**Activity 1: Predicting the winning numbers!**

# Learning Intentions

* Discuss a problem that can be addressed by statistical methods and identify related questions to explore.
* Decide which data to collect to answer a question, and the degree of accuracy needed; identify possible sources.
* Plan how to collect the data, including sample size; construct frequency tables with given class intervals.
* Collect data using a suitable method.
* Construct, on paper and using ICT:

- pie charts;

- bar charts and frequency diagrams;

- simple line graphs for time series;

- simple scatter graphs.

Identify which are most useful in the context of the problem.

* Interpret tables, graphs and diagrams and draw inferences that relate to the problem being discussed; relate summarised data to the questions being explored.
* Communicate orally and on paper the results of a statistical enquiry and the methods used, using ICT as appropriate; justify the choice of what is presented.

**Hypothesis 1: You can predict the winning numbers mathematically. The higher the ‘Set’ number, the higher the balls will be.**

*Resources*

* *‘Master’ spreadsheet (discussion only)*
* *‘Set’ spreadsheets*
* *Hypothesis 1 Collection sheets (optional)*
* *Graph paper*
* *Lottery simulator*
* *Silly lottery facts*

1. Discuss the ‘Master’ spreadsheet – highlight key features such as machine, set of balls number, etc

2. Divide the class into groups and give each group a different set spreadsheet. Each group collects a random sample of winning lines (sample size discussion – 10% for each set number) using randomly generated numbers. Tally the frequency of each number in class intervals of 10.

*Example: Set 1*

|  |  |  |
| --- | --- | --- |
| Class interval | Tally | Frequency |
| 0 – 9 |  |  |
| 10 - 19 |  |  |
| 20 – 29 |  |  |
| 30 – 39 |  |  |
| 40 - 49 |  |  |

3. Use ICT/paper to interpret the results and draw conclusions.

4. Ask each group to analyse their samples and select the 6 numbers that appear most likely to win the jackpot. Simulate the national lottery using ‘Lottery Simulation’ with their predicted winning numbers – **emphasise their total loss**. The lottery is a bad investment! Use the simulator to illustrate that you need around 57 goes to win £10 – i.e. congratulations, you have lost £47! Compare this with the **LUCKY NUMBERS** chart in **APPENDIX A**.

1. Blind the learners with crazy facts surrounding the lottery!

*Official Odds from National Lottery Literature (2004)*

|  |  |
| --- | --- |
|   | **Odds** |
| **Matching Numbers** | **Lottery** | **Thunder ball** | **Extra** |
| Match 6 | 1 : 13,983,816 |   | 1 : 13,983,816 |
| Match 5+ | 1 : 2,330,636 | 1 : 3,895,584 |   |
| Match 5 | 1 : 55,492 | 1 : 299,660.3 |   |
| Match 4+ |   | 1 : 26,866.1 |   |
| Match 4 | 1 : 1,033 | 1 : 2,066.6 |   |
| Match 3+ |   | 1 : 959.5 |   |
| Match 3 | 1 : 57 | 1 : 73.8 |   |
| Match 2+ |   | 1 : 106.6 |   |
| Match 1+ |   | 1 : 32.8 |   |

Compare the 1 in 14 million chance of winning the lottery with:

|  |  |
| --- | --- |
| ***Dying from ….. in any one year*** | ***Odds*** |
| Being struck by lightning | 1 in 10 million |
| Drowning in the bath | 1 in 800,000 |
| Playing football | 1 in 25,000 |
| In a plane crash | 1 in 20,000 |
| An asteroid or comet hitting the Earth | 1 in 20,000 |
| Being involved in a road accident | 1 in 8,000 |
| Influenza | 1 in 5,000 |
| Smoking 10 cigarettes a day | 1 in 200 |

**Crazy facts**

* *For every £1 paid into the lottery 50p goes into the prize money* and the rest goes in tax, good causes and administration. That means your expected return on each bet is a loss of 50p! Every time you don’t play the lottery you have made a 50p profit! – see ‘**WHERE DOES YOUR MONEY GO?**’pie chart in **APPENDIX A**.
* *Which day of the week should you buy a ticket for the Saturday lottery?* The answer is you buy it on Friday or Saturday. If you buy it earlier than Friday, your chance of winning the jackpot is 1 in 13.9 million which is lower than the chance of being run over by a car in a 2 day period – 1 in 10 million! There does remain at least one unclaimed jackpot. Is that the reason why?

* *Only mugs play the national lottery*! There is a 1 in 57 chance of winning £10. Therefore, on average, you lose £47 when you think you have won £10. How many people stop if they win £10?
* *Does it matter where you live?* See **lucky locations** in **APPENDIX A** – misuse of data?!
* *How does a win affect you?* 100% of jackpot winners put on weight.
* Unlucky for some? See **most/least likely drawn numbers** in **APPENDIX A**
* Play the ‘nice lottery’ – you still lose!
	+ Compare the odds of the Irish Lottery using Pascal’s Triangle. For the UK lottery you choose 6 numbers from 49. Go to row 49, diagonal 6 of Pascal’s Triangle, and you will find the number 13,983,816 – the number of different ways of choosing your 6 numbers, and therefore the origin of the 1 in 13,983,816 chance of winning.
	+ While you can’t change your chance of winning, you can maximise your winnings if you do – by avoiding popular combinations which would result in you sharing the prize money. For example:

- Many people choose numbers lower than 32 as they correspond to birthdays.

- Many people choose sequences of numbers, times tables – even 1, 2, 3, 4, 5 and 6!

* + But the most effective way is to choose seven numbers and buy seven tickets – each one omitting one of the seven numbers. Then, if six of your numbers come up you win the jackpot – and six of your tickets match five of the numbers! Apparently, this paid off for one very fortunate gentleman in the USA a few years ago.

**Activity 2: The average number**

# Learning Intentions

* Calculate statistics … recognise when it is appropriate to use the range, mean, mode or median
* Interpret graphs and diagrams and draw inferences that relate to the problem being discussed
* Interpret graphs and diagrams and draw inferences to support or cast doubt on initial conjectures; have a basic understanding of correlation.

**Hypothesis 2: The higher the average of the 6 numbers, the higher the set number**

*Note: superb outliers are week 9 (133 winners) and any in bold – ‘special’ guaranteed winning weeks*

*Preparation tasks:*

* Find the scatter-diagram buddy
* Discussion about appropriate choice and use of averages
1. Use a random generator between 1 and 882 to select a random sample of 30 lines. Students construct a hand drawn scatter-diagram and comment on the correlations, identify any outliers and comment on the significance of the gradient and y-intercept.

1. Use ICT (class demonstration or individual) to analyse bigger samples (10%: 88 lines) to produce a scatter-diagram of average winning number against set number.



PMCC = 0.094451

Calculate regression values and analyse trend lines to draw conclusions.

*There is slight positive correlation in this case. Does this mean that there is evidence that the hypothesis is correct? Obviously, this is not right. It might be appropriate to discuss the outliers. You could demonstrate the impact of outliers by removing them and recalculating the PMCC)*

POPULATION RESULT: PMCC = 0.012331. No surprise.

**Activity 3: How much is paid out?**

**Hypothesis 3: The higher the average of the 6 numbers, the higher the total paid out by Camelot**

Use a random generator between 1 and 882 to select a random sample of 30 lines. Students construct a hand drawn scatter-diagram and comment on the correlations, identify any outliers and comment on the significance of the gradient and y-intercept. (Note: bold figures are guaranteed weeks)

Use ICT (class demonstration or individual) to analyse bigger samples (10%: 88 lines) to produce a scatter-diagram of average winning number against jackpot paid out.



PMCC =

-0.12853

Calculate regression values and analyse trend lines to draw conclusions.

*Weak negative correlation – the higher the average winning number, the lower the jackpot paid out?! The gradient indicates that for every one increase in the average number, the total jackpot decreases by £95586. The y-intercept is meaningless (zero average winning number implies a jackpot of 7,000,000) because data range has to start at (6+5+4+3+2+1)/6 = 3.5*

POPULATION RESULT: PMCC = -0.03338. No surprise.

**Further ideas**

**Hypothesis 4:**

* **Most people use dates of birthdays as their 6 lottery numbers**
* **You must always have a number higher than 32 to win a larger share of the Jackpot**
* **The higher the average of the 6 numbers, the higher the jackpot winnings per person**
* **The higher the average of the 6 numbers, the more winners**
* **The total sum should be distributed normally about 150 (6x25)**

*Note: Samples including Week 9 will give nice discussion points*



PMCC = 0.10616

Calculate regression values and analyse trend lines to draw conclusions.

*Weak Positive correlation – the higher the average winning number, the more money each person wins? The gradient indicates that for every one increase in the average number, the total money winnings per person increases by £52409! The y-intercept is meaningless (zero average winning number implies a jackpot of £3,000,000) because data range has start at (6+5+4+3+2+1)/6 = 3.5. The trend line can be used to calculate the difference in winnings between someone who has an average winning number of 20 compared to an average winning number of 40 – almost £1,000,000 difference!*

POPULATION RESULT: PMCC = 0.240524

*Further Reading*

* Teaching Mathematics through National Lotteries
* Lottery Guides - Calculating the Odds
* How to win the National Lottery, Peter Stirling

**APPENDIX**











*Source:* [*www.national-lottery.co.uk*](http://www.national-lottery.co.uk) *– results up to June 2004*