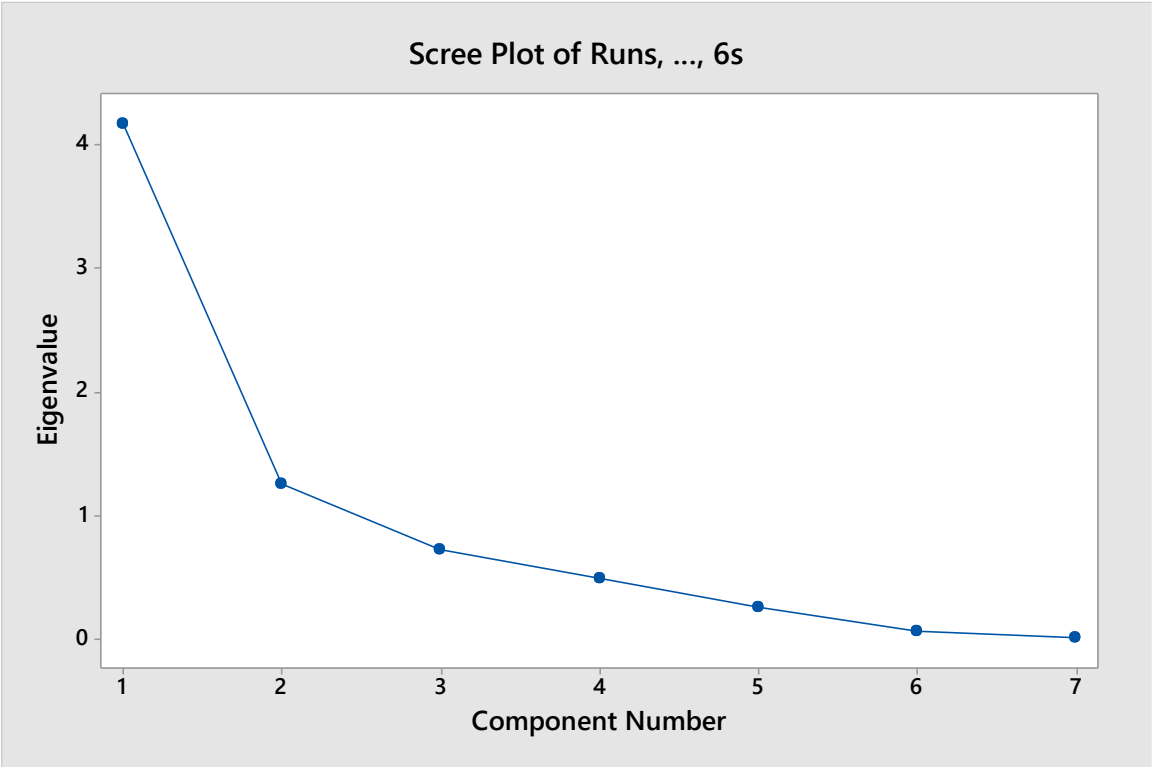


Fig.4.3

Table 4.2 Correlation matrix

	Runs	Ave	SR	100	50	4s	6s
Runs	1	0.37	0.228	0.545	0.907	0.918	0.755
Ave	0.37	1	0.356	0.422	0.534	0.246	0.385
SR	0.228	0.356	1	0.394	0.218	0.089	0.594
100	0.545	0.422	0.394	1	0.536	0.483	0.628
50	0.907	0.534	0.218	0.536	1	0.884	0.622
4s	0.918	0.246	0.089	0.483	0.884	1	0.513
6s	0.755	0.385	0.594	0.628	0.622	0.513	1

The variables taken for study are measured on very diff. scales so they must standardize before PCA analysis.

Table 4.3 Eigen analysis of the Correlation Matrix

Eigenvalue	4.174	1.258	0.728	0.493	0.262	0.06	0.01
Proportion	0.596	0.18	0.104	0.07	0.038	0.009	0.003
Cumulative	0.596	0.776	0.88	0.951	0.988	0.997	1

Table 4.4 Principal component score for batsman

Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Runs	0.454	0.273	-0.121	0.156	-0.17	-0.318	-0.742
Ave	0.283	-0.305	0.859	0.085	-0.12	-0.249	0.072
SR	0.228	-0.686	-0.282	0.368	0.503	-0.018	-0.098
100	0.362	0.206	-0.067	-0.889	0.155	0.032	-0.08
50	0.447	0.253	0.183	0.166	0.15	0.808	-0.009
4s	0.405	0.443	-0.096	0.076	0.4	-0.425	0.533
6s	0.409	0.243	-0.348	0.094	-0.705	0.045	0.38

Therefore, the first principal component for batsmen is

L1= 0.454*Runs+0.283*Ave+0.228*SR+0.362*100s+0.447*50s+0.405*4s+0.409*6s

Where the variables Runs, Ave, SR, 100s, 50s, 4s, 6s have already been standardized

Table 4.5 Top Ten Batsmen Using First Principal Component

Players	Mat	Inns	Runs	Ave	SR	100	50	4s	6s	L1
CH Gayle	132	131	4772	41.13	150.11	6	31	383	349	5.308
DA Warner	142	142	5254	42.71	141.54	4	48	510	195	5.045
V Kohli	192	184	5878	38.16	130.73	5	39	503	201	4.165
AB de Villiers	169	156	4849	40.4	151.91	3	38	390	235	4.165
SK Raina	193	189	5368	33.34	137.11	1	38	493	194	3.263
S Dhawan	176	175	5197	34.41	126.87	2	41	591	108	3.263
RG Sharma	200	195	5230	31.31	130.61	1	39	458	213	3.010
SR Watson	145	141	3874	30.99	137.91	4	21	376	190	2.225
MS Dhoni	204	182	4632	40.99	136.75	0	23	313	216	1.970
RV Uthappa	189	182	4607	27.92	129.99	0	24	454	163	1.380

Table 4.6 Batsmen Ranking B

Rank	Batsman	L1	Rank	Batsman	L1
1	**CH Gayle**	5.3083	26	**M Vijay**	-0.7322
2	**DA Warner**	5.046	27	**Yuvraj Singh**	-0.8336
3	**V Kohli**	4.7153	28	**SPD Smith**	-0.8958
4	**AB de Villiers**	4.1656	29	**Q de Kock**	-0.9189
5	**SK Raina**	3.2637	30	**MEK Hussey**	-0.9272
6	**S Dhawan**	3.2156	31	**SR Tendulkar**	-0.9408
7	**RG Sharma**	3.0109	32	**JC Buttler**	-0.9923
8	**SR Watson**	2.2557	33	**F du Plessis**	-1.0077
9	**MS Dhoni**	1.9704	34	**DA Miller**	-1.1454
10	**RV Uthappa**	1.3801	35	**SS Iyer**	-1.1791
11	**G Gambhir**	1.2394	36	**JP Duminy**	-1.2126
12	**AM Rahane**	1.1447	37	**PA Patel**	-1.2135
13	**KL Rahul**	0.8709	38	**KS Williamson**	-1.2189
14	**V Sehwag**	0.6501	39	**SA Yadav**	-1.3716
15	**AT Rayudu**	0.3746	40	**AJ Finch**	-1.5729
16	**YK Pathan**	0.3119	41	**JH Kallis**	-1.5802
17	**KA Pollard**	0.2805	42	**WP Saha**	-1.6144
18	**KD Kartik**	0.1524	43	**Jayawardene**	-1.7518
19	**SE Marsh**	0.1467	44	**R Dravid**	-1.859
20	**BB McCullum**	0.0684	45	**MA Agarwal**	-1.9952
21	**MK Pandey**	-0.2127	46	**RA Jadeja**	-2.2606

22	**RR Pant**	-0.2687	47	**KC Sangakkara**	-2.3222
23	**SV Samson**	-0.4357	48	**MK Tiwary**	-2.46
24	**DR Smith**	-0.6074	49	**Mandeep Singh**	-2.641
25	**AC Gilchrist**	-0.6142	50	**NV Ojha**	-2.7857

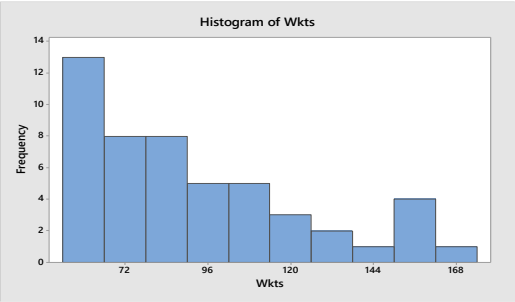
Conclusion: According to PCA technique Batsman with highest value of first Principal Component score has good batting performance. Therefore, here CH Gayle has highest PCA value and has rank first, while NV Ojha has lowest -2.7857 value and has lowest rank 50.

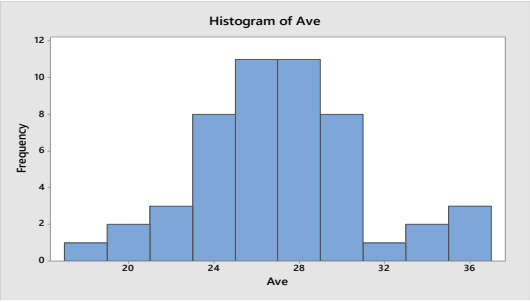
Principal Components Analysis for Bowling

Table 4.7 This analysis includes all bowler who have played at least 50 innings and scored at least 55 wickets.

Bowler	Mat	Inns	Overs	Wkts	Ave	Econ	SR
SLMalinga	122	122	471.1	170	19.8	7.14	16.6
A Mishra	150	150	526.5	160	24.16	7.34	19.7
PP Chawla	164	163	541	156	27.32	7.87	20.8
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
JP Faulkner	60	60	204.3	59	30.13	8.67	20.7
SK Warne	55	54	199	57	25.38	7.27	20.9

Histogram of Wkts, Ave, Econ, SR





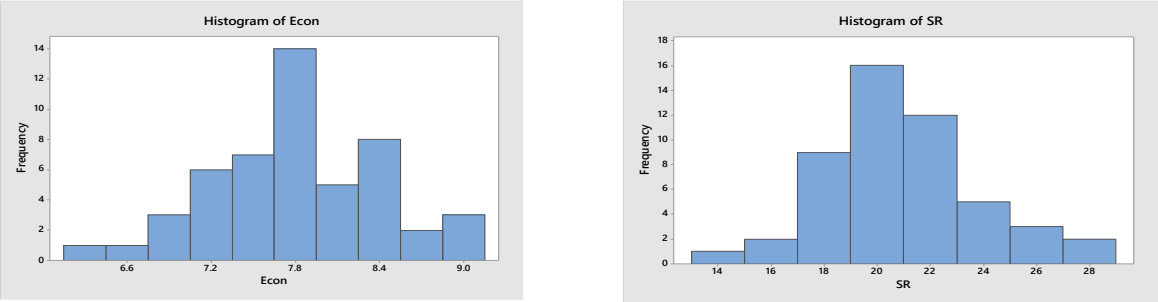

Histogram of Econ
Frequency
Econ
Histogram of SR
Frequency
SR

Fig.4.4

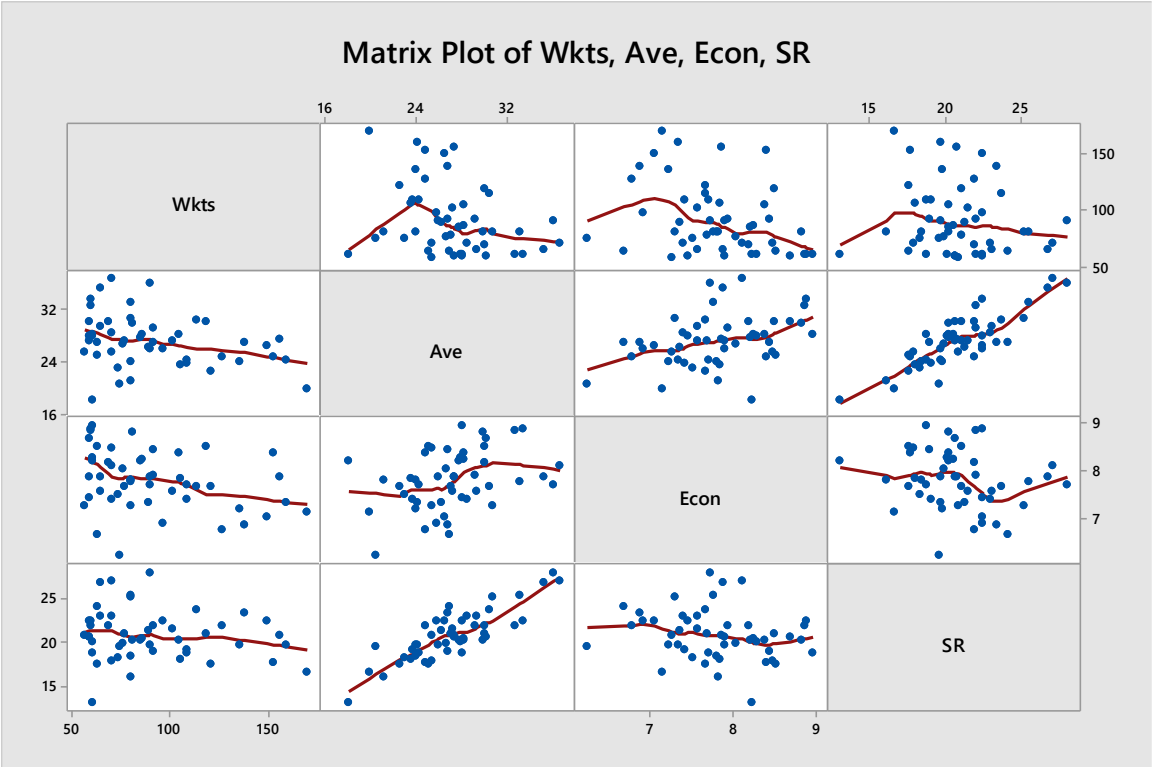

Matrix Plot of Wkts, Ave, Econ, SR
Wkts
Ave
Econ
SR

Fig 4.5

Scree plot for bowling parameters

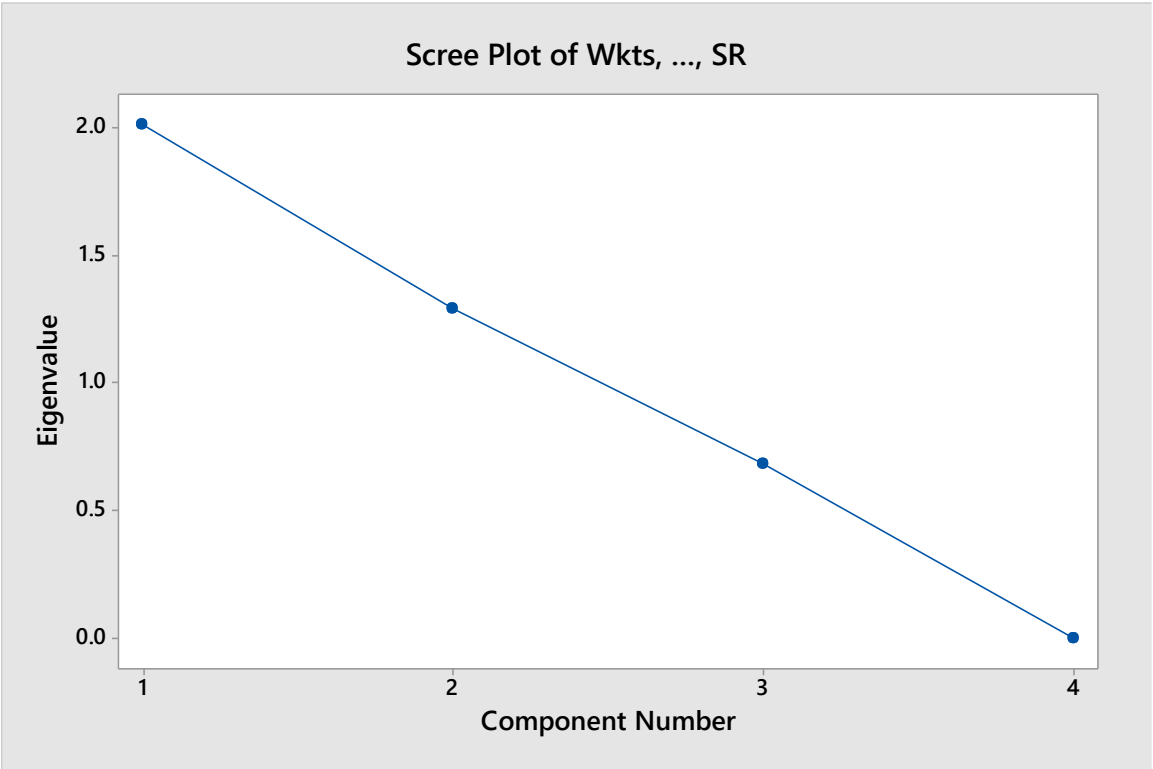


Fig 4.6

Table 4.8 Correlation matrix

	Wkts	Ave	Econ	SR
Wkts	1	0.314	-0.328	0.149-
Ave	-0.314	1	0.36	0.843
Econ	-0.328	0.36	1	-0.196
SR	-0.149	0.843	-0.196	1

Table 4.9 Eigen analysis of the Correlation Matrix

Eigenvalue	2.014	1.296	0.687	0.001
Proportion	0.504	0.324	0.172	0.000
Cumulative	0.504	0.828	1.000	1.000

Table 4.10 PCA score for bowling parameters

Variable	PC1	PC2	PC3	PC4
Wkts	-0.377	0.452	0.809	-0.006
Ave	0.682	0.090	0.272	0.673
Econ	0.253	-0.726	0.521	-0.370
SR	0.573	0.510	-0.022	-0.641

Therefore, the first principal component for bowlers is

L1= -0.377*Wkts+0.682*Ave+0.253*Econ+0.573*SR

Where the variables Wkts, Ave, Econ, SR have already been standardized.

Table 4.11 Top Ten Bowlers using First Principal Component L1

Bowlers	Mat	Inns	Wkts	Ave	Econ	SR	L1
L Mallinga	122	122	170	19.8	7.14	16.6	-3.361
K Rabada	35	35	61	18.09	8.23	13.1	-2.579
YS Chahal	99	98	121	22.5	7.67	17.6	-1.877
I Tahir	58	58	80	21.08	7.83	16.1	-1.856
Rashid khan	62	62	75	20.49	6.24	19.6	-1.848
A Mishra	150	150	160	24.16	7.34	19.7	-1.781
B Kumar	121	121	136	23.91	7.23	19.8	-1.556
DJ Bravo	140	137	153	24.82	8.4	17.7	-1.547
A Nehra	88	88	106	23.53	7.84	18	-1.365
JJ Bumrah	92	92	109	23.72	7.41	19.1	-1.325

Table 4.12 Bowlers Ranked by First Principal Component

Rank	Bowler	L1	Rank	Bowler	L1
1	*SL Malinga*	-3.361	26	L Balaji	0.008
2	K Rabada	-2.579	27	R Vinay Kumar	0.127
3	YS Chahal	-1.877	28	M Morkel	0.169
4	Imran Tahir	-1.856	29	JA Morkel	03
5	Rashid Khan	-1.848	30	DS Kulkarni	0.356
6	A Mishra	-1.781	31	KV Sharma	0.423
7	B Kumar	-1.556	32	M Muralitharan	0.489
8	DJ Bravo	-1.547	33	UT Yadav	0.503
9	A Nehra	-1.365	34	MG Johnson	0.541
10	JJ Bumrah	-1.325	35	AD Russell	0.591
11	Sandeep Sharma	-1.167	36	SR Watson	0.616
12	MM Patel	-1.151	37	ShakibA1hasan	0.728
13	SP Narine	-1.065	38	R Bhatia	0.735
14	CH Morris	-0.902	39	RA Jadeja	0.803
15	Harbhajan Singh	-0.842	40	JD Unadkat	0.883
16	PP Chawla	-0.748	41	SK Trivedi	1.047
17	R Ashwin	-0.505	42	AB Dinda	1.142
18	RP Singh	-0.382	43	JP Faulkner	1.240
19	TA Boult	-0.377	44	AR Patel	1.410
20	MJ McClenaghan	-0.369	45	KA Pollard	2.000
21	DW Steyn	-0.354	46	IK Pathan	2.084
22	PP Ojha	-0.231	47	Mohammed Shami	2.245
23	MM Sharma	-0.175	48	JH Kallis	2.951
24	SK Warne	-0.099	49	P Kumar	2.963
25	Z Khan	-0.075	50	I Sharma	3.270

Conclusion: According to PCA technique Bowlers with lowest value of first Principal Component score has good bowling performance. Therefore, here SL Malinga has lowest PCA -3.361 value and has rank first, while I Sharma has highest 3.270 value and has lowest rank 50.

4.3 Chi-Square Test

Introduction

The Chi-square test for independence is non-parametric test also called Pearson's Chi-square test or chi-square test for association is used to discover if there is a relationship between two categorical variables.

Assumption

- The two variables should be measured at an ordinal and nominal level.
- The two variables should consist of two or more categorical independent group.

Objectives

To check the association between two variables

- To check the association between Match winning and Toss decision.
- To check the association between Match winning and Home Ground

.

Data Description

Below Table 4.43 is about toss win by corresponding team and taking decision about Bat or Field and match result. And other data is about home ground of corresponding teams and their Match results. The below data is for two years IPL 2018,2019

$$\text{Toss Decision} = \begin{cases} 1, & if\ Team\ choose\ Batting \\ 0, & if\ Team\ choose\ Field \end{cases}$$

$$\text{Match Result} = \begin{cases} 1, & if\ Team\ choose\ Batting \\ 0, & if\ Team\ choose\ Field \end{cases}$$

$$\text{Home grd} = \begin{cases} 1, & if\ match\ is\ played\ at\ home\ ground\ of\ corresponding\ team \\ 0, & if\ match\ not\ played\ at\ home\ ground\ of\ corresponding\ team \end{cases}$$

Match ID	Toss Toss	Toss Decision	Match Result	Home Ground	Match ID	Toss Toss	Toss Decision	Match Result	Home Ground
7894	Field	0	1	0	7915	Field	0	0	0
7895	Field	0	1	1	7916	Field	0	0	0
7896	Field	0	1	1	7917	Field	0	1	0
7897	Field	0	1	1	7918	Field	0	0	1
7898	Field	0	1	1	7919	Field	0	0	1
7899	Field	0	0	1	7920	Field	0	1	0
7900	Field	0	1	1	7921	bat	1	1	0
7901	Field	0	1	1	7922	Field	0	1	0
7902	Field	0	1	0	7923	Field	0	0	1
7903	Field	0	1	0	7924	Field	0	0	1
7904	Field	0	0	0	7925	Field	0	0	1
7905	Field	0	0	1	7926	Field	0	1	1
7906	Field	0	0	1	7927	Field	0	1	0
7907	Field	0	0	1	7928	Field	0	1	1
7908	bat	0	1	0	7929	bat	1	0	1
7909	Field	1	1	1	7930	Field	0	0	1
7910	Field	0	0	1	7931	Field	0	1	1
7911	Field	0	1	0	7932	Field	0	0	1
7912	Field	0	1	1	7933	bat	1	1	1
7913	Field	0	0	0	7934	Field	0	0	0
7914	bat	1	0	1	7935	bat	1	0	0

Match ID	Toss Toss	Toss Decision	Match Result	Home Ground	Match ID	Toss Toss	Toss Decision	Match Result	Home Ground
7936	bat	1	0	1	11313	Field	0	1	1
7937	Field	0	0	0	11314	Field	0	1	1
7938	Field	0	1	0	11315	Field	0	1	1
7939	Field	0	1	1	11316	Field	0	1	0
7940	Field	0	1	0	11317	Field	0	1	0
7941	Field	0	1	0	11318	Field	0	1	0
7942	Field	0	1	1	11319	Field	0	1	0
7943	Field	0	0	1	11320	Field	0	1	0
7944	Field	0	0	1	11321	Field	0	0	0
7945	Field	0	0	1	11322	Field	0	1	1
7946	bat	1	1	1	11323	Field	0	0	1
7947	bat	1	0	0	11324	Bat	1	0	1
7948	bat	1	1	1	11325	Bat	1	1	0
7949	Field	0	1	1	11326	Field	0	0	0
7750	Field	0	1	0	11327	Field	0	1	1
7951	Field	0	0	1	11328	Field	0	1	1
7952	Field	0	0	0	11329	Field	0	1	1
7953	Field	0	1	0	11330	Field	0	0	1

11137	field	0	1	1	11331	field	0	1	0
11138	field	0	1	1	11332	field	0	1	1
11139	field	0	0	0	11333	field	0	0	1
11140	field	0	0	0	11334	field	0	1	0

11141	bat	1	0	0	11335	field	0	0	0
11142	field	0	0	1	11336	field	0	1	1
11143	field	0	0	0	11337	Bat	1	1	1
11144	bat	1	0	0	11338	field	0	0	1
11145	field	0	1	1	11339	field	0	0	1
11146	field	0	1	1	11341	field	0	0	1
11147	field	0	0	0	11342	Bat	1	1	1
11148	field	0	0	0	11343	field	0	1	0
11149	field	0	0	0	11344	Bat	1	0	1
11150	field	0	1	1	11345	field	0	1	1
11151	field	0	0	0	11346	field	0	1	1
11152	field	0	1	1	11347	field	0	1	1
11153	field	0	1	1	11412	Bat	1	0	0
11309	bat	1	1	1	11413	field	0	1	0
11310	field	0	0	0	11414	field	0	0	0
11311	field	0	1	1	11415	bat	1	1	0
11312	field	0	1	1					

Chi-Square Test for Independence

Chi-Square Test for Association: Toss Decision, Match Result

Rows: Toss decision Columns: Match Result

H0: The impact of Toss Decision is independent on Match result
H1: The impact of Toss Decision is dependent on Match result

Table 4.44 observed values

	Toss Decision	Match Result	Total
Field	42	57	99
Bat	10	10	20
Total	52	67	119

Table 4.45 expected values

	Expected Values		Total
Field	43.26	55.74	99
Bat	8.739	11.261	20
Total	52	67	119

Table 4.46 squared difference values

	Toss Decision	Match Result	Total
Field	0.037	0.029	0.066
Bat	0.182	0.141	0.323
Total	0.219	0.17	0.389

Chi-Square = 0.389, DF = 1 p-Value = 0.533
p-Value = 0.535 > 0.05

Therefore, we fail to reject H0

Conclusion: It is conclude that null hypothesis H0 is not rejected.

Therefore, the impact of toss decision is independent on match result

Chi-Square Test for Association: Home Condition, Match Result

Rows: Home Condition Columns: Match Result

H0: The impact of home condition is independent of match result

H1: The impact of home condition is dependent of match result

Table 4.47 observed values

	Toss Decision	Match Result	Total
Field	19	30	49
Bat	33	37	70
Total	52	67	119

Table 4.48 expected values

	Expected values		Total
Field	21.41	27.59	49
Bat	30.59	39.41	70
Field	52	67	119

Table 4.49 squared distances

	Toss Decision	Match Result	Total
Field	0.272	0.211	0.483
Bat	0.19	0.148	0.338
Total	0.462	0.359	0.821

Chi-Square = 0.821, DF = 1, p-Value = 0.365

Here, p-Value =0.365 > 0.05

Therefore, we fail to reject H0

Conclusion: Here Ho is not rejected so, the impact of home condition is independent on match result.

Conclusions

The approach has brought out analysis and visualization of various aspects of IPL matches and gives useful results to the user.

1. It could be great help to team owners who purchase players for their teams in auction every year, on the basis of overall batting and bowling parameters for corresponding batsman and bowlers.
2. It also could be great help to coaches and captain to make right selection of players (i.e., batsman, bowlers etc) or playing 11 team on the basis of **performance score** of batsman or bowlers.
3. It also gives information about the helpful decision on various venues.

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Softwares

1. Minitab
2. Python
3. MS-Excel
4. MS-Word