SWiN BUR •NE•

SWINBURNE UNIVERSITY OF TECHNOLOGY

Kicking goals with Maths and Stats Applications in Sport and Gambling

Stephen R Clarke

Faculty of Life and Social Sciences

- Thankyou for opportunity
- Was a regular attender 75-91
- Remember the great enthusiasm
- Joke about brains
- What I do is not rocket science lots of the things I do could be tackled by students of varying standards.

NEWS

Football's number cruncher

A statistician is tackling footy tipping with the click of a button, reports Bianca Carmona

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Champion Data

New force in footy

HOW WE PULL RANK

QUALITY, not QUANTITY

Footy Show

Tipsters Star on Footy Show

Sports Research

- Scoring Systems – tennis, squash, badminton
- Strategy – Dynamic Programming
- Prediction – winner, chance of winning, length of game
- Home ground advantage
- Betting.

NUMBER-CRUNCHING COMPUTER
REVEALS WHICH TEAMS HAVE THE EDGE

Maths professor on the ball figuring out footy winners

Rugby league tipping

Defending castles, aligned planets and computers ... footy tips made easy

Swinburne statisticians predict England to win

SWINBURNE sports statisticians believe England is a firm favourite to take out the 2003 Rugby World Cup. After examining statistical data, experts from Swinburne's Sports Statistics Unit say England has a 49 per cent chance of winning the prestigious event that kicks off in Sydney this Friday, October 10.

Soccer

NEWS

Uni zeros in on our chances

Prof Stephen Clarke.

Motor Racing

CHAMPIONSHIP PREDICTIONS

Virtual motor racing
Computer Simulation

Technological fortune tellers

„Nur fünf haben Chancen"
Schumacher-Forscher Stephen Clarke über die Saison 2003

Motor Cycling

Computer odds favour The Doc

Time to hit the Island!

Odds favor Safin

Tennis

FACTORING out injury, form and the crowd's influence, Marat Safin should take out the men's Australian Open title next weekend.

Mathematicians from Swinburne University have calculated the probability of each player succeeding at the tournament — and the 19-year-old Russian is given a 35.1 per cent chance of claiming his second Grand Slam in a row.

World No. 1 Gustavo Kuerten came in a close second at 34.4 per cent, while two-time winner Pete Sampras is third favorite at 11 per cent.

Professor Stephen Clarke and sports statistician Anthony Bedford have designed a tennis match simulator to work out the odds.

Using ATP rankings, they feed the Open draw through the computer 1000 times a day, revealing the likelihood of players winning their matches.

Aussie hope Lleyton Hewitt was given a 2.4 per cent chance of winning his first major.

— EVONNE BARRY

Computer sees Sampras prize

Computer opts for Sampras win

Pete Sampras will win Wimbledon, according to a computer tournament simulator at Melbourne's Swinburne University of Technology. The university's simulator has given Sampras an 86.5 per cent chance of winning and Patrick Rafter 13.5 per cent. The computer is leading the AFL tipping competition, but it is fallible, having given France only a 9.4 per cent chance of winning soccer's World Cup. "But then so did everyone else except France, I think," said associate professor of sports statistics Stephen Clark Clark.

TENNIS latest, Back page

melbourne cup | Ted Hopkins
Go for a favourite: don't curse Patterson

The Melbourne Cup trophy.

Ted Hopkins is a director of Champion Data Pty Ltd. More analysis at www.swin.edu.au/sport

Stats show the Way

KAAPSTAD Way will win today's Caulfield Cup, a Melbourne sports statistician predicts.

Anthony Bedford, from Swinburne University's Mathematics School, ranked all 18 horses using a computer program.

Mr Bedford analysed the last six starts for each horse and worked out how long on average it took them to travel a distance of one metre.

A doctoral student, he then used this to predict how long it would take the starter to run 2400m.

Mr Bedford predicted Kaapstad Way, on odds of 15-1, would beat the favorite, Fairway, by three-quarters of a length.

Streak would come last.

Mr Bedford's work was based on the assumption the condition of the track would be classified "good".

SWINBURNE'S TOP FIVE
9. Kaapstad Way
2. Fairway
13. Hill of Grace
6. Ken's Joy
11. Camarena

A Current Affair

Maths whiz expects home advantage to deliver Aussies record 60 medals

Hopes hinder heroes

Oi, medal tally best yet
By VANESSA WILLIAMS

OUR OLYMPIC HEROES
It all adds up to a record medal haul

Tipping boffin predicts 60 medals

Being blond gets votes

SWINBURNE University's sports statistics department identified last night's Brownlow Medal winner before a vote was counted.

Researcher Michael Bailey found that players who stood out through looks normally polled more votes than their performances suggested they should.

"As a rough guide any player with blond or red hair or a darker skin color is more likely to be awarded votes," Bailey said.

And last night Melbourne's

Shane Woewodin and Western Bulldog Scott West, two of the game's stand-out blonds, finished first and second with 24 votes and 22 respectively.

Last year's winner, Shane Crawford, is another blond campaigner.

Crawford did not poll his first votes last night until Round 14, for a best-afield performance against St Kilda.

The Hawthorn midfielder polled only five votes overall.

"Some players consistently poll more votes than their performance statistics suggest they should," he said. "They can be broadly categorised as players that stand out, whether through ability or looks. As a rough guide, any player with blond or red hair or a darker skin color is more likely to be awarded votes."

The department's favorites for the medal predictably place Collingwood's Nathan Buckley and the Bulldogs' Scott West in spots one and two.

Cricket batting myth hit for six

Anna Salleh
ABC Science Online

Monday, 29 March 2004

The common wisdom that it's better to bat first if you win the toss in test cricket has been debunked by a new statistical analysis by Australian researchers.

Sports statistician Professor Stephen Clarke and PhD student Paul Allsopp of the Swinburne University of Technology in Melbourne report their analysis in a study to be published in the *Journal of the Royal Statistical Society: Series A*.

"In test cricket there's a general feeling that if you win the toss you should bat," Clarke told *ABC Science Online*.

"But when you look at the past record, it shows that both home and away teams do better when they bat second than when they bat first."

Clarke and Allsopp analysed the results of 151 test matches between 1997 and 2001 and found that the team batting second won 49% of matches and lost only 26%. The figures do not add up to 100 because there are a lot of draws in test cricket.

"[The second-batting advantage] could be because it just so happened that the better teams always batted second," he said. But Clarke and Allsopp did some

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Cricket | Ted Hopkins and David Dyte

Zimbabwe: Champions of the world?

Rating teams and analysing outcomes in one-day and test cricket

P. E. Allsopp and Stephen R. Clarke

Swinburne University of Technology, Melbourne, Australia

Summary. Multiple linear regression techniques are applied to determine the relative batting and bowling strengths and a common home advantage for teams playing both innings of international one-day cricket and the first innings of a test-match. It is established that in both forms of the game Australia and South Africa are rated substantially above the other teams. It is also shown that home teams generally enjoyed a significant advantage. Using the relative batting and bowling strengths of teams, together with parameters that are associated with common home advantage, winning the toss and the establishment of a first-innings lead, multinomial logistic regression techniques are applied to explore further how these factors critically affect outcomes of test-matches. It is established that in test cricket a team's first-innings batting and bowling strength, first-innings lead, batting order and home advantage are strong predictors of a winning match outcome. Contrary to popular opinion, it is found that the team batting second in a test enjoys a significant advantage. Notably, the relative superiority of teams during the fourth innings of a test-match, but not the third innings, is a strong predictor of a winning outcome. There is no evidence to suggest that teams generally gained a winning advantage as a result of winning the toss.

Keywords: Cricket; Linear modelling; Logistic regression; Sports

1. Introduction

Cricket has two distinct phases: the batting phase and the bowling phase, which provide an indication of a team's attacking and defensive abilities. Generally, the batting team strives to maximize its score by making as many runs as possible whereas the bowling team endeavours to restrict the score of the batting team. A match result can be construed as the combined effect of the batting and bowling abilities of the respective teams. In this paper we shall model the bat-

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Footy's a matter of maths

By ELISSA HUNT

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aussie rules | Ted Hopkins

Statisticians figure out another line of attack

M eta-analysis has arrived in the coaching box on the eve of the AFL finals. Which clubs are doing it, how, and what role is it likely to play in the grand final result?

A preview of how information technology is providing the critical edge was last week's thrilling battle between Sydney and Geelong at the SCG. It was widely remarked how the capacity home crowd was unusually quiet, despite the close scores.

Is it possible that the subdued atmosphere was because they were witnessing an absorbing game full of chess-like moves where the contest was played about the shoulders?

What they could not be privy to, however, were the laptops in the respective coaching boxes recording the moves. A crew of club statisticians using Statmaster software and entering information and feeding it to an interactive display terminal monitored by the coaching panel is now familiar to most AFL clubs.

Swinburne Tips
Swinburne computer tips for AFL qualifying finals

Sydney v Bulldogs	60% (ga−3 pts)
Adelaide v W Coast	71% (ga 23 pts)
St Kilda v Brisbane	59% (ga 1 pts)
Geelong v Sth Melb	50% (ga 0 pts)

% = chance of win
ga = estimated ground advantage

More analysis on www.club12.com.au

point prices coin is not good enough. Players cannot run out onto the MCG shrieking a spread sheet. During play, coaches cannot be expected to read and absorb detailed accounts. This is why the clubs mentioned are different. They are the first to put a person with knowledge of both football and information technology into the coaching box. It at this person's job to watch for the trends and report to the coaching panel in ways that translate to instant meaning.

None of this is possible, however, without the considered laying of workable plans that identify crucial factors likely to be at stake between a team and its opposition. In this

Footy record, Sep 22, 2001

maths and the sports statistician

Why use sport in teaching

Essendon Football club chief executive Peter Jackson , discussing the 3 or 4 corporate leadership seminars the club runs each year, said

"corporate people concentrate more if sport was used as an example because they absorb the lessons because they think we're interesting".

The Sunday Age, Aug 5, 2007, Sport 5.

- Story of Dillon
- REAL
  Problems
- Home advantage
- Counting number of winners
- Checking which team won –
- Difference of margins
- My stundent – lineaar regression taking ability

Sport is important

- Governments: Olympics, Commonwealth Games
- Business:
  - New AFL TV rights - $1.253 billion
- Learned Societies - ISI, ASA, RSS, AMS
  - 4 pages on Dili
  - 17 pages on election
  - 45 pages on sport

Simple example

- String around the world problem.

$C = 2 \pi r$

Rail - Surfing Example

- Expanding rail line

1 km + 1 cm

???

1 km

Rail - Surfing Example

- Expanding rail line
- $(1 \text{ km} +1\text{cm})^2 - (1 \text{ km})^2$

  $= (1 \text{ km} +1\text{cm} + 1\text{km})(1 \text{ km} +1\text{cm} - 1\text{km})$

  $= 2000\text{m} * 1/100 \text{ m} = 20\text{m}$
- So line rises sqrt(20) = 4.5 m
- In race to a buoy 450 m off shore and back, how far down the beach can a swimmer start if prepared to swim an extra metre?

  30 metres

Serving up bold predictions

Characteristics of scoring systems

- Assume we have a chance p = 0.52 of winning a point.
- What is chance of winning
  - □ a game? .55
  - □ A set? .64
  - □ A 5 set match? .75
- What is expected length
  of a 5 set match? 258 pts

Other tennis scoring systems

- Best of 5 sets to 4 games
- First to 4 point games
- 0-30 games
- Super tie break sets

- Table tennis has changed systems
- Squash has always had 2 systems

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Tinhead makes a Blue

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Slide 44

Ted Hopkins

MCG really neutral ground

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Slide 45

Footy undergoes a computer revolution

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Slide 46

swinburne university's afl tips

TEAMS	% ADV	GROUND ADV
Richmond defeats Collingwood	55%	0pts
Western Bulldogs defeat Geelong	52%	16pts
St Kilda defeats Hawthorn	82%	0pts
West Coast defeats Sydney	66%	27pts
Adelaide defeats Port Adelaide	68%	0pts
Carlton defeats Melbourne	62%	13pts
Essendon defeats Fremantle	72%	2pts
N. Melbourne defeats Brisbane	80%	6pts

Percentage advantage is based on previous scores plus a ground advantage rating either plus or minus to the team with the higher chance of winning. It does not take into account player selections.

Eagles vs Swans This game is a crucial early-season litmus test for two genuine grand-final aspirants. The Swinburne University computer has the greatest respect for the Eagles when they play at home, crediting them with a whopping ground advantage of 27 points. Their recent wins in Perth against the Pies and the Dockers were impressive, but this is what the computer would expect against opponents who did not have the necessary arsenal. Sydney does. The computer rates the Swans a better side than the Eagles, but not enough to overcome the Perth factor. It calculates a West Coast victory by 18 points. However, if the Eagles fail to exploit their natural advantage and lose, or win by only a narrow margin, it could be a sign that they have not improved on last season's disappointments.

Ted Hopkins is a director of Champion Data Pty Ltd

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Slide 47

afl ladder | Ted Hopkins

Computer puts Saints, Roos on top

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Slide 48 — Professor Punt

Professor Punt
Round 11

Home team		Away team		Ground
Geelong	vs	Essendon	at	Telstra Dome
Richmond	vs	Kangaroos	at	MCG
Brisbane Lions	vs	Adelaide	at	Gabba
Sydney	vs	St. Kilda	at	SCG
Port Adelaide	vs	Hawthorn	at	AAMI Stadium
W. Bulldogs	vs	Fremantle	at	Telstra Dome
West Coast	vs	Carlton	at	Subiaco
Melbourne	vs	Collingwood	at	MCG
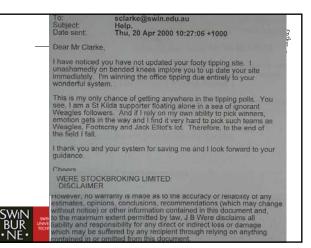
* In real life Professor Punt is Stephen Clarke, professor of sports statistics at Swinburne University.
* Bold and black denotes team tipped to win

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www.swin.edu.au/sport

Prof Stephen Clarke says his program can help any AFL tipster.

Here's a tip: log on first

The Best Footy Tipper in Melbourne — Can you guess who it is?

Footytips.com.au

Experts				
Prof Stephen Clarke		1	154	154
Matthew Richardson		0	146	146
Computer Program		1	146	146
Sam Kakovich		0	143	143
Jason Akermanis		1	143	143
Robert Walls		1	142	142
Michael Sullivan		1	141	141
Troy Luff		0	141	141
Garry Lyon		1	140	140
John Dolochio		0	139	139
Julie Gillard		0	136	136
Tim Fraser		0	134	134
mattichowbacca martin		0	133	133
Gary Ablett		1	112	112

How good is the computer

- In 2011 we had 145 correct winners over the home and away season, and 9 out of 10 in the finals.
- On the www.footytips.com.au website we topped the table of 14 experts and personalities, 8 ahead of the second placegetter (Matthew Richardson).
- We finished in the top 0.3% of the 375,734 people who entered their weekly tips through this site.
- The Age and the Herald Sun had 54 expert and celebrity tipsters between them. They averaged 8 behind the computer.

To: sclarke@swin.edu.au
Subject: Help.
Date sent: Thu, 20 Apr 2000 10:27:06 +1000

Dear Mr Clarke,

I have noticed you have not updated your footy tipping site. I unashamedly on bended knees implore you to up date your site immediately. I'm winning the office tipping due entirely to your wonderful system.

This is my only chance of getting anywhere in the tipping polls. You see, I am a St Kilda supporter floating alone in a sea of ignorant Weagles followers. And if I rely on my own ability to pick winners, emotion gets in the way and I find it very hard to pick such teams as Weagles, Footscray and Jack Elliot's lot. Therefore, to the end of the field I fall.

I thank you and your system for saving me and I look forward to your guidance.

Cheers

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AFL tipping Feedback

- Many thanks for your tips each week...Thanks to you I won the tipping comp at my office. On those occasions I thought I knew better I usually bombed out !! Mike

- I religiously look up your wonderfully helpful site each week - in the hope of improving my tipping ability. Cathy

- Thanks to your predictions I came second in my footy tipping competition....
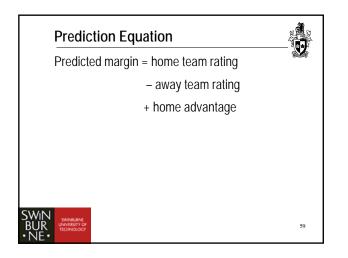
  ....and beat all the boys! THANKS! Sonia

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Swinburne Computer

- Uses exponential smoothing (cf ELO) of past results and simulation to predict
  - Winners
  - Margins
  - Probability of winning
  - Probability of making finals and finishing in any ladder position
- Clarke, S. R. (1993). Computer forecasting of Australian Rules football for a daily newspaper. *Journal of the Operational Research Society* **44**(8): 753-759.

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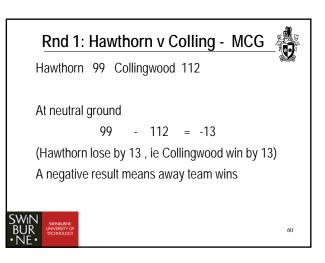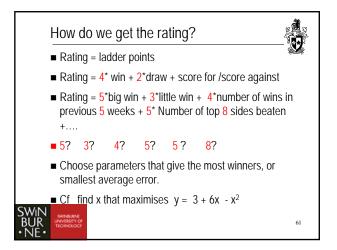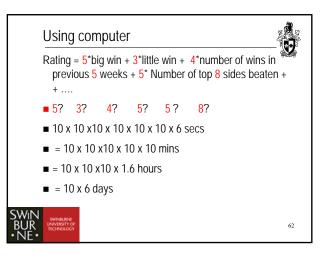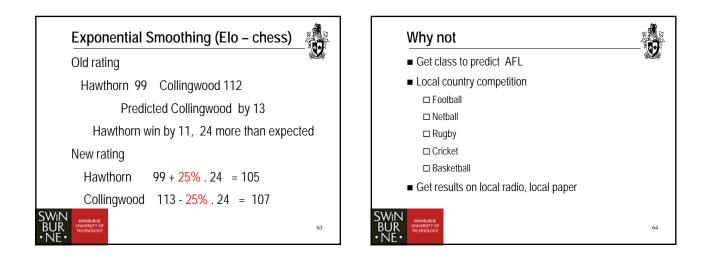
Computer tipping - how it works

Rating for each team

Geelong	118
Collingwood	112
Hawthorn	99
….	
Gold Coast	20

Home advantage 10

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Prediction Equation

Predicted margin = home team rating

– away team rating

+ home advantage

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Rnd 1: Hawthorn v Colling - MCG

Hawthorn   99   Collingwood 112

At neutral ground

99   -   112   =   -13

(Hawthorn lose by 13 , ie Collingwood win by 13)

A negative result means away team wins

60

How do we get the rating?

- Rating = ladder points
- Rating = 4^* win + 2^*draw + score for /score against
- Rating = 5^*big win + 3^*little win + 4^*number of wins in previous 5 weeks + 5^* Number of top 8 sides beaten +….
- 5?   3?   4?   5?   5 ?   8?
- Choose parameters that give the most winners, or smallest average error.
- Cf   find x that maximises $y = 3 + 6x - x^2$

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Using computer

Rating = 5^*big win + 3^*little win + 4^*number of wins in previous 5 weeks + 5^* Number of top 8 sides beaten + + ….

- 5?   3?   4?   5?   5 ?   8?
- 10 x 10 x10 x 10 x 10 x 10 x 6 secs
- = 10 x 10 x10 x 10 x 10 mins
- = 10 x 10 x10 x 1.6 hours
- = 10 x 6 days

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Exponential Smoothing (Elo – chess)

Old rating

   Hawthorn 99   Collingwood 112

       Predicted Collingwood by 13

   Hawthorn win by 11, 24 more than expected

New rating

   Hawthorn   99 + 25% . 24   = 105

   Collingwood   113 - 25% . 24   = 107

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Why not

- Get class to predict AFL
- Local country competition
  - ☐ Football
  - ☐ Netball
  - ☐ Rugby
  - ☐ Cricket
  - ☐ Basketball
- Get results on local radio, local paper

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How do we get odds?

- Look at Errors

   Collingwood by 13 points

Look at our past errors

If 40% of the time we out by more than 13 points

Then 20% of the time Collingwood lose, Hawthorn win

And 80 % of the time Collingwood win

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The Australian

National Affairs

We're happy to lead the world in gambling

- by: Mike Steketee
- From: The Australian
- May 28, 2011 12:00AM
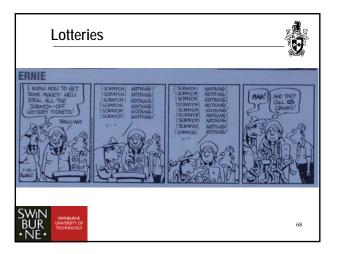
WE like to rank ourselves against the rest of the world but we could do without our status as the biggest losers.

According to international gaming industry consultants H2 Gambling Capital, Australians last year lost close to $US1300 on gambling for every resident (not including tourists) aged 17 and over. Singapore, which recently built two mega casinos, was next on about $US1150. Those famously lucky Irish came in third, but were hardly in the race with less than $US600, while the Americans and British averaged losses of less than $US400.

It would be one thing if Australians' willingness to bet on anything was no more than an endearing national characteristic. Instead, we have a problem on a uniquely Australian scale. This was brought home by a report last year from the Productivity Commission.

Pardon the following heavy diet of data but the statistics are staggering. The commission calculated total gambling losses at more than $19 billion in 2008-09, a tripling over 20 years and an average of $1500 per gambling adult. Considering the report estimated 70 per cent of Australians participate in some sort of gambling, that is in the same ball park as the H2 figures.

The expansion of gambling in the 1990s saw the share taken by casinos and electronic gaming machines, which we used to call pokies, rise from 40 per cent to 75 per cent in the 20 years to 2006-07. In 2009, there were 198,300 gaming machines in Australia, including 97,065 in NSW (but only 1750 in Western Australia).

Lotteries

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House Percentage

- Craps 1.4%
- Roulette 3%,
- Poker machines 10%-12%,
- Tattslotto and Keno over 40%.

- Racing - Totalisator 13% -18%
- Sports betting ? 2.5% - 5%

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Market Inefficiencies in Player Head to Head Betting on the 2003 Cricket World Cup

Michael J Bailey and Stephen R Clarke

School of Mathematical Sciences, Swinburne University

1 Background

The first official one-day International cricket match (ODI) was played at the Melbourne Cricket Ground on January 5 1971 between Australia and England. Since the inception of limited over cricket, there have been various rule changes, although general principles have remained the same. Both sides bat once for a limited time (maximum 50 overs) with the aim in the first innings to score as many runs as possible, and in the second innings to score more than the target set in the first innings. Prior to the 2003 World Cup, 16 countries had played 1936 official ODIs, although 95% of all matches have been played by 9 main cricketing nations (Australia, England, India, Pakistan, West Indies, Sri Lanka, New Zealand, South Africa and Zimbabwe). Just over 1200 cricketers have represented their country in ODIs.

Traditional betting markets have been in sports such as horse and dog racing where the sport survives primarily because of the associated betting
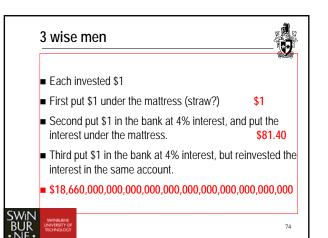

Examples on inefficiency

- Michael Bailey – cricket - 99 bets 16% ROI
- Australian Maths Society - MCS conference - Hong Kong company
- PhD on greyhound racing
- D. B. Hausch et al : Efficiency of Racetrack Betting markets
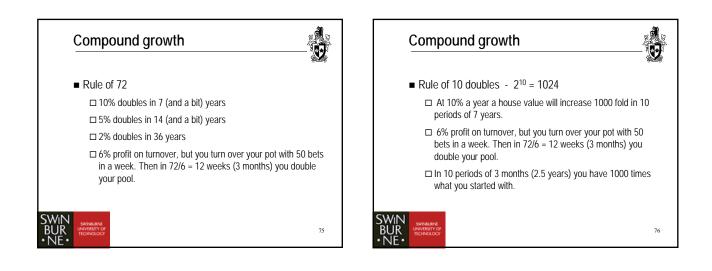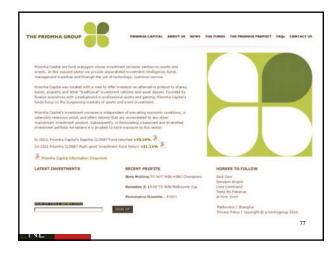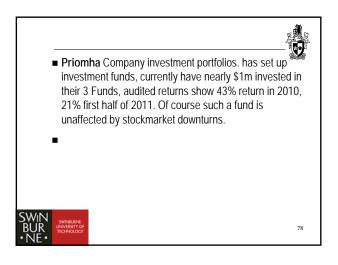- Student project on Rugby

71

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Prediction Performance

- 46 of 48 predicted winners correct
- Betting pool of $75 rose to nearly $1000 by end of tournament
- Continued on a range of sports
- Pool rose to $15 000, before plummeting in a couple of weeks to $2 000
- Currently about $800, dividends of $11 000
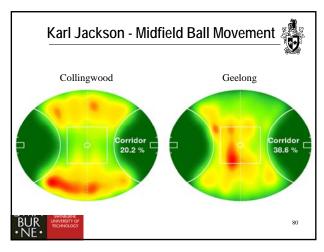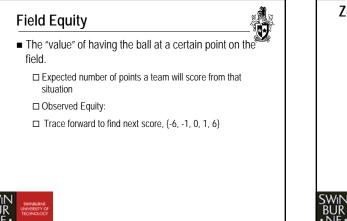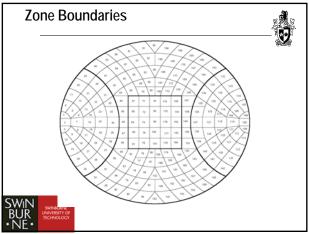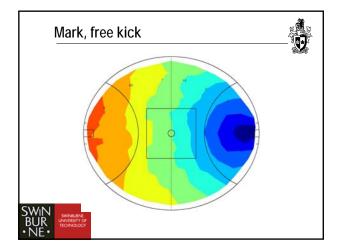- Simple forecasting models can be effective and profitable

73

3 wise men

- Each invested $1
- First put $1 under the mattress (straw?)   **$1**
- Second put $1 in the bank at 4% interest, and put the interest under the mattress.   **$81.40**
- Third put $1 in the bank at 4% interest, but reinvested the interest in the same account.
- **$18,660,000,000,000,000,000,000,000,000,000,000,000**

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Compound growth

- Rule of 72
  - 10% doubles in 7 (and a bit) years
  - 5% doubles in 14 (and a bit) years
  - 2% doubles in 36 years
  - 6% profit on turnover, but you turn over your pot with 50 bets in a week. Then in 72/6 = 12 weeks (3 months) you double your pool.

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Compound growth

- Rule of 10 doubles - $2^{10} = 1024$
  - At 10% a year a house value will increase 1000 fold in 10 periods of 7 years.
  - 6% profit on turnover, but you turn over your pot with 50 bets in a week. Then in 72/6 = 12 weeks (3 months) you double your pool.
  - In 10 periods of 3 months (2.5 years) you have 1000 times what you started with.

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- **Priomha** Company investment portfolios. has set up investment funds, currently have nearly $1m invested in their 3 Funds, audited returns show 43% return in 2010, 21% first half of 2011. Of course such a fund is unaffected by stockmarket downturns.

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Karl Jackson - Midfield Ball Movement

Collingwood   Geelong

Corridor 20.2 %   Corridor 38.6 %

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Field Equity

- The "value" of having the ball at a certain point on the field.
  - Expected number of points a team will score from that situation
  - Observed Equity:
  - Trace forward to find next score, {-6, -1, 0, 1, 6}

Zone Boundaries

Mark, free kick

3 PHASES

Advanced Kicking

- Take into account "difficulty" of each kick
- Each kick measured on whether it hit its target
- ELO-like rating system

$$R_i = H_i - \mathbb{E}(H; \theta_i)$$

$$R = \frac{\sum w_i R_i}{\sum w_i}$$

H = Hit Rate $\in \{0,1\}$
i = 1,2,3,...,n
θ = Direction, Distance, Intent, Location, Pressure

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3 PHASES

Pressure

	Set Position	No Pressure	Implied Pressure	Physical Pressure
K:H	5.29	1.48	0.98	0.39
Kick Eff	77.7%	72.4%	57.2%	26.9%
Hand Eff	98.0%	94.6%	85.2%	58.6%
Eff Disp Rate	80.9%	81.4%	69.8%	28.4%
Value	0.75	1.00	1.79	3.75

$$PF = \frac{\sum Values}{n}$$

Top 10 Kick Ratings (100+ Kicks)
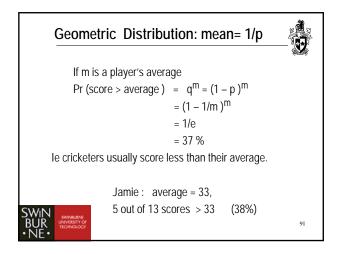
1.	Barry Hall	Western Bulldogs	+16.0%
2.	Matthew Scarlett	Geelong Cats	+11.2%
3.	Matthew Jaensch	Adelaide Crows	+10.1%
4.	Robert Murphy	Western Bulldogs	+9.9%
5.	Adam Schneider	St Kilda	+9.6%
6.	Brendon Goddard	St Kilda	+9.1%
7.	Chris Newman	Richmond	+8.8%
8.	Jared Rivers	Melbourne	+8.8%
9.	David Rodan	Port Adelaide	+8.4%
10.	Chris Yarran	Carlton	+8.4%

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Fitting standard distributions

- *In most sports and games, the winner of a particular contest, .., is decided both by skill and by luck.*
- *Fitting a standard distribution to scores allows us to measure the skill factor.*
- *The rest is chance (luck).*

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Consistency - Jamie Siddons

Sheffield Shield competition scores in 1985/6

33, 17, 76, 5, 74, 7, 7, 107, 1, 45, 17, 2, 36

Average = 33,

Probability of going out before scoring an extra run = constant p =1/33.

Prob scoring extra run = (1-p) = q =32/33

Score	0	1	2	3	4
Prob	p	qp	q^2p	q^3p	q^4p

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Jamie Siddon's cricket scores

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Geometric Distribution: mean= 1/p

If m is a player's average

Pr (score > average) $= q^m = (1-p)^m$

$\qquad\qquad\qquad = (1 - 1/m)^m$

$\qquad\qquad\qquad = 1/e$

$\qquad\qquad\qquad = 37\%$

Ie cricketers usually score less than their average.

Jamie :   average = 33,

5 out of 13 scores > 33   (38%)

Don Bradman's cricket scores

- 18, 1, 79, 112, 40, 58, 123, 37, 8, 131, 254, 1, 334, 14, 232, 4, 25, 223, 152, 43, 0, 226, 112, 2, 167, 299, 0, 103, 8, 66, 76, 24, 48, 71, 29, 25, 36, 13, 30, 304, 244, 77, 38, 0, 0, 82, 13, 270, 26, 212, 169, 51, 144, 18, 102, 103, 16, 187, 234, 79, 49, 0, 56, 12, 63, 185, 13, 132, 127, 201, 57, 138, 0, 38, 89, 7, 30, 33, 173, 0

Bradman's scores – cf geometric

Don Bradman's – 80 innings Av 100

100's	29	36%	1/e =37%
200's	12	15%	$1/e^2$=14%
300's	2	3%	$1/e^3$=5%

Ponting 263 innings Average 53 (49)

50's	95	36%	1/e=37%
100's	39	15%	$1/e^2$=14%

Randomness

- Goals in a soccer match - Poisson
- Goals per quarter in AFL - Poisson
- Dot balls in an over of cricket– Binomial
- goals from the free throw line in basketball – binomial

- Simulate a season of football

Conclusion

- *Sport is a fun area to apply mathematics*
- *But it also has serious applications*
- *PhD in Gambling, football, cricket and tennis*
- *Methods used in other areas*
- *Check our web site www.swin.edu.au/sport for weekly footy tips*
- *Career opportunities*
- *Can be hard work*

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The End

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