

A Study of The Duckworth-Lewis-Stern Principle in Limited Overs Cricket

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(T.Y.B.Sc 2017-2018)

CERTIFICATE

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This is to certify that the project report entitled "A Study of The Duckworth-Lewis-Stern Principle in Limited Overs Cricket" is the record of work done by the students Suraj Parmekar, Anagha Kerkar, Simran Shaikh and Harshada Samant during the academic year 2017-2018, under my guidance; and that, to the best of my knowledge, has not previously formed the basis of the award of any degree or diploma, in Goa University or elsewhere.

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DECLARATION

We declare that this project report has been prepared by us and to the best of our knowledge has not previously formed the basis for the award of any diploma or degree by this or any other university.

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Chapter 1

The Basics of Cricket

*I argued.... She argued...
I shouted.... She shouted...
And then she Cried..
Result..... “She won by the Duckworth Lewis Method”*

– Anonymous

1.1 Introduction

Cricket is the second most popular game in the world, after football. With millions of followers around the world, the DLS method is one of the greatest contributions to the sporting world by the field of Mathematics. But before we jump into this complex method, we shall look into certain aspects of the game as well as some of the methods which were in use prior to the DLS method. Let's begin with a formal introduction to the game of Cricket.

Cricket is a team sport played between 2 teams, generally in an open space. Each team consists of 11 players. The main acts to be performed in this game are 'Batting' and 'Bowling'. The purpose of the batting team is to score as many runs as possible using the 'Overs' allotted to them and 'Wickets' in hand. The purpose of the bowling team is to restrict the batting team from scoring runs. After Team 1¹ complete their innings, the roles are reversed. Team 2 now tries to score runs and Team 1 tries to restrict them.

¹Throughout this project, we shall refer to the side batting first as 'Team 1' & to the side batting second as 'Team 2'

If Team 2 is able to score fewer runs than Team 1 in their allotted overs, the latter wins the match. If Team 2 surpasses Team 1's total, Team 2 is declared the winner. If the scores are level then the match ends in a 'Tie'.

1.2 Cricketing Terms

Cricket is generally played in a large oval or round field. Roughly in the middle of the field there is a brownish white strip known as the **pitch**. In the first over batting takes place at one end of the pitch before switching ends in the next over. For the batsman facing the ball, the side of the field facing his bat is called the **Off side** and the side facing his back is called the **Leg side**. At both ends of the pitch, a set of 3 wooden sticks can be seen. These are called **stumps**. On the top of the stumps, two small wooden bits are balanced. These are called **bails**.

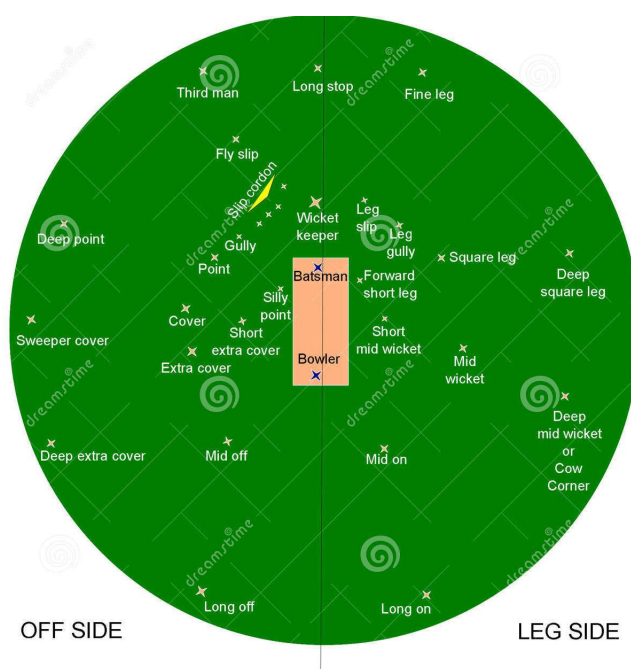


Figure 1.1: Fielding positions in cricket against a Right handed batsman

When play starts, the bowler tries to hit the stumps with the ball. On the other hand, the batsman tries to keep the ball from hitting the stumps, by using his bat. If despite the efforts of the batsman the bowler is able to hit the stumps and the bails fall off, the batsman is declared **out**. There are

a total of 10 ways in which a batsman can get out which are listed in Table 1.1. This is the basic contest in cricket. The bowler tries to get the batsman out, while the batsman tries to keep the bowler from doing so. However, keeping the ball from hitting the stumps is not the only aim of the batsman. He also needs to score **runs**.

Method	Description
Bowled	The bowler hits the batsman's stumps
Caught	The batsman hits the ball and the ball is caught by the fielding team before it hits the ground
Leg Before Wicket*	The batsman prevents the ball from hitting the stumps using his pads
Hit Wicket	The batsman accidentally hits his own stumps
Run Out	The fielding team hits the stumps with the ball before the batsman completes the run
Stumped Out	Similar to a Run Out, except the batsman isn't attempting a run
Obstructing the field	The batsman tries to prevent a fielder from running him out/completing a catch
Handled the ball	The batsman uses his free hand to prevent the ball from hitting the stumps
Hitting the ball twice	The batsman deliberately hits the ball twice
Timed Out	The Batsman fails to get to the crease within 3 minutes following the previous dismissal

Table 1.1: 10 types of Dismissals in Cricket

*See Appendix

The purpose of the batsman is to hit the ball with the bat in order to score runs. The batsman at the non-striker's end comes into the picture now. Once the batsman hits the ball with his bat, both the batsmen run along the pitch to the opposite end. This process earns them one run. If they cross ends again it earns them one more run and so on. There is a safe zone that

each runner must reach for a run to be considered complete, marked by a white line drawn at both the ends of the pitch called the **crease**. Both the runners must ground either some part of their body or their bat beyond the crease at their respective ends to complete a run.

Besides the method of hitting the ball and running end to end, runs can be scored by hitting the ball beyond the boundary rope, which surrounds the entire field. If the batsman hits the ball directly beyond the boundary or hits the rope on the full, he is awarded 6 runs. If the ball hits the ground on its way to the boundary, he is awarded 4 runs. There also exists a concept of **extra runs** in cricket which is discussed in Table 1.2.

Extras	Description
Wide	1 run is awarded if the ball diverges outside the line perpendicular to the crease, towards the batsman's off side or anywhere towards the batsman's leg side
No Ball	1 run is awarded if the bowler oversteps the crease while bowling; the batsman cannot be adjudged out in any way other than a run out. The next delivery becomes a free hit for the batsman. A waist high full toss is also termed a No ball.
Leg Byes	If the batsman attempts a shot and the ball hits any part of his body other than the bat
Byes	If the delivery is legal and the batsman attempts a shot but the ball does not hit either a part of his body or the bat
Penalty Runs ⁺	Runs awarded due to unfair play by the bowling team

Table 1.2: Extra runs in Cricket

⁺See Appendix

Lets go deeper and understand how a cricket match works. A toss takes place at the start. The captain of the team that wins the toss decides if he wants to bat first or bowl first. Whichever team is batting sends out 2

batsmen to start the innings. All 11 players of the bowling team take the field at once. As one batsman gets dismissed, another batsman walks out to replace him and the game continues. Only one batsman can be ruled out at a time.

For the fielding team, one bowler starts the innings. However he is allowed to bowl only 6 legal balls at the batsman at a time. This lot of 6 balls is called an **over**. Once he completes his over, he must be replaced. The innings continues until either 10 batsmen of the batting team are out or the maximum number of agreed overs per innings have been bowled. After this the roles are reversed.

1.3 The 3 Forms of the Game

Cricket is played at two levels; namely the International Level & the Domestic Level (also called “First Class Cricket”). International Cricket matches were officially recognised for the 1st time in 1877. Currently, 12 countries play all 3 formats of the game at the International level, namely:

1. Test Cricket
2. One Day International Cricket
3. T20 Cricket

These 12 countries are England, Australia, South Africa, New Zealand, Bangladesh, India, Pakistan, Sri Lanka, West Indies, Zimbabwe, Ireland & Afghanistan². Domestic cricket is played between states or counties of a country. The rules for Domestic cricket may differ from country to country but the rules for International cricket remain the same. For example the Domestic ODIs in England are played as 40 over matches rather than the regular 50-Over format. The Ranji Trophy matches in India are 4 days long at the Round Robin stage. International matches are governed by the **International Cricket Council (ICC)**.

1.3.1 Test Cricket

Test cricket is the longest form of the game, played for a maximum of 5 days. It was called a ‘Test’ match because the match was a real test of the strength

²Afghanistan and Ireland have not played a test match till date although they have received the status of a Test playing nation in June 2017

& endurance of both the teams to play for 5 continuous days. It is considered to be the highest level of the game & players wear white playing kits. This is quite similar to the tradition followed at the Wimbledon tennis tournament where players wear white tennis outfits.

In a test match, Each team gets to bat twice; hence a test match has 4 innings. If Team 1 scores x runs in their first innings & Team 2 scores y runs in their first innings, we say that Team 1 **lead by $x-y$** runs if $x > y$. If $y > x$, we say that Team 1 **trail by $y-x$** runs. After Team 1 completes their second innings, the lead or deficit is added or subtracted respectively from their second innings total & the final score obtained is what Team 2 have to chase. If Team 2 manages to chase down this total, they win the match. If Team 2 members are all out before they surpass this total, Team 1 wins. If Team 2 scores less than this final total but hasn't lost all 10 wickets at the end of the fifth day, the match ends in a 'Draw'. In some cases Team 1 can force Team 2 to play their second innings before Team 1 themselves play again. This is called a **Follow On**.³

1.3.2 One Day International Cricket

As time went by, the need to obtain quicker results arose. It is quite boring to watch a match continuously for 5 days when you are not even guaranteed to get a result. This is when the concept of limited overs cricket came in and the first ODI match was played in 1971 between England & Australia.

Initially the format saw both sides bat for a maximum of 60 overs. Since a result was guaranteed within a day, ODI Cricket started gaining a lot of popularity. Very soon, The first ODI World Cup, which is the highest level of ODI cricket, was played in England in 1975. After a few years, ODI cricket was standardized to 50 overs a side wherein 1 bowler could bowl a maximum of 10 overs.

In ODI cricket, the concept of penalties for Slow Over Rate⁴ comes into picture. In an uninterrupted ODI match, the bowling team is expected to bowl 14-15 Overs in an hour (4 minutes per over). Therefore an ODI innings should be completed in not more than 3.5 hours. If the bowling team is found to be bowling at the rate of 12-13 overs per hour, it is termed as a **Minor Slow Over Rate Offense**. Any slower & the offense is termed as a

³Check Appendix

⁴Slow Over Rate rules apply differently for Test Cricket. See Appendix

Major Slow Over Rate Offense. In this case, the entire team is penalised by cutting off 10% of their match fees per over whereas the captain receives a fine of 20% of his match fees per over along with a one match ban.



Figure 1.2: Sachin Tendulkar in action

1.3.3 T20 Cricket

T20 was initiated in the year 2003 after huge demands for a very short & crisp format of the game. In this format each team gets a maximum of 20 overs to bat. The rules are exactly the same as those in ODI Cricket apart from the fact that a tied ODI match does not have a tie-breaker. In a T20 match, a tied match is resolved by a **Super Over**, which is literally a 1-over shootout. The team which batted second gets to play first during the super over. In case the super over also ends up in a tie, the team which has hit the most number of sixes throughout their innings is declared the winner.

Since the inception of the T20 format, the game of Cricket has spread far & wide. Every test-playing nation has its own domestic T20 league. For example The IPL, The Australian Big Bash, The Bangladesh Premier

League, The Caribbean T20 League, etc. This format of the game attracts people all across the world & many non cricket-playing nations have started taking keen interest in the sport over the last decade.

1.4 The Menace of Rain

The game of cricket sometimes has to go through the obstacle of rain. If rain interrupts a Cricket match, it is inadvisable to play the match to its full length. Therefore the number of overs are reduced to a certain pre-specified amount. A normal ODI match is played for about 8 hours & a normal T20 match is played for around 3 hours. There are many other reasons to reduce the number of overs in a rain affected match, some of which are discussed below:

1. **Players & officials need to move on to the next match.**

When a cricket tour is fixed, it may consist of a Test series, an ODI series & a few T20 matches as well. Rain does not affect Test matches in the way that it affects ODI matches. The 3 day gap between two ODI matches gets utilised for travelling, resting as well as practising at the venue of the next match. Therefore, if the result of a match is not decided in one day, it disrupts the schedule of the entire tour. Previously the concept of reserve days was used but that is no longer in practice now.

2. **Transport and Hotels**

If a match is abandoned & a decision has been made to play the match on a later date, the rearrangement of transport & hotels at such short notice becomes really difficult. Since the tour is booked well in advance, hotels are booked in advance as well. But if a match is postponed, the dates of the remaining matches of the tour would also be pushed ahead & hence it would be difficult to manage the situation.

3. **TV Broadcasters**

Live Telecast of Matches is done by respective channels at the expense of their regular telecasts. Therefore TV broadcasters do not like to disrupt the schedule of their viewers. For example, if the timings of a Cricket match & a Formula 1 race coincide, the channels normally

prefer to show cricket. But if a match is postponed, the cricket fans as well as the Formula 1 fans are unhappy.

4. **Spectators are bored**

Normally an ODI match goes on for about 8 hours. If a rain-affected match is played to its full length, the match can go on for a really long time which is unfavourable for the spectators on the ground as well as, to some extent, for the people watching at home. Day night matches will be severely affected since the matches will have to be carried on beyond midnight; hence the post-match formalities will also be delayed. Players will be deprived of sleep in such cases & spectators will not prefer driving home so late at night.

5. **Inconvenience to the ground's managing staff**

Groundsmen work really hard in order to make a perfect playing pitch. If the match is postponed to a different date, the management needs to employ the staff again, incurring extra expenses. The pitch needs to be well-maintained even after the rain & the outfield need to be dried as well. Playing cricket on a wet surface is totally inadvisable.

Chapter 2

The Average Run Rate Method

2.1 Introduction

As seen in the earlier chapter, it is quite pragmatic to settle a rain-affected limited overs match on the given day itself. This results in a shorter match and hence the need arises for a method to reset the target score. But the manner in which this is done needs to be fair to both the teams. The following points need to be kept in mind when a suitable method is developed:

- The relative positions of the 2 teams should not be altered after the resumption of play; i.e. a team's probability of winning the match at the point of interruption should not change.
- The method must produce a reasonable target in all possible situations.
- The method must be easy to understand for the umpires as well as both the Teams.
- The target should be simple to calculate, requiring just a table and a calculator.

Keeping these points in mind, the most obvious suggestion would be to set the target in proportion to the overs available to both the teams. This is precisely what the 'Average Run Rate Method' does! It simply tells Team 2 to maintain a scoring rate higher than that of Team 1 in order to win.

2.2 The Method

In Cricket, the concept of **Run Rate** plays a very important role; not just in the context of this method, but also to break ties in the Round Robin stages of a tournament. A team's Average run rate is given by:

$$ARR = \frac{\text{Total number of Runs scored}}{\text{Total number of Allotted overs}} \quad (2.1)$$

This is slightly different from **Net Run Rate**⁵ which, as mentioned earlier is used to break ties. Suppose, Team 1 Scores at a rate of R_1 runs per over in their N_1 allotted overs. Then if play is interrupted by Rain, the revised target T for Team 2 in their N_2 allotted overs is given by:

$$T = (N_2 \times R_1) + 1 \quad (2.2)$$

If any further interruptions occur, the above target is reduced according to the number of overs lost. In case the match cannot be continued further, the **Par Score** is simply the product of Team 1's run rate and the overs faced by Team 2. This method was in use right from the start of ODI cricket in 1971 until the early 90's. We shall now see examples of some rain-affected matches where we shall use this method to determine the Target score.

2.3 Examples

Example 2.3.1. England vs Sri Lanka- 1987 WC Group Stage

In this match, England managed to score 296-4 in their 50 overs. Rain delayed the start of the Sri Lankan innings and hence they were allotted 45 overs to bat. Calculate Sri Lanka's target using ARR method.

Solution:

England : 296-4 (50 Overs)
England's run rate: 5.92 RPO

Rain delays the start of the Sri Lankan innings

⁵See Appendix

Overs lost : 5

Revised target in 45 overs: $45 \times 5.92 + 1 = 267$

Sri Lanka : 158-8 (45 Overs)

Result : England win by 108 runs

□

Example 2.3.2. West Indies vs Australia- 1989 World Series Final

In this controversial 3rd final of the Benson and Hedges World Series, Australia were batting at 83-2 in 23.1 overs when rain stopped play and 12 overs were lost per side. Australia finished at 226-4 in their 38 overs. Rain intervened again when West Indies had put up a total of 47-0 in 6.4 overs. At this stage, 20 overs were reduced. Calculate the revised target using ARR method.

Solution:

Australia : 83-2 (23.1 Overs)

Rain stops play. Match reduced to 38 overs per side.

Australia : 226-4 (38 Overs)

Australia's run rate: 5.947 RPO

West Indies : 47-2 (6.4 Overs)

West Indies need 180 runs off 31.2 Overs

Rain stops play

Overs lost : 20

Revised target in 18 overs: $18 \times 5.947 + 1 = 108$

i.e West Indies need 61 runs off 11.2 overs

West Indies : 111-2 (13.2 Overs)

Result : West Indies win By 8 wickets

□

Example 2.3.3. Self Created Example

Here, Team 1 put on 300 runs on the board for the loss of 2 wickets. Team 2 managed a total of 151-9 after 25 overs when rain stopped play and the match could not be continued further. Calculate the par score and declare the result using ARR method.

Solution:

Team 1: 300-2 (50 Overs)
Team 1's run rate: 6.00 RPO

Team 2: 151-9 (25 Overs)

Rain stops play and the match cannot be continued further.

Overs lost : 25

Par Score after 25 overs: $25 \times 6.00 = 150$

Result : Team 2 win by 1 run

□

Example 2.3.4. Self Created Example

In this match, Team 1 were batting at 127-5 after 25 overs when an intervention by rain saw both sides lose 10 overs each. Team 1 post a final score of 215-8 in their 40 overs. Rain delays the start of Team 2's innings and they lose a further 10 overs. Calculate the revised target at this stage. After play resumes, Team 2 find themselves struggling at 111-9 after 20 overs when a 3rd rain interruption forces play to stop. Calculate the par score and declare the result using ARR method.

Solution:

Team 1: 127-3 (25 Overs)

Rain Stops Play. Match reduced to 40 overs per side.

Team 1: 215-8 (40 Overs)

Team 1's run rate: 5.375 RPO

Rain delays the start of Team 2's innings.

Overs lost : 10

Revised target in 30 overs: $30 \times 5.375 + 1 = 162$

Team 2: 111-9 (20 Overs)

Rain intervenes again and the match cannot be continued further.

Par score after 20 Overs: $20 \times 5.375 = 107$

Result : Team 2 win By 4 runs

□

Example 2.3.5. Self Created Example

In this example, after 30 overs, Team 1 were playing at 157-5 when a rain delay saw both sides lose 15 overs each. Team 1 finished at 185-7 in their 35 overs. In their reply, Team 2 had put up 150-2 in 30 overs when play stops again and the match cannot be continued further. Calculate the par score and declare the result using ARR method.

Solution:

Team 1: 157-5 (30 Overs)

Rain stops play. Match reduced to 35 overs per side.

Team 1: 185-7 (35 Overs)

Team 1's run rate: 5.28 RPO

Team 2: 150-2 (30 Overs)

Rain intervenes again and the match cannot be continued further.

Par Score after 30 overs: $30 \times 5.28 = 158$

Result : Team 1 win by 8 runs

□

Example 2.3.6. Self Created Example

In this match, Team 1 are all out for 154 in 30 overs. Team 2 in their reply were struggling at 62-8 after 20 overs when rain stopped play and the match could not be continued further. Calculate the par score and declare the result using ARR method.

Solution:

Team 1: 154-10 (30 Overs)

Team 1's run rate: 3.08 RPO

Team 2: 62-8 (20 Overs)

Rain intervenes and match cannot be continued further.

Par Score after 20 overs: $20 \times 3.08 = 62$

Result : Match Tied

□

2.4 The Flaws

The Average Run Rate method received a lot of criticism in the early 90's for the reasons mentioned below, especially after the West Indies-Australia match. The above examples clearly reflect the inadequacy of the method.

1. The method generally alters the balance of the match in favour of Team 2

In Example 2.3.2, the contest was finely balanced before rain came in during the West Indies innings. But the revision of the target completely tilted the match in favour of the West Indies' side. Due to the way in which targets were set, the captains could choose to bowl first if there were any signs of rain before the match started.

2. Loss of wickets is ignored

In Example 2.3.3 and 2.3.4, Team 1 was just 1 wicket away from winning the match when rain intervened. But since Team 2 had a higher run rate, they were unfairly declared winners. Had Team 2 lost only a few wickets in their run chase, we could agree that they would have easily gone on to win the match in case there wasn't any interruption. The exact opposite occurs in Example 2.3.5, where Team 2 had loads of wickets in hand; but having a lower run rate at the point of stoppage cost them the match.

3. No compensation for Team 1 for the loss of final overs

In Examples 2.3.4 and 2.3.5, Team 1 ended up unexpectedly losing some of their final overs where they could have put in a lot of runs. Since Team 2 already know that they have lesser overs to play, they can pace their innings accordingly in order to match Team 1's run rate. To balance things out, Team 2 should have received a slightly higher target.

Chapter 3

Most Productive Overs Method

3.1 Introduction

The Average Run Rate method was found to have many loopholes. As we saw earlier, the conclusion of the Benson and Hedges World Series Final between West Indies and Australia in 1989 raised a lot of controversy. The method was severely criticized, especially by the Australian media and the Australian captain at the time Allan Border. It was quite clear to the governing bodies of the game that the method seemed to favour the team batting second.

The Australian Cricket Board (ACB) then came up with the “Most Productive Overs” method (also called the “Slog over method”). In this method, the amount of runs required by Team 2 is adjusted according to the Most Productive Overs faced by Team 1.

3.2 The Method

Suppose, Team 1 scores \mathbf{X} runs in their \mathbf{N} allotted overs and an interruption by rain results in a loss of \mathbf{r} overs for Team 2.

We first arrange the runs scored by Team 1 in each over in descending order. We then cut off the runs scored by them in the **last \mathbf{r} overs**.

Let \mathbf{Y} denote these cut-off runs. Then the Target \mathbf{T} for Team 2 in $(\mathbf{N}-\mathbf{r})$ overs is given by:

$$T = (X - Y) + 1 \quad (3.1)$$

If further interruptions occur and \mathbf{r}_i overs are lost after the i^{th} interruption, then the score corresponding to the final r_i overs is knocked off. In case

the match cannot be continued further and r overs are lost, then the **Par Score** after $(N-r)$ overs is set equal to the runs scored by Team 1 in their Most Productive $(N-r)$ Overs

3.3 Examples

Example 3.3.1. England vs South Africa - 1992 WC Semifinal

In this historic world cup semifinal, rain delayed the start of play which meant that the match was reduced to 45 overs a side. England managed to score 252-6 in 45 overs. In reply, South Africa were batting at 231-6 in 42.5 overs when rain stopped play and 2 overs were lost. Calculate the revised target using MPO method.

Solution:

Rain delays Start of Play. Match reduced to 45 Overs per side.

England : 252-6 (45 Overs)
South Africa : 231-6 (42.5 Overs)

South Africa need 22 runs off 13 balls
 Rain stops play.

Overs lost : 2
Runs to be knocked off : 1

Revised target : South Africa need 21 runs from 1 ball

South Africa : 232-6 (43 Overs)
Result : England win By 19 runs

□

Example 3.3.2. Self Created Example

In this low scoring encounter, Team 1 were all out for 162 in 42 overs. Team 2 were struggling at 55-5 in 15 overs when rain intervened and 30 overs were lost. Calculate the revised target using MPO method.

Solution:

Team 1: 165-10 (42 Overs)

Team 2: 55-5 (15 Overs)

Team 2 need 111 runs off 35 overs

Rain stops play.

Overs lost : 30

Runs to be knocked off : 50

Revised target : Team 2 need 61 runs from 5 overs

Team 2 : 105-8 (20 Overs)

Result : Team 1 win by 10 runs

□

Example 3.3.3. Self Created Example

In this high scoring game, Team 1 put up a massive score of 350-7 in their 50 overs. Team 2 get an excellent start and are batting at 200-2 in 30 overs when play stops and it results in a loss of 10 overs. Calculate the revised target using MPO method.

Solution:

Team 1: 350-7 (50 Overs)

Team 2: 200-2 (30 Overs)

Team 2 need 151 runs off 20 overs

Rain stops play.

Overs lost : 10

Runs to be knocked off : 40

Revised target : Team 2 need 111 runs from 10 Overs

Team 2 : 290-6 (40 Overs)

Result : Team 1 win by 20 runs

□

Example 3.3.4. Self Created Example

In this match, rain delayed the start of play and the match was reduced to 30 overs a side. Team 1 put up a score of 210-5 in their 30 overs. Team 2 get a steady start and are batting at 60 for no loss after 10 overs when a rain intervention causes a loss of 10 overs. Calculate the revised target at this stage. After play resumes, Team 2 put up 100 runs on the board for the loss of 1 wicket in 15 overs when it starts raining again and Team 2 loses another 5 overs. Calculate the target using MPO method.

Solution:

Rain delays the start of play. Match reduced to 30 overs per side.

Team 1: 210-5 (30 Overs)

Team 2: 60-0 (10 Overs)

Team 2 need 151 runs off 20 overs

Rain stops play.

Overs lost : 4

Runs to be knocked off : 10

Revised target : Team 2 need 141 runs from 16 Overs

Team 2 : 100-1 (15 Overs)

Team 2 need 101 runs from 11 overs

Rain stops play again.

Overs Lost : 5

Runs to be knocked off : 35

Revised target : Team 2 need 66 runs from 6 overs

Team 2 : 150-4 (21 Overs)

Result : Team 1 win by 15 runs

□

Example 3.3.5. Self Created Example

Team 1 manage to score 275-8 in their 50 overs. Team 2 go all guns blazing and put up 135 runs for no loss in 25 overs when rain intervenes and the match cannot be continued further. Calculate the par score and declare the result using MPO method.

Solution:

Team 1: 275-8 (50 Overs)

Team 2: 135-0 (25 Overs)

Team 2 need 141 runs off 25 overs

Rain stops play and the match cannot continue further.

Overs lost : 25

Runs to be knocked off : 90

Par Score after 25 overs : 185

Result : Team 1 win by 50 runs

□

3.4 The Flaws

As we can clearly see from the above examples, the Most Productive Overs method was no better than the Average Run Rate method. The reasons are discussed below:

1. The method heavily favours Team 1.

Whereas the Average Run Rate Method is partial towards Team 2, The MPO method clearly favours Team 1. This is because it keeps the best parts of Team 1's innings and requires Team 2 to match this throughout the whole of their innings. Therefore, in cases where very few overs are lost, there is an almost negligible change in the revised target as we see in Example 3.3.1.

2. It penalizes Team 2 for their good bowling performance.

The overs that are knocked off are the ones wherein Team 2 restricted Team 1 from scoring many runs. Some of those may well have been maiden overs (overs where no runs are scored). As we can see in Example 3.3.2, Team 2 managed to bowl out Team 1 with 8 overs to spare. But the interruption ended up setting an unfair target for Team 2 and hence cost them the match.

3. The loss of wickets is ignored

In Example 3.3.3, the match was finely balanced with Team 2 having 8 wickets in hand. But the revised target increased the required run rate, forcing Team 2 to take more risks and eventually lose the match. If Team 2 had lost, say 6 wickets at the point of interruption, it would be fair to say that Team 1 would go on to win the match. Similarly in Example 3.3.5, Team 2 were in a much better position to go on and win the match but the par score at that stage was completely unjust.

Chapter 4

The Duckworth-Lewis-Stern Method

“Surely someone, somewhere could come up with something better”

– Christopher Martin-Jenkins

4.1 Introduction

It was after the fiasco of the 1992 World Cup semifinal between England and South Africa that it was decided that something needs to be done. on radio during the 1992 WC semifinal between England and South Africa

4.2 The Method

4.3 Examples

Example 4.3.1.

Example 4.3.2.

4.4 Revisiting examples from Chapters 2 and 3

Let us now reset the target scores in the examples we saw in chapters 2 and 3 using the DLS method.

Example 4.4.1. England vs Sri Lanka- 1987 WC Group Stage

50 overs per side (100% resources available to both teams)

England : 296-4 (50 Overs)

$$\therefore \mathbf{S} = 296$$

Since there wasn't any interruption during the England innings,

$$\mathbf{R}_1 = 100\%$$

Rain delays the start of the Sri Lankan innings and they lose 5 overs

$$\mathbf{r}_2 = 100\% \text{ (50 overs, 0 wickets)}$$

$$\mathbf{s}_2 = 95\% \text{ (45 overs, 0 wickets)}$$

$$\therefore \mathbf{R}_2 = 100 - (100 - 95) = 95\%$$

$$\text{Here, } \mathbf{R}_2 < \mathbf{R}_1$$

\therefore The Target for Sri Lanka in 45 overs is given by:

$$\mathbf{T} = \frac{\mathbf{S} \times \mathbf{R}_2}{\mathbf{R}_1} + 1$$

$$\therefore \mathbf{T} = \frac{296 \times 95}{100} + 1$$

$$\therefore \mathbf{T} = 282$$

Example 4.4.2. West Indies vs Australia- 1989 World Series Final

50 overs per side (100% resources available to both sides)

Australia : 83-2 (23.1 Overs)

Rain stops play. Match reduced to 38 overs per side.

$$\begin{aligned} \mathbf{r}_1 &= 63.2\% \text{ (26.5 overs, 2 wickets)} \\ \mathbf{s}_1 &= 42.2\% \text{ (14.5 overs, 2 wickets)} \end{aligned}$$

$$\begin{aligned} \therefore \mathbf{R}_1 &= 100 - (63.2 - 42.2) \\ \therefore \mathbf{R}_1 &= 79\% \end{aligned}$$

$$\begin{aligned} \text{Australia : } &226\text{-}4 \text{ (38 Overs)} \\ \therefore \mathbf{S} &= 226 \end{aligned}$$

At this stage,
 $\mathbf{R}_2 = 86.7\% \text{ (38 overs, 0 wickets)}$

$$\text{Here, } \mathbf{R}_2 > \mathbf{R}_1$$

\therefore The Target for West Indies in 38 overs is given by:

$$\begin{aligned} \mathbf{T} &= \mathbf{S} + \frac{\mathbf{G}_{50} \times (\mathbf{R}_2 - \mathbf{R}_1)}{100} + 1 \\ \therefore \mathbf{T} &= 226 + \frac{240 \times (86.7 - 80.6)}{100} + 1 \end{aligned}$$

$$\therefore \mathbf{T} = 239$$

$$\text{West Indies : } 47\text{-}2 \text{ (6.4 Overs)}$$

West Indies need 180 runs off 31.2 overs
 Rain stops play and West Indies lose 20 overs

At this stage,
 $\mathbf{r}_2 = 69.0\% \text{ (31.2 overs, 2 wickets)}$
 $\mathbf{s}_2 = 34.2\% \text{ (11.2 overs, 2 wickets)}$

$$\begin{aligned} \therefore \mathbf{R}_2 &= 86.7 - (69.0 - 34.2) \\ \therefore \mathbf{R}_2 &= 51.9\% \end{aligned}$$

\therefore The Target for West Indies in 18 overs is given by:

$$\begin{aligned} \mathbf{T} &= \frac{\mathbf{S} \times \mathbf{R}_2}{\mathbf{R}_1} + 1 \\ \therefore \mathbf{T} &= \frac{226 \times 51.9}{84} + 1 \end{aligned}$$

$$\therefore T = 139$$

i.e West Indies need 92 runs off 11.2 overs

4.5 Theory