CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)	**Project Number**
Abdur R. Amin	**J1201**

Project Title

The Actual Cost of Credit Cards

Abstract

Objectives/Goals

This project was performed in order to determine which credit card would charge the least amount of interest with regard to the percantage of the balance paid. It also helps in choosing which card is best under certain conditions.

Methods/Materials

Three top rated credit cards with similar plans were chosen as the subject of this experiment and they were: Blue from American Express, Discover Platinum, and Chase VISA. Three preset starting balances were chosen and were: $100, $500, and $1000 without any additional costs being added. There were cases in which one who did not pay the balance at all, one who paid only the minimum balance, one who paid ¼, ½, # of the balance but not less than the minimum payment, and one who paid the entire balance. The spreadsheet was designed to study any starting balance and any percent paid of the balance. All the cases were tested under each plan to determine which card was the best under each condition. After each billing period, the new balance was calculated for each case under all APR#s for the cards.

Results

The results indicated that Discover was the best choice for one who does not pay at all. However the ending balance after a year with no payments paid at all throughout the year was more than 7.5 times higher than the original balance which was a $100. If it was $500, the ending balance increased by about 3.5 times of the original, and for $1000 it increased about 3 times more than the original. Similar findings agree with the remaining two cards. American Express was better for balances more than $100 and payments equal or less than the minimum. If one paid the minimum balance, one would be out of debt by the 9th billing cycle with American Express or Discover. The lower rate offered by Discover would allow one to pay off the balance by the eighth month. And VISA would leave one with around $70 by the end of the year. None of the credit cards ended up with a balance of $0 after a year if the starting balance was $500 or $1000. All the credit cards would have an ending balance of $0 if one paid a quarter or more of the balance.

Conclusions/Discussion

One should try to pay as much as one could, for one could pay off their dues faster and end up paying much less than the starting balance. It is worth it at least to pay the minimum balance. That would drop the new balance to about 20% in a year. Overall Discover is the best choice than other studied cards.

Summary Statement

This project calculates the total cost of credit card expenses by comparing different payment methods under different credit card plans.

Help Received

Sister helped design board; teacher corrected and supervised work; high school student taught me more about MS Excel

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Jasleen K. Bains

Project Number
J1202

Project Title
Pi Calculation Methods and Practical Application in the Usage of Pi in the Scientific World

Abstract

Objectives/Goals
The goals and objectives of this project are to compare three distinct formulas to find the most accurate and quickest formula that calculates Pi, find the importance of Pi, and actually finding out how our lives would be without this irrational number. Some questions that can be asked are:
1: What are some of the different ways that calculate the constant Pi? Is any method more accurate and efficient than another?

Methods/Materials
I used three distinct methods/formulas that calculated Pi: Buffon's Needle Experiment, Wallis Infinite Product, and Brent-Salamin Algorithm.(Each formula had a long procedure and since there is a 2400 character limit, each procedure will not be described in detail.) There was a total of ten trials and an average. Five materials were used: toothpick (2 5/8 inches), highlighter (green and blue), pencils, papers, and a ruler.

Results
The Brent-Salamin provided the most accurate calculation in approaching the value of Pi and the Buffon's Needle Experiment was the quickest formula. The real resultant from this data was that no method or formula can calculate Pi's exact value, except Pi, itself.

Conclusions/Discussion
After completing my investigation, on comparing different methods that calculate Pi, finding the importance of Pi, and how life would be without Pi, I discovered that the best method to calculate Pi was the Brent-Salamin Algorithm. So, if ever any circular obbjects are made the Brent-Salamin should be used. Technology is just an excuse. If one uses their own brain to figure something out, a pleasure that is somewhat unknown creeps into you. Also, only mathematicians don't use Pi, even farmers use this constant.

Summary Statement
My Project is about comparing different formulas that calculate Pi to find the most accurate and quickest equation.

Help Received
Friend helped make display board.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Holden T. Bamford

Project Number

J1203

Project Title

Forming Fabulous Fern Fractals

Abstract

Objectives/Goals

The purpose of this student's project is to explore four things new to the researcher: (1) computer programming, (2) a graphing calculator, (3) algebra, and (4) fractals found in both geometry and nature. This project examines whether it is possible to create a computer program involving fractals to display an image of a fern plant using a graphing calculator that contains a fractal program for the Serpinski Triangle. The student wished to explore how a very new area in mathematics, the study of fractals, could be used to explore one of the oldest plants on earth.

Methods/Materials

The student began with a computer program for the Serpinski Triangle found in the manual of a graphing calculator. The student changed variables in each program that was created such as the number of points plotted, the boundaries of the X axis and the Y axis, and the parameters of the algorithms. The student plotted the points using the graphing calculator and made programming notes to help with the researcher's quest for a realistic image of a fern.

Results

It was possible to begin with the fractal program for the Serpinski Triangle that was programmed into a hand held graphing calculator, and then modify the basic program in order to produce images that look like those of common fern plants.

Conclusions/Discussion

Various programs and changes to the programs were tried during the quest for a realistic image of a fern. During the manipulation of various variables, it was confirmed that increasing the number of points plotted will create a more detailed image, changing the X and Y axis will change the height and width of the fern image, and changing the parameters of the algorithms used will change the pattern of the fern#s leaves and shape. Unfortunately, it may be that if a programmer uses too many points plotted, the increasing iterations may make the images not as appealing. This probably should be tested further with a computer that has more pixels and other capabilities This student researcher greatly enjoyed learning the #tip of the iceberg# when it comes to programming and creating fern images out of fractals. This student researcher also plans on making many more attempts at computer generated images, and wonders if this pursuit could become habit forming!

Summary Statement

Can modifications be made to a #fractal# computer program for the Serpinski Triangle, including modifications to the number of points plotted, the boundaries of the X axis and the Y axis, and the parameters of the algorithms, in order to gr

Help Received

My dad taught me how to understand basic computer programming. He also helped me figure out how to modify the initial computer program and experiment with different parameters I found in articles about fern images made with fractals. My mom proofread my work and helped me learn about living ferns. My

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Neethi Baskaran

Project Number

J1204

Project Title

Inverse Symmetry Pattern in the Multiplication Table

Abstract

Objectives/Goals

My objective is to find out why when a multiplication table is folded diagonally so that the fold runs from the upper left corner to the lower right corner, the numbers that touch each other (excluding the row and column headings) have identical ones place numbers.

Methods/Materials

Methods: I thought that this pattern was caused by another pattern in the factors of the numbers with identical ones place digits, so I examined these factors and looked for patterns.

Materials: A multiplication table

Results

I did find a pattern in the factors of the numbers with ones place digits related to this previously found pattern. However, while I was explaining my findings to a judge in the Santa Clara Valley Science Fair, I discovered that this pattern that I had found did not always work. As far as I know now, it only works for the even pairs of numbers. I also found that this pattern with the ones place numbers only occurs in square multiplication tables that go up to a multiple of five. In the process, I noticed some other patterns in the factors of these numbers, which will take a while to explain thoroughly, so I am not including that in the abstract.

Conclusions/Discussion

The quite significant pattern that I found (which I later discovered to not always work) that is relevant to the first pattern is explained here. Take two of the numbers with identical ones place digits explained previously.

10 40

2 x 5 8 x 5

Give them two other common factors.

2 x 5 2 x 20

Multiply the common factor, 2, by the ones place digit of the other number in each product.

2 x 5 = 10

2 x 0 = 0

I condensed all of this into one formula, that is shown here, in which n = the ones place value.

n { GCF(b, y) x n[(b / GCF(b, y)) x c] } = n { GCF(b, y) x n[(y / GCF(b, y)) x z] }

Summary Statement

Why, when a multiplication table is folded diagonally so that the fold runs from the upper left to the lower right corner, do the numbers that touch each other (excluding the row and column headings) have identical ones place numbers?

Help Received

My Mother and my teachers helped me to find ideas. My Mother did some of the formatting for the report. My teachers helped me to improve the report, the poster and my presentation.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Trent J. Boras

Project Number

J1205

Project Title

Bugs in the Box

Abstract

Objectives/Goals

To determine which Anti-Virus software on the market is the most effective,cost efficient, and has the most features.

Methods/Materials

2 home built computers-AMD Athlon 2800, Windows xp Panda Antivirus, AVG Antivirus, Ez Trust Antivirus,Norton Antivirus,McAfee Antivirus, Bitdefender Antivirus,8 common viruses, 3 custom Viruses

Results

Panda and Bitdefender outperformed the other Antivirus software. Norton performed average, while McAfee was below average.

Conclusions/Discussion

Panda and Bitdefender are the best Antivirus out on the market right now.Even though Norton and McAfee are the most popular, Panda and Bitdefender are the most reliable and contain more features.

Summary Statement

Effectiveness of Anti-virus software

Help Received

mom, for preparing and buying my supplies, Jay with helping me to work on my tests and graphs

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Aaron E. Boussina

Project Number

J1206

Project Title

Fibonacci in Nature

Abstract

Objectives/Goals

The purpose of my project was to observe the occurrences of Fibonacci numbers, sequences, the Fibonacci ratio, and the Fibonacci spiral in nature.

Methods/Materials

The experimental methods were as follows:

1. I measured the three sections of people's fingers, and calculated the ratios of the three bone sections in each finger in order to confirm the Fibonacci Ratio.
2. I went outside to observe plants and flowers in order to find Fibonacci numbers in their amount of leaves and pedals.
3. I organized the Fibonacci numbers in a table and derived the Fibonacci ratio, spiral, and Fibonacci sequences.

Results

Results indicate that Fibonacci numbers, sequences, ratios, and spirals occur in plants, flowers, rabbit breeding patterns, shells, pinecones, human fingers and much more in nature.

Conclusions/Discussion

It was concluded that there is an abundance of Fibonacci numbers, sequences, ratios, and spirals in nature. There are Fibonacci numbers all around us, wherever we go; which confirms my hypothesis that Mathematics is part of the natural process (nature is a Mathematician).

Summary Statement

Observing the occurrences of Fibonacci numbers, sequences, the Fibonacci ratio, and the Fibonacci spiral in nature.

Help Received

Parent helped glue items to the display board and proof-read my work.   Parents and friend provided their fingers for measurement.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Lauren K. Cote

Project Number

J1207

Project Title

The Gaming Theory Is a Winner

Abstract

Objectives/Goals

My project is to see if the gaming theory invented by John von Neumann and Oskar Morgenstern help to improve your chances when you are involved in a gambling game as apposed to using more traditional factors such as luck, hunches, or counting cards. I believe that the gaming theory can help improve your when you are involved in a gambling situation.

Methods/Materials

For my experiment I had a dealer deal 100 rounds of black jack to four subjects. Three subjects used traditional methods such as luck and hunches, while one player used special gaming theory/black jack tables.

Results

The person using the gaming theory tables had a higher amount of money in chips after 100 rounds of blackjack.

Conclusions/Discussion

My conclusion is, that people using gaming theory when applied to a game of black jack have a greater money outcome than using traditional methods.

Summary Statement

My project studies the effectiveness of gaming theory in a game of black jack.

Help Received

Mom, Dad, Alex Cote, Dr. Dunn, subjects- Elizabeth Niles, Mikayla Richter

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Aaron Joseph J. Cruz

Project Number

J1208

Project Title

Pick's Theorem and the A.C. Extension

Abstract

Objectives/Goals

The purpose of my project is not to only prove Pick's Theorem because that would be a bit boring. I also wanted to see if his theorem works on alternately consistent spaced grids. If not, I wanted to see if I can come up with a formula of my own that would work. My hypothesis was that Pick's Theorem should work on my alternately consistent spaced grids. Also, since the grids are consistently spaced I should be able to derive a formula of my own from my data.

Methods/Materials

I used one-fourth inch by one-fourth inch grid paper, alternately consistent spaced grid paper(a.k.a Aaron's Grid Paper),colored pencils,and a calculator. Basically, I drew polygons on regular grid paper and alternately consistent grid paper. I found the areas of these shapes using traditional methods and with Pick's Theorem. If Pick's Theorem would not work, I tried to derive my own formulas that would work.

Results

I found out that Pick's Theorem did not work with my squares on my type of grid. Therefore, I had to come up with my own formula. The formula is not exact, but with some rules it comes out right every time. I call it Aaron's Formula. The formula is ($A=2.25I + 0.7B - 1$). The variable (I) stands for the number of interior points and (B) stands for the number of boundary points when graphed. The variable (A) is the area. Now, when you multiply $2.25I$ or $0.7B$, the answers will not always be whole numbers. That's where Aaron's Rule comes in! Since you might get a whole number with a decimal it will be a bit hard to calculate the areas. My rule states that if it is an odd number to round up, and if it is an even number to round down. If it is already a whole number just leave it alone.

Conclusions/Discussion

My conclusion is that Pick's Theorem did not work on my alternately consistent spaced grids. The formula is not exact, but I am currently trying to find one that is. I am also experimenting with formulas for polygons other than squares.

Summary Statement

My project is about experimenting if Pick's Theorem will work on finding the area of polygons on alternately consistent spaced grids and if not, coming up with my own formulas that will work.

Help Received

School teachers helped explain mathematical terms.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Landon R. Epps

Project Number

J1209

Project Title

Flight Sim 2006

Abstract

Objectives/Goals

To create a program demonstrating menus and 3D graphics that will allow the user to control the flight of an airplane within the 3D environment.

Methods/Materials

Windows Me/XP compatible Toshiba Satellite 2805-S201, Blitz 3D, Game Programming for Teens by Maneesh Sethi, 1 3D compatible graphics card, and an Intel Celeron Processor, to program Flight Sim 2006

Results

I found that I could successfully create a 3D environment that a user can fly a plane through a 3D terrain using a mouse or joystick that supports different menus and mouse input. I also found I could create a 2 player interface that supports dual cameras and different views.

Conclusions/Discussion

I can create a flight simulator using Blitz 3D, a successful programming language, with 3D graphics, menus, music, 2 player support, camera views, lighting and server support. I also found that I could create a 3d terrain with texture maps.

Summary Statement

Programming a 3D environment that supports input from the user and controls a 3D DirectX airplane.

Help Received

Robert Epps for helping me do a flow chart. John Epps and Terri Epps for helping me come up with ideas of what to include in this project and helping me with the notebook and display board. Mrs. Culley for giving me suggestions. Mark Sibly for creating Blitz 3D

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Nick J. Famiglietti

Project Number

J1210

Project Title

Can a Computer Accurately Simulate Rolling Dice?

Abstract

Objectives/Goals

My question is, "Can a Computer Accurately Simulate Rolling a Dice?"

Methods/Materials

1. Notebook, pencil or pen (to record results)
3. 1 six-sided die
4. Flat area such as tabletop minimum of 1m by 1m
5. Computer
6. Psuedo-random number generator capable of generating a random number from 1 to 6 100 times

I rolled a die and recorded the result 100 times in a table in my notebook, then went to my computer and ran the pseudo-random number generator (which generates a number from 1 to 6 100 times) and recorded those results as well. I repeated this cycle 3 times, then averaged how many times in 100 each number appeared, and created a graph with that data.

Results

Averages of how many times each face appeared (after 3 trials of 100 rolls each):
>Human - 1: 14.3, 2: 17.6, 3: 14.3, 4: 19.3, 5: 15.3, 6: 19
>Computer - 1: 17.6, 2: 18, 3: 15.6, 4: 15, 5: 17.6, 6: 16

Conclusions/Discussion

If you were to plot the above data in a graph, the bars would not be the same height. But we are dealing with true randomness here, and so exact sameness doesn#t occur. The numbers compensate for each other; the computer rolled 1 more than I did, but I rolled 4 more than the computer. So yes, I think that my hypothesis is correct and that a computer can accurately simulate rolling a dice.
Random number generators are used all the time # they would have to be accurate. The generator I wrote is just a single example of one.

Summary Statement

My experiment was to find out if a computer could accurately simulate rolling one six-sided die.

Help Received

My mother and father helped me come up with original idea.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Lisa D. Felber

Project Number

J1211

Project Title

How to Deal with a 3-Card 16 in Blackjack

Abstract

Objectives/Goals

The objective is to determine if it is reasonable in Blackjack to act differently with a 2-card 16 than with a 3-card 16 against a dealers 10. I think it is reasonable to say that the 3-card 16 has a higher chance of going bust.

Methods/Materials

I calculated the probabilities of drawing all possible cards for all possible combinations of 2-card 16s and 3-card 16s. I used Microsoft Excel to organize the probabilities and I used a standard 52-card deck to better understand the probabilities.

Results

The probability of going bust with a 3-card 16 against a dealers 10 is 61.43%. The probability of going bust with a 2-card 16 is only 59.18%.

Conclusions/Discussion

My conclusion is that it is reasonable to draw to a 2-card 16, but stick on a 3-card 16 against a dealers 10. This conclusion agrees with the single author who made a distinction between the two cases, and disagrees with all the authors who recommended drawing in all cases.

Summary Statement

The probabilities of going bust in Blackjack with a 2-card 16 and a 3-card 16 against a dealers 10 were calculated and compared to see if it is reasonable to draw to a 2-card 16, but stick on a 3-card 16.

Help Received

My father helped teach me the probability theory that I needed for this project. My teacher helped me organize the graph and proofread my papers.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Casey L. Fu

Project Number

J1212

Project Title

Divisibility Discovery: A New Divisibility Rule

Abstract

Objectives/Goals

Different divisibility rules for some specific numbers have been established. But is there a general divisibility rule, or pattern, that applies to any number? I hypothesized that there is a general divisibility rule for any divisor ending in 1, 3, 7, and 9. The reason I chose 1, 3, 7, and 9 is because divisors ending in 0, 2, 4, 5, 6, and 8 can be broken down into divisors ending in 1, 3, 7, or 9 unless they are powers of 2 or 5.

Methods/Materials

I used 11, 21, 31, and 41 as divisors ending in 1 and chose some of their multiples as dividends. I studied the relationship between the digits of the dividends and divisors and performed different operations on the digits to find the operation that would always produce results that are multiples of the divisors. This operation would be the divisibility rule for divisors ending in 1. I established the rules for divisors ending in 3, 7, and 9 in the same way. Then I used Microsoft Excel to test my rules with greater dividends and divisors.

Results

For any dividend, 10A+a(1), where a(1) is the unit's digit of the number, and A is the number formed by the dividend without the unit's digit, and any divisor, 10B+b(1), where b(1)=1, 3, 7, or 9, and B is the number formed by the divisor without the unit's digit, the divisibility rules for divisors ending in 1, 3, 7, and 9 are A-a(1)*B, A-a(1)*(7B+2), A-a(1)*(3B+2), and A-a(1)*(9B+8) respectively, which means for divisors ending in 1, if A-a(1)*B is divisible by the divisor, the original dividend is also divisible by the divisor, and the same for divisors ending in 3, 7, and 9. For example, is 5082 divisible by 231? In this case A=508, a(1)=2, B=23, and b(1)=1. Since 508-2*23=462, and 462 is divisible by 231, 5082 is divisible by 231. These rules were valid for every dividend and divisor tested using Microsoft Excel. Using modular arithmetic, I further proved the rules to be valid for any number.

Conclusions/Discussion

My hypothesis is supported because the results show that there is a general divisibility rule for divisors ending in 1, 3, 7 and 9, and the rule is related to A, a(1), and B. The rules I established contribute to the number theory and can be applied to prime number testing, which is important in fields such as cryptography. Next, I will try to find a more general divisibility rule for any number ending in any digit.

Summary Statement

There is a general divisibility rule for any divisor ending in 1, 3, 7, or 9 and the rule is related to A, a(1), and B.

Help Received

Mrs. Diana Herrington gave advice on report. Mom designed computer program to test my rules. Grandpa helped glue board.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Kristina E. Fung

Project Number

J1213

Project Title

Cycling Antibiotics to Control Antimicrobial Resistance: A Mathematical Model

Abstract

Objectives/Goals

The purpose of my project is to determine if cycling various antibiotics can reduce antimicrobial resistance using a model I created on Excel.

Methods/Materials

Computer with Microsoft Excel
Parameters of bacterial growth rates

I created a mathematical model on Excel that represents the spread of antimicrobial resistance throughout a population of bacteria, and the effect when different antibiotics are cycled. Starting with binary fission (growth) for bacteria, I created the model by assembling equations made up of variables that explained what was happening (death from natural causes and antibiotics, rate bacteria become resistant and nonresistant, slowed growth rates of resistant bacteria) to show that cycling antibiotics reduces antimicrobial resistance. I also tested different values for each of the variables to see how sensitive the results were to each variable.

Results

The results showed that, with the values I chose, cycling antibiotics is a partial solution to antimicrobial resistance. The Stage 1 results were sensitive to a and s, and n could not be changed a lot because it has to be greater than a and less than 1; the results were not sensitive to r. Changing the value of n again did not change the percentages of resistant, AB1-resistant, and AB1AB2-resistant bacteria because, it increased the numbers of all the bacteria but did not change the proportion of how many bacteria were resistant and non-resistant. In Stage 2, changes in a and s caused dramatic changes, changes in n and r did not cause as much change, and even drastic changes in m produced less than .01% change because m was a small number.

Conclusions/Discussion

My hypothesis that cycling antibiotics is a partial solution to antimicrobial resistance appears, according to my model, to be correct. However, because I used a model to test my hypothesis, the results cannot show exactly what would happen if cycling was used in the real world. I did not use exact data or parameters in my model, partly because this is often not available, since this is such a new subject, and also because the parameters vary among bacteria and antibiotics. In the future, I would also like to include stochasticity to make my model more realistic. It is likely that cycling antibiotics will work for some, but not all combinations of bacteria and antibiotics, depending on the exact growth rates and reaction to the specific antibiotics.

Summary Statement

I built a mathematical model to show that cycling antibiotics reduces the spread of antibiotic resistance.

Help Received

Father helped me understand journals, taught me how to create graphs, edited my report; Mother found literature for me; helped me understand journals, proofread formulas; Jacob Pollock taught me about Excel and that I could create my own model; Teachers edited parts of my report and provided me with

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Alex A. Giannetta

Project Number

J1214

Project Title

Did College Football Get It Right in 2003 and 2004?

Abstract

Objectives/Goals

My goal was to determine whether the formula used by the Bowl Championship Series (BCS), college football ranking system, placed the most qualified teams in the National Championship game in 2003 and 2004.

Methods/Materials

I constructed a spreadsheet that included the following information for all 117 Division 1A College Football teams: Winning Percentage, Strength of Schedule, Points per game, Yards per game, and Yards Against per game. Based on this information, I created my own formula which was (Winning Percentage + Strength of Schedule) X (Points per game+ Yards per Game # Yards Against Per Game). After applying the formula to each team, I received a numerical value that I placed in order from highest to lowest. This provided the rankings I used to find which team I believe should have played in the championship games.

Results

The experimentation ended with the Oklahoma and USC in the National Championship game, just like the BCS rankings said.

Conclusions/Discussion

My conclusion is that the BCS, which ranks the teams, is not always 100 % correct, however the teams who played in the National Championship games were the same for both my ranking system and the BCS system. My results somewhat supported my hypothesis.

Summary Statement

My project is to determine if the ranking system used by college football ensures that the top two teams played in the championship game in 2003 and 2004.

Help Received

My parents assisted me in designing my board, as well as helping me to locate some of the statistics used. My science teacher worked with me on expanding my project to include the 2003 championship for a second year of comparison.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Ryan T. Goulden

Project Number
J1215

Project Title
Your Password Is Not Secure

Abstract

Objectives/Goals
The purpose of this experiment is to determine what type of password is most #secure#, where type is classified by character set and length.

Methods/Materials
The testing was done by scripting my computer (Dual 2 GHz #PowerPC 970 (2.2)# processors, 2GB DDR SDRAM) to generate and cycle through character strings. Various scripts used different parameters to generate different types of character strings. The parameters were character set and length: 1) lengths varied from one to eight characters, and 2) the character sets were numeric, alpha, alpha + caps, alpha-numeric, alpha-numeric + symbols, and all typeable ASCII characters. The scripts also timed themselves.

Results
The scripts that took the longest time to cycle through used larger character sets, versus only a longer string. For example, all combinations of six numeric characters takes half as much time to cycle through compared to three characters in the alpha-numeric + symbols character set.

Conclusions/Discussion
In password security, the size of the character sets plays a greater role than the length of the password. More secure passwords contain many different types of characters.

Summary Statement
This experiment tests the security of different types of passwords.

Help Received
I received assistance from my parents in the grammatical proofreading of my write-ups.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Kaylee M. Hanks

Project Number

J1216

Project Title

Determining the Effects of Image Compression on DPI and Image Quality of Digital Photographs

Abstract

Objectives/Goals

The purpose of my project was to find out which file format (TIFF, GIF, JPEG)had the best image quality.

Methods/Materials

First, I took four different photographs with the Kodak Easy Share digital camera.Then, I uploaded the photos to the computer using the USB cable. After that, I saved the photos into the different file formats. Next, I saved the files to the Attach'e memory stick. Then, I took them to school,loaded them up to the Apple laptop computer, and let 34 6th graders compare the files.

Results

It turned out that to the 6th graders TIFF and JPEG were the best. TIFF is the best file format.

Conclusions/Discussion

I found that my hypothesis is correct. 14 students thought that JPEG was the best. Another 14 thought that TIFF was the best and only 5 thought GIF was the best.

Summary Statement

My project is about image compression and digital photographs.

Help Received

Mother helped attach letters to display board.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Patrick E. Holub

Project Number

J1217

Project Title

The Eleventh Variation

Abstract

Objectives/Goals

The purpose of this project is to determine if there is a mathematical solution for the card trick known as The 11th Variation. How does the mystery card the volunteer selects always end up being the eleventh card in the stack after the trick is done?

Methods/Materials

A volunteer selects a card from a group of 21 cards and places it back in the stack. The dealer distributes the cards into 3 columns with 7 rows. The volunteer only confirms the column his card is in. The dealer picks up the cards placing the identified column between the other two. This procedure is repeated two more times. After the third cycle, the dealer counts down to the eleventh card in the final stack to reveal the card chosen by the volunteer.

Results

Let x equal the initial position of the mystery card (MC) in the stack of 21 cards. Let y equal the MC row position. The first equation becomes: $y = x/3$, this row result is rounded up to the nearest whole number. Placing the MC column between the other two places 7 cards are ahead of the MC column. The MC position now becomes $x = 7 + y$. Substituting any initial card position for x (i.e. 1-21) and performing the calculation three times always ends with a final MC solution of eleven. The mystery card is always the eleventh card from the top of the stack regardless of it' initial position.

Conclusions/Discussion

The results from the research proved that there is a mathematical solution for the 11th Variation. I found the formula for the position of the mystery card. I found out why the mystery card is always the eleventh card from the top. Now, since I have found out the math behind this, I figured out that not all card tricks require deception in order to be successful.

Summary Statement

Proving that some tricks involve no deception or trickery at all, they can be explained mathamatically.

Help Received

Mr. Minton got me started by helping me express my ideas and my father helped with the results.

Name(s)

Rebecca E. Jacobs

Project Number

J1218

Project Title

The Nimber-Simplex Graph as a Model to Compare LDPC and Turbo Codes

Abstract

Objectives/Goals

The objective of this project was to expand on my previous projects, which defined and characterized the Nimber-Simplex graph. The first goal was to prove that all binary linear codes map to the graph. The second goal was to demonstrate the graph's practical applicability by comparing low density parity check (LDPC) codes and turbo codes.

Methods/Materials

To prove my first hypothesis, I formally defined the Nimber-Simplex graph, then proved that all binary linear codes map to the graph by mapping message digits to the vertices. I showed examples using Hamming codes, single parity check codes, and maximum length codes. Next, I formally defined binary linear sets as abelian groups with self-inverse and proved that they map to the graph. I showed examples using BCH codes and polynomials in binary fields. To prove my second hypothesis, I showed how Gaussian elimination can be used to derive standard generator and check matrices from an LDPC matrix. Using these standardized matrices, I mapped the LDPC (15, 7)-code to the graph and then showed a construction of standard parity check codes and turbo codes which are roughly equivalent to the original LDPC code. I briefly discussed measures of code performance and outlined a direct comparison between the two families, proving my hypothesis.

Results

This project proves its hypotheses and gives an outline for future study. The proof that all binary linear codes and sets map to the graph allows a direct comparison between two highly effective but dissimilar modern code families: LDPC codes and turbo codes. A proposal for implementation of this comparison is outlined.

Conclusions/Discussion

In this project, the Nimber-Simplex graph, which had been previously described as an abstract mathematical object, is shown to have applications to modern coding theory. The comparison between LDPC and turbo codes establishes a methodology to compare other code families. The Nimber-Simplex graph may be used to design new LDPC codes by reversing Gaussian elimination. The ability to map binary linear sets to the graph may also offer new ways of designing linear codes with a wide variety of properties.

Summary Statement

This project proves that all binary linear error-correcting codes map to the Nimber-Simplex graph and uses this mapping to formulate a direct comparison between LDPC and turbo codes.

Help Received

My father helped me learn the advanced coding theory necessary to create this project. Both of my parents assisted with backboard construction and reviewed the report for readability and technical accuracy. Dr. Duncan Buell provided valuable comments regarding my projects from both this and prior years.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Connor J. Kreeft

Project Number

J1219

Project Title

Are the Cards Stacked Against You? The Randomness of Card Shuffling: Manual vs. Automatic

Abstract

Objectives/Goals

The purpose is to determine whether the manual riffle method of shuffling a deck of cards produces a more random deck than an automatic card shuffling machine. I hypothesize the manual riffle shuffle method will produce a more random deck. I do not believe the automatic card shuffler will produce a thorough, professionally shuffled deck after the third shuffle as stated in the instruction manual.

Methods/Materials

New decks of standard playing cards were opened and numbered in order from 1 to 52. One deck of cards was shuffled by the manual riffle method. The numerical order of the cards was recorded, beginning with the top of the deck. The process of shuffling and recording was repeated for a total of eight riffle shuffles. The experiment was then conducted using the Deluxe Card Shuffler, instead of the manual riffle method. The entire experiment was run eight times. The data was analyzed with respect to the frequency of rising sequences of cards at each shuffle.

Results

The frequency of rising sequences in each shuffle was much higher when the automatic card shuffler was used. After the third shuffle, the number of rising sequences ranged from 6 to 14, and 14 was the most common. After five shuffles, the number ranged from 2 to 8, and 8 was the most common. After seven shuffles, the number ranged from 1 to 7, and 5 was most common. The manual riffle method was clearly better at randomizing the deck. After the third riffle shuffle, the number of rising sequences ranged fairly evenly from 3 to 13. After five riffle shuffles, the number ranged from zero to 7, and zero was the most common, followed by 2. After seven riffle shuffles, the number ranged from zero to 3, and zero was the most common, followed by 1.

Conclusions/Discussion

The manual riffle method of shuffling was more effective at randomizing the deck of cards than the automatic card shuffling machine. The manual riffle method consistently produced a more random deck by the fifth shuffle. In contrast, the automatic card shuffler did a very poor job of randomizing the deck, even after eight shuffles. The data clearly disproves the claim in the instructions of the Discovery Home Casino Deluxe Card Shuffler that using the card shuffler two to three times will produce a "thorough, professional shuffling."

Summary Statement

My project tests whether the manual riffle method of shuffling a deck of cards is more effective at randomizing the deck than an automatic card shuffling machine.

Help Received

Mother helped type report and did all manual riffle shuffling.

Name(s)

Erik L. Kreeger

Project Number

J1220

Project Title

What Is the Probability that Probability Is Correct? Can a Computer Generate Random Numbers Accurately?

Abstract

Objectives/Goals

My first objective was to see whether a computer using Java#s Math.random method can generate numbers as evenly as in real life events and as predicted by theoretical probability. My second objective was to see how sample size affects the distribution of random numbers.

Methods/Materials

I wrote two Java programs which used Math.random to generate random numbers that simulated real world events, flipping a coin and rolling a die. First, I simulated flipping a coin 1000 times and rolling a die 3600 times. I then flipped a coin and rolled a die the same number of times. I did two additional tests for my second objective. I flipped a coin ten times and rolled a die 36 times and modified the Java program to simulate a coin being flipped 10 and 100,000 times and a die being rolled 36 and 360,000 times. Lastly, I graphed and compared the data to reach my conclusions.

Results

The random number generator produced values whose percentages where closer to the expected theoretical percentage then when I physically rolled a die or flipped a coin. Also, in both the real life and computer randomness test, the larger sample sizes created values closer to the expected percentage.

Conclusions/Discussion

My conclusion is that the Math.random method can produce random numbers as accurately distributed as real life events. They are not true random numbers though since the random numbers produced are dependent on the seed value used to start the random number generator. I also concluded that when using both Math.random and real life randomness, the larger the sample size, the closer to the expected percentage the results will be.

Summary Statement

My project was about determining if computers can generate random numbers as well as real world events and how sample size affects the number distribution.

Help Received

Dad helped write Java programs.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Alex Krolewski

Project Number

J1221

Project Title

Packing Ellipses into a Hexagon: Does Varying the Ratio of the Two Axes of an Ellipse Affect Packing?

Abstract

Objectives/Goals

The goal of these experiments was to determine if there is a correlation between the ratio of the two axes of an ellipse and the number of times the ellipse can be packed into a given hexagon. The experiment#s hypothesis is that the least elliptical ellipses will pack into the hexagon a greater number of times.

Methods/Materials

Twelve ellipses with different dimensions were constructed. Each ellipse was duplicated, and the duplicates were packed into a hexagon, with three trials per distinct ellipse. Then the trial producing the best packing was found, and it was used to represent the ellipse in all plotted data.

Results

The experiments seemed to prove the hypothesis wrong, although I did not observe a significant difference between ellipses of different ratios. However, it was more difficult to pack the least elliptical ellipses. These results should not be interpreted to mean that all packings of ellipses into hexagons follow the same curve, regardless of the size of the ellipses relative to the hexagon. Rather, it was hypothesized that, based on the previous observation, the smaller the ellipses became, relative to the hexagon, the more pronounced the slight negative correlation would become.

Conclusions/Discussion

The results showed no clear correlation. Whereas it had been postulated that the less elliptical ellipses would fit into the hexagon a greater number of times, there was actually a weak negative correlation: the less elliptical ellipses fit into the hexagon a lesser number of times. I theorized that the weak negative correlation I observed will gradually become more pronounced as the ellipses become smaller relative to the hexagon. This is because the ellipses are more difficult to manipulate when less elliptical.

Summary Statement

This project investigates optimal packing of two-dimensional elipses in a hexagon.

Help Received

My father filled out this application because I was in Japan for a 2.5 week period that overlapped the filing period. I received no other assistance.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Kaycee Jade Nerhan

Project Number

J1222

Project Title

Taking Stock in Phi: The Golden Ratio

Abstract

Objectives/Goals

Open your wallet and pull out a credit card. Why does this card have such a familiar and pleasing physical dynamic? The answer is Phi, the Golden Ratio. The ratio of Phi exists in many aspects of our daily life such as proportions in architecture, engineering and even the dimensions of the human face. The research and testing attached attempts to explain if there is a relationship of the Phi Ratio (1.618:1) to price movements in the stock market.

Methods/Materials

To begin, the value of Phi was solved for using the quadratic equation. After finding the value of 1.618, ten stocks were chosen from either the NASDAQ or the New York Stock Exchange. A graph of each stock was printed showing price movements for the year of 2005. Each stock graph was then overlaid with grid lines corresponding to the Phi ratio of 1.618:1. The grid was then moved over the stock graph until it matched at a Phi point. A Phi point is being defined as an upward or downward movement which begins on the Phi line.

Results

The overall percentage of stock prices graphically corresponding to PHI from averaging all 10 stocks was 52%. By averaging the yearly highs and lows for the ten chosen stocks, the stock price averages were very close to 1.618 (Phi)

Conclusions/Discussion

The overall results from testing stock price movements to the PHI ratio of 1.618:1 were astounding. The numerical and graphic evidence shows a definite relationship between PHI (1.618) and the price movements of each of the ten chosen stocks over the last year. Some of the stocks had a significant relationship to PHI while others were only slight. The graphic average overall percentage of stock prices falling into the PHI grid was 52%. This represents a high percentage considering the amount of variation in stock prices. The results achieved from averaging the price highs and lows (1.689 compared to 1.618) also lead to the conclusion that PHI has a relationship to these stocks.

Summary Statement

Determining the value of Phi by quadratic equation and comparing this ratio graphically to the upward or downward trends of the stock market.

Help Received

Mr. Gary Meisner showed me Phi Matrix software

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Marie E. Nielsen

Project Number

J1223

Project Title

Searching for Perfection: Utilizing Patterns to Calculate Perfect Numbers

Abstract

Objectives/Goals

The objective is to discover some pattern or equation that shows one how to find perfect numbers.

Methods/Materials

Using a calculator, a pencil, and paper, patterns were sought among the factors of the first three perfect numbers and tested. Then, using those patterns, logic, and algebra, an equation was developed to identify more perfect numbers. Algebra was used to prove what the experimental work was showing.

Results

Two patterns in the factors of perfect numbers were found. The first pattern is that there is one more factor inside the parentheses than outside - the parentheses are a trick that was used to clarify between the factors that were powers of two and the remaining factors beginning with a prime number (which happened to be a mersenne prime) that then doubled. The other pattern that was found was that each factor doubled to get the next factor in the sequence but the factors on the inside didn#t double to get the first factor on the outside; the sum of the factors on the inside became the first factor on the outside. From these patterns, an equation for finding perfect numbers was discovered.

Conclusions/Discussion

A perfect number is a number in which all of its factors except itself add up to itself. It was found that non-perfect numbers, and perfect numbers, can be classified by their prime factorization. These categories showed the difference between the number and the sum of its factors except itself. As the prime factors increased, the difference increased. It was shown that the difference between the numbers would never reach zero. For these classes, each factor must be a prime factor and the number 1 is included as one of the prime factors. Proofs showed that only certain combinations and amounts of factors would work out to produce a perfect number. It was proven that most of the factor classes do not produce perfect numbers.

Summary Statement

Experimentation with perfect and non-perfect numbers was used to identify patterns and discover an equation to generate perfect numbers.

Help Received

Mathematical concepts were explained by Mr. Koens and my father; proofreading by my parents.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)	Project Number
Kaitlyn M. Sims	J1224

Project Title

Let's Make A Deal: The Monty Hall Theory

Abstract

Objectives/Goals

The objective of my project is to determine if the Monty Hall Theory, created by Marilyn vos Savont,is mathematically correct.

Methods/Materials

Informed consent was obtained from 100 men and women, randomly selected. The previously state people were each individually shown three cards, face down. They chose one, and a different card that wasn't the winner was shown to them. They were then given the option to switch to the other, unchosen card.

Results

12 percent of the subjects changed and won. Zero% of the subjects changed and lost. 30% of the subject stayed with their original choice and won. 58% of the subjects stayed with their original choice and lost. The people who stayed and won can be added with the people who changed and lost, because if the latter hadn't changed, they would have won. The ones who changed and won or stayed and lost go together because if the latter had changed, they would have won. Using that formula, the former section is 30 people or 30%, while the latter section is 70 people or 70%.

Conclusions/Discussion

Marilyn vos Savont's theory stated if you stayed, 33.33% of the time you would win, and if you changed, 66.66% of the time you would win. I accept my hypothesis that Marilyn vos Savont's theory is correct.

Summary Statement

My project is about testing Marilyn vos Savont's mathematical theory for probability.

Help Received

Mother supervised during human polls/interviews. Both parents assisted with the typing.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Kaelin Swift

Project Number

J1225

Project Title

The Planar Isometries of Polygons

Abstract

Objectives/Goals

In this project, the planar isometries of polygons are characterized by their grap structure. It is shown that the reflections and rotations are the only possible planar isometries. A geometric proof of Langrange's Theorum is given.

Methods/Materials

Analytic and geometric methods are used to study and characterize the planar isometries of polygons.

Results

I found that the only possible isometries where rotations and reflections.

Conclusions/Discussion

The project concludes that the only possible isometries are rotations and reflections.

Summary Statement

This project characterizes the planar isometries of polygons as rotations and reflections.

Help Received

Father helped prepare display board. I received some minimal advise from Dr. J. Gani of the Australian National University.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Jennifer I. Vazquez

Project Number

J1226

Project Title

How Does Particle Density Influence "Monte Carlo" Derivations of Pi?

Abstract

Objectives/Goals

The purpose of my project was to derive the value of PI using the Monte Carlo Effect with particles of different densities, and to determine whether or not the density of the particle affected the accuracy of the derivation. Monte Carlo methods use random numbers instead of predictable algorithms to simulate physical and mathematical relationships.

Methods/Materials

I made a large poster containing a circle (radius = 16 inches) inscribed within a square (side = 32 inches). I randomly distributed a small quantity of one of three particle types (rice, lentils or confetti) on to the circle and square. I then used a ratio of how many particles fell on the circle to how many fell on the whole square (including the circle), and substituted this ratio for what would normally be the ratio of the area of the circle to the area of the square in the formula [(4 x circle area)/square area = PI]. This allowed me to calculate an approximation for PI based on Monte Carlo methods. I repeated this process 45 times for each of the three particle types.

Results

My results showed that the trials performed with rice produced the closest average approximation to PI. Rice was the densest of the three particle types. One thing I noticed while I was filming the trials is that the more dense particles (lentils or rice) fell together and bounced and spread out when they hit the paper, whereas the confetti spread out in the air as it fell.

Conclusions/Discussion

My results somewhat supported my hypothesis because I stated that the more dense the particle is, the more accurate the approximation for PI would be. However, lentils are denser than confetti, and yet confetti produced a more accurate approximation for PI. If I would have performed more trials, my data may have produced a closer approximation for PI no matter what particle I used. The Law of Large Numbers states that the more trials you perform, the closer the experimental ratio will get to the theoretical ratio, which in my experiment was circle area/square area. However, the outcomes of Monte Carlo events in this project were somewhat dependent on particle density.

Summary Statement

In this project I used the Monte Carlo Effect to derive an approximation for PI.

Help Received

My teachers, Mr. Quintrell and Mr. Simonsen, helped edit my report.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Thomas T. Wooding

Project Number

J1227

Project Title

Is the Roll of a Die Fair?

Abstract

Objectives/Goals

The puropse of this experiment is to determine if the shape of a die affects the fairness of the roll.

Methods/Materials

1.I will roll each polyhedral dice 25 times per side.
A)Tetrahedron # 4 sided die will be rolled 100 times
B)Cube # 6 sided die will be rolled 150 times
C)Octahedron # 8 sided die will be rolled 200 times
D)Decahedron # 10 sided die will be rolled 250 times
E)Dodecahedron # 12 sided die will be rolled 300 times
F)Icosahedron # 20 sided die will be rolled 500 times
2.I will then make a non-isohedral pentahedral out of cardboard.
3.I will roll the non-isohedral die 25 times per side.
A)Pentahedral # 5 sided die will be rolled 125 times
4.All dice will be rolled under the same conditions.
5.I will then analyze and compare the results.

Results

For all the die, except for the non-isohedral pentahedron, the die landed within 10% of the expected value for each face. The expected value was the total number of rolls divided by the number of faces.

Conclusions/Discussion

My hypothesis was correct. The tetrahedron, cube, octahedron, decahedron, dodecahedron and the icosahedrons are fair dice. The experiment proved that each die would land on each face within 10% of the expected value. The research also showed this to be true based on Euler#s Equation. The non-isohedral pentahedron is not a fair die because the faces are not identical. Because the faces have different shapes and surface areas, the die landed on the large triangular faces more frequently than on the smaller rectangular ones. The biggest problem I had in this experiment was finding a non- isohedral die. In fact I couldn#t, so I had to make one. If I were to do this experiment I would like to use a bigger selection of dice.

Summary Statement

Does the shape of a die affect its fairness?

Help Received

N/A