Name(s)

Michael H. Cassel

Project Number

J1201

Project Title

Can Rocket Simulations Accurately Predict the Flight Characteristics of Model Rockets?

Abstract

Objectives/Goals

My objective was to find out if rocket simulations are accurate. My hypothesis was that rocket simulations would be accurate to 20% of the actual measured values.

Methods/Materials

Material List:
6 Drafts of Rockets; 1 Calculator; 1 Triple Beam Balance Scale; 6 rockets; 2 Estes Altitude Finders; 1 Estes Porta-Pad# II; 1 Electronic Beam Launch controller; 2 Stopwatches; 6 Estes A8-3 Engines.

Procedure:
1. Obtain Materials on Material list; 2. Determine The Mass of rocket by weighing it on scale; 3. Determine diameter of rocket using draft; 4. Determine the Area of rocket in Square Meters using the following equation: A=d*(0.5*(diameter in inches/12)*.3048)2= dr2; 5. Determine engine thrust and impulse from engine specifications; 6. Compute Burn Time for the engine: impulse/thrust; 7. Determine k: k= (0.5*1.2 kg/cubic meter*.75*area); 8. Compute Gravitational force: Mass*9.8 m/sec=M*g; 9. Calculate velocity at burn out : velocity=q[1-exp(-x*(impulse/thrust) / [1+ exp (-x*(impulse/thrust)], where x =2*k*q/Mass; 10. Calculate altitude at end of boost = [-Mass/2*k) * ln[Thrust-mass*9.8 m/sec*velocity2]/mass*9.8 meters/sec; 11. Calculate altitude at end of coast phase: [Mass/2*k]*ln(Mass*9.8 meters/sec+k*velocity2)]/Mass*9.8 meters /sec; 12. Sum steps 9 and 10 to come up with final altitude; 13. Calculate using the following equations: qa = sqrt(M*g / k), qb = sqrt(g*k / M), ta = arctan(v / qa) / qb; 14. Add burn time to ta to come up with time to apogee; 15. Divide altitude by time to apogee to come up with speed in feet per second; 16. Convert feet per second into MPH by multiplying speed in feet per second by .6818; 17. Launch Rocket and measure altitude and speed with altitude finder and stopwatch; 18. Repeat for every rocket used.

Results

The expected values came within 20% of the actual values.

Conclusions/Discussion

Rocket Simulations CAN Predict the flight characteristics of model rockets.

Summary Statement

This project is about determining the accuracy of mathematical simulations using model rockets.

Help Received

Mom and Dad helped build board, Teacher helped correct papers.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Bennett Adam Caughey

Project Number
J1202

Project Title
Streaks in Baseball: A Matter of Chance?

Abstract

Objectives/Goals
The purpose of my project was to determine whether random chance alone or other factors affect the frequency of win/loss streaks in baseball. My hypothesis was that factors other than random chance affect the frequency of win/loss streaks in baseball.

Methods/Materials
I began by finding the actual frequency of streaks in the National League for 2001. Then I used two techniques to create artificial seasons based on chance alone. One was a Monte Carlo simulation using a coin flip. The other was a season based on calculated streak frequencies. Using a test of significance, I compared the Standard Deviations (SD) of the streak frequencies in the National League to the SD of the streak frequencies of the artificial seasons.

Results
The artificial season based on calculated streak frequencies yielded more comparable results than the Monte Carlo simulation. When compared to the actual National League streak frequencies, the theoretical frequencies were significantly different at both the 95% and 99% confidence.

Conclusions/Discussion
The distribution and frequency of streaks in Major League Baseball is not purely random, confirming my hypothesis. However, much of the streakiness appears to be caused by random chance. Factors contributing deviation from randomness could include pitcher rotation or playing games in series.

Summary Statement
My project explored the causes of the frequencies of streaks in baseball and discovered that the frequencies are not caused purely by random chance, but by other factors as well. .

Help Received
Father helped with writing, grammer and understanding concepts. Family friend helped set up F-test.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Laura S. Chanan

Project Number

J1203

Project Title

Got Change for $10,000? A Mathematical Analysis

Abstract

Objectives/Goals

The objective is to determine how many ways there are to make change for a given amount of money using the following 5 coins: pennies, nickels, dimes, quarters, and half-dollars.

Methods/Materials

A Fortran program was written to determine the number of ways to make change for various amounts of money using the 5 U.S. coins by finding the maximum number of each coin needed, then testing all possible combinations and seeing if they matched the desired amount. This program ran very slowly. Patterns in the numbers of solutions were searched for and found, and a new program, based on the patterns, was written. It was verified that the results of the new (fast) program agreed with the old (slow) program. The reason why the algorithm works was found.

Results

The differences between the numbers of solutions in the 5 coin problem for amounts differing by $0.05 are the same as the number of solutions for the larger amount in the 4 coin problem. For example: In the 5 coin problems, there are 9 solutions for $0.20 and 13 solutions for $0.25, and there are 13-9=4 solutions for $0.25 in the 4 coin problem. The differences in the 4 coin problem are similarly related to the 3 coin problem solutions. A simple formula was found for computing the number of solutions for the 3 coin problem.

Conclusions/Discussion

An efficient algorithm was found that determined the number of solutions for the original 5 coin problem by relating it to the simpler 4 coin problem, and then to the even simpler 3 coin problem. For $5.00, the new program ran over 26,000 times faster than the original program and even faster for larger amounts. The number of solutions grows very quickly as the amount of money increases. For $1.00 there are 292 solutions, for $5.00 there are 59,576 solutions, and for $10,000 there are 666,794,085,020,860,416 solutions. This last number was computed in less than an hour using the new algorithm.

Summary Statement

The five coin problem (e.g., how many different ways can you make change for $5.00 using only the five U.S. coins) was investigated and a highly efficient algorithm was discovered.

Help Received

Father helped with Fortran programming and suggested looking for patterns in the data. Mother helped with the display board.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Chris W. Fletcher

Project Number

J1204

Project Title

Artificial Intelligence in a Nutshell

Abstract

Objectives/Goals

Natural Language Processing is the study of the interpretation and understanding of human speech. A successful project in this field would be able to consume simple or complex sentences, interpret, and then apply them in a productive way.

Methods/Materials

The method used in which to construct this program was comparing known and used sentence structures (RTN) with example sentences, then programming the computer to compare the two. For this project, the programming language Scheme was used.

Results

The purpose of the following program was to enable a computer to check an English sentence, of arbitrary length, and to determine whether it is grammatically correct.

Conclusions/Discussion

At its current level of complexity, this program was able to recognize noun phrases (ornate noun), verb phrases, and complex sentences (fancy noun). From completing this project, the researcher learned a great deal about how to program in Scheme, along with advanced English grammar.

Future research concerning Natural Language Processing could be to program a computer to recognize more complex sentence structures, and types of words.

Summary Statement

This project is about how to program a computer to apply a human language in a productive or practical manner.

Help Received

mentor help coordinate paper; teacher helped learn programming language

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Eric A. Ford

Project Number

J1205

Project Title

Energy Enigma

Abstract

Objectives/Goals

My objective was to determine an optimal location for a gas-powered electrical power plant to help meet the energy shortfall in southern CA by building a mathematical model using linear programming. I hypothesized that the optimal location would be centrally located to the major cities of southern CA, those with the greatest power consumption, because the distribution from this location would have minimal line loss.

Methods/Materials

To determine the best location to construct a power plant, I developed a set of functions in an Excel spreadsheet. I placed a coordinate plane over a map of southern CA and established nodes within the state boundaries. I determined whether a given node was within the natural gas pipeline corridor by calculating linear inequalities to represent the boundaries of the corridor. To find the distance from a given node to the major cities, I used the distance formula and weighted the distances by the city populations. I used the weighted distances to calculate the power loss from a potential plant to consumers. I used the power loss to calculate a hypothetical sales price, decreasing this sales price with increasing power loss. I expressed environmental and property costs by assigning higher costs to nodes within 50 miles of a major city. I devised an optimizing objective equation that combined the sales price and production costs (constraints) and then used this equation to find the locations (feasible solutions) that balanced a low production cost with a high sales price.

Results

The mathematical model shows that the best location to construct a power plant is about 50 miles east of Lancaster. Second and third best locations are east of Riverside and Bakersfield, respectively. I changed the constraints to approximate hot summer conditions and found that in addition to the regions above, two locations closer to LA were also feasible solutions during periods of high demand.

Conclusions/Discussion

The optimal location for a power plant is not centrally located to the major cities included in my experiment, as I hypothesized. The model showed that the best locations are outside the Clean Air Zones and areas of high property costs and within the gas corridor, but still close to the population centers. The environmental, property, and production costs associated with running a power plant in the LA basin shifted the optimal locations further from the major cities than I had anticipated.

Summary Statement

My project is a mathematical model using linear programming and multiple constraints to determine an optimal location for a gas-powered electrical power plant to help meet the energy shortfall in southern California.

Help Received

Tejbir Bling, Bob Collins, and Peter Wiley provided me with math books and advice. My uncle, Greg Ford and Greg Ford (no relation) of the California ISO provided information about energy production in California. My parents helped me with the spreadsheet and the display.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Eli E. Friedman

Project Number

J1206

Project Title

A Controlled Look at Chaos: The Varying Effects of Precision on Iterative Processes

Abstract

Objectives/Goals

This experiment was designed to examine chaos under controlled conditions. This experiment looks at chaos and how it appears in iterative processes that differ by a constant and are computed using different levels of precision. The experiment tests how varying levels of precision affect outcomes with processes with different constants.

Methods/Materials

The experimenter compared outcomes for different values of the constant r and different levels of precision for the iterative process $x(n+1) = rx(n)(1-x(n))$. Each process was repeated for 26 iterations, starting with $x(0) = 0.5$. Microsoft Excel was used to calculate the iterations. The experiment tested different values of r, from 2.70 to 3.70 in increments of .02. The experiment also tested the effects of precision on sequences, using precision levels of 2, 3, 4, and 15 digits past the decimal point for each value of r.

Results

The experimenter found that the constant used had a great effect on the type of sequence that resulted: convergent (repeating a single number), bifurcating (alternating between two numbers), and chaotic (never settling down or tending toward any number). The experimenter also found that, for some constants, changing the level of rounding had such a strong effect that the same sequence would either bifurcate (alternate between two numbers) or converge (repeat a single number), depending on the precision. For example, with constant 2.92, sequences with lower levels of precision bifurcate while higher ones converge. The rounding, however, had a much smaller effect than expected for chaotic sequences that have no apparent attractors.

Conclusions/Discussion

Overall, the constants are an important part of the iterative process. Precision has a distinct effect, although it does not affect certain chaotic sequences as much as expected.

Summary Statement

This experiment reveals how chaos appears in iterative processes with differing levels of precision.

Help Received

Parents and teachers proofread report; I learned about chaos theory by reading books myself.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Darik Gevorkian

Project Number

J1207

Project Title

Mathemusicians: How to Play Music Notes with Mathematical Equations

Abstract

Objectives/Goals

The objective of my project is to prove that music notes are mathematically realated, and to find an equation that will explain the relation. I hypothesized that different lengths of a 60cm. string where the fret is placed, will produce speculated note and will fit in a mathematical equation.

Methods/Materials

I used a monochord that consists of a single string with one fixed bridge and a movable fret. I plucked the open string, and I measured the frequency with the CBL (I connected a microphone to the CBL and linked the calculator to the CBL and used the program SOUND and FREQ to find the frequncy of the note)and it was the frequency of the "do" in the first octave. I also used the intellitouch tunner to confirm the result. With the same method, at the length 30cm, I could hear the #do# again. Then I tried to define an octave. I had to find a multiplier that could be used 12 times (there are 13 half steps in each octave) to produce 30 from 60. I wrote an equation 30 = 60 x12. x = 1/ 12, also a geometric sequence, where t13 = 30 , t1= 60, and t13 = t1 * r 13-1 . Both ways, the ratio = 0.943874313. I used the multiplier (ratio) to find the length for all the 13 notes in one octave. I put the fret to the calculated lengths and plucked the string and measured the frequency. The frequency of the notes produced by calculated lengths was the frequency of my speculated notes. I worked on three different octaves, and repeated the same procedure for each octave more than ten times; the result always supported my hypothesis. I also worked on the frequency of the notes to find if they fit in a mathematical equation.

Results

The results supported my hypothesis. I proved that there is a lot of math in music.

Conclusions/Discussion

1)I found out that the string length for each note, in any given octave fits in a geometric sequence. 2) Two notes that are one octave apart, the string lengths are in a ratio of 1:1/2. 3) The note sol, in all the octaves is 2/3 of the length of the string. 4) The ratio works for all the octaves. 5) In each measure the tempo given should be maintained mathematically. If the time signature is 3:4 the note lengths should add up to #. 6) As you move one octave higher, the frequency of all the notes are doubled. 7) By looking at the graph for the string length, one can see the resemblance of a Grand Piano.

Summary Statement

Mathematical relation in the music notes.

Help Received

Mother helped to prepare the board.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)	Project Number
Catherine E. Gilbert	J1208

Project Title

Tails Up

Abstract

Objectives/Goals

How many times do you have to drop ten quarters, while re-dropping all the ones that land on heads until you get all tails? Also, do the results vary if you use pennies, nickles, dimes, or fifty-cent coins?

Methods/Materials

My materials were Lego's, ten quarters, ten pennies, ten nickels, ten dimes, ten fifty-cent coins, and a rular. My methods were: firstly, I built a platform seventeen inches high with Lego's. Secondly, I placed the quarters at the edge of th Lego structure. Thirdly, I pushed all of the quarters off of the structure at the same time. Fourthly, I recorded how many quarters landed with the tails side up. Fifthly, I re-dropped all of the coins that landed with the heads side up. Then, I repeated steps two to five until all of the quarters landed with the tails side up. After that, I repeated steps two to six using pennies, nickels, dimes, and fifty-cent coins. Finally, I cleaned up.

Results

The average number of times dropped were: quarters, four; pennies,five; nickeld, five; dimes, five; and fifty-cent coins, four.

Conclusions/Discussion

The conclusion of my results was that the averages are constant. The typical number of times dropped for quarters is four. Four and five tenths, rounded to five, is the standered number of drops for pennies. The common number for nickels is also five, rounded from four and seven tenths. The normal number of drops is four and eight tenths, or five, for dimes. Finally the average number of times dropped for fifty-cent coins is four.

Summary Statement

I dropped ten quarters and re-dropped all the ones that landed on heads until I got all tails and I saw if the results varied if I used pennies, nickels, dimes and fifty-cent coins.

Help Received

Mother helped get supplies

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Aruna O. Gnanasekaran

Project Number

J1209

Project Title

Pi of Pieces: Unlimited

Abstract

Objectives/Goals

The objective is to derive recursive equations for Pi by estimating the area and circumference of a circle in terms of squares and triangles.

Methods/Materials

Method: If the radius of a circle = 1, the circumference = 2(PI), and the area = PI. Step #1: Inscribe a square in a circle of radius 1. Step #2: The sum of the four sides divided by two is the first estimation of Pi from circumference. The area of the square is the first estimation of Pi from area. Step #3: Draw a radius, bisecting a side of the square. Connect both ends of the side to the point where the radius intersects the circle. This forms an isosceles triangle with the side of the square as its base. Repeat this on the other 3 sides. Step #4: Determine the isosceles sides using the Pythagorean theorem. The sum of eight isosceles sides divided by two is the next estimation of Pi from circumference. Summing the area of the four triangles to the former area gives us the next estimation of Pi from area. Step #5: Using each isosceles side as the next base, repeat this procedure to get a new set of smaller triangles. Determine the next estimations for Pi. Step #6: Step 5 can be repeated endlessly: there will always be space above the sides of the last set of triangles. This produces equations of infinite terms with patterns for Pi. Step #7: From the patterns expressions for Pi can be written. This method can be applied with an inscribed triangle to obtain two more equations. Materials: Computer, printer, calculator, paper, pencil, eraser, ruler, compass, and protractor.

Results

The four equations I have derived are:

1. K(0) = -2; K(n) = sqrt(2 + K(n-1)), n >= 1; CPi(n) = 2^n * sqrt(2 - K(n)), n >= 1
2. APi(1) = 2; APi(2) = 2 * (sqrt(2) # 1); K(0) = -2; K(n) = sqrt(2 + K(n-1)), n >= 1; APi(n) = Pi(n-1) + 2^(n-1) * sqrt(2 - K(n-1)) # 2^(n-2) * K(n-1), n >= 3
3. K(0) = -1; K(n) = sqrt(2 + K(n-1)), n >= 1; CPi(n) = 2^(n-2) * 3 * sqrt(2 - K(n-1)), n >= 1
4. APi(1) = (3 * sqrt(3)) / 4; K(0) = -1; K(n) = sqrt(2 + K(n-1)), n >= 1; APi(n) = 2^(n-3) * 3 * sqrt(2 - K(n-2)), n >= 2

Conclusions/Discussion

I was able to find patterns and derive four different recursive expressions for Pi. I have written a computer program(C++) implementing the equations. I am planning to derive equations for other regular polygons, and format a unified equation.

Summary Statement

Using the approximations of the area and circumference of a circle, in terms of squares and triangles, four recursive equations for Pi have been derived.

Help Received

My father taught me the use of the Pythagorean theorem, and that when the radius bisects a chord in the circle they are perpendicular. He helped cut and paste things for the board, and stayed with me late nights encouraging me. My science teacher, Mrs. Terra, allowed the entire class to work on their projects in class

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Andrea N. Harmon

Project Number

J1210

Project Title

Step Right Up! Carnival Game Probability

Abstract

Objectives/Goals

My objective was to find the real chance of winning a prize at a carnival dice game, and what the operator needs to charge to make a profit. In my hypothesis I stated that I think there is at least a 3 in 6 chance of winning. For the operator to make a profit, he should charge at least $2.00 due to the costs of the prizes.

Methods/Materials

I learned probability by solving practice problems so I would have no problem solving my main problem. Then I designed my number tree that would help me with my figuring. I looked for the branches that had one, two, and three of a number 1-6 to find my probabilities. Then I needed to find the expected value, the amount of money on average that it costs the operator per player.

Results

When my teacher said the results I came up with were wrong, I tried to figure out her point of view but I kept getting my same answer. I realized there might be two ways to look at this problem: the player#s point of view or the operator#s point of view. Players point of view: I learned that the number choice does not affect the probability of winning a certain prize. Operator's point of view: you would include the probability of the player choosing a number as well as the probability of the dice showing that number. The answers that I originally got were correct and if the probabilities are the same, the expected value would not change.

Conclusions/Discussion

I found that my hypothesis was completely incorrect. If the real probability of winning was 3/6,or ½ then the game would be fair but it is not. The probability of winning is actually closer to 1/3 (25/72). Carnival game operators want you to think that a game is fair like I did, so that you will play. If you knew that the probability of winning a game was only about 1/3, most likely you would not waste your money. I also incorrectly thought that the operator would have to charge at least $2.00 to make a profit because of the cost of the prizes. Now I realize what a huge profit carnival game operators make if they only lose on average 60 cents per player (this varies for different games) but charge up to $2.00 for each person to play. That is an enormous profit of 70%. Now I see carnival games as a gambling device directed at children. Another thing I learned from this is that some probability problems are tricky. There may be several ways of going about solving a problem.

Summary Statement

The probability of winning a prize at a carnival game.

Help Received

My Sister helped in checking work.

Name(s)
Richard Ho

Project Number
J1211

Project Title
Exploring Binary Sequences

Abstract

Objectives/Goals
My first intention on the goal of this project was to find something new, like an invention to innovate this society. I had no trouble starting with a topic, since my head is always full of questions. I was more interested in computers and binary numbers, and so I studied binary numbers in depth.

Methods/Materials
I researched on the fundamentals of computing algebra, and found out the arithmetic operations in the computer. This inspired me to see what happens to the counting number sequence after it has undergone a binary transformation. My original hypothesis was that I wouldn#t get any noticeable patterns, or maybe one that won#t be helpful. The Inverse Sequence came directly from computer subtraction algorithm, but I invented the Reverse Sequence (a.k.a. #the Richard Sequence,# which I happily named it after myself). Converting a number to binary, and converting it back to decimal after a string operation could be a tedious duty. And so I prepared my procedures accordingly: write all programs on my TI-89 graphing calculator, generate sequences for at least the first 1000 terms, observe sequences, and try to prove or explain patterns if any.

Results
After generating the sequences, I noticed astounding patterns. The Inverse sequence was generated by inverting the binary (0=1 1=0) of the natural number sequence, and the results came out as expected (the subtraction sequence). But the Richard Sequence did surprise me. Created by reversing the string of the binary of the natural number sequence, it holds many patterns, some obvious and some hidden. I derived formulas of some patterns for both sequences. (Although the formulas look complex, they are the only mathematical explanation of the observed patterns.) Uncovering some patterns required grouping of terms, summing, and manipulation of entire sequences.

Conclusions/Discussion
After my whole research, I concluded that I discovered something entirely new that no one has ever done, thus I am the one who should be able to find a pertinent use for this invention. Overall, I think the Richard Sequence is a very interesting sequence, and proofs will be needed to follow-up my patterns, formulas, and theories. I will try to work on proofs in the future, and maybe someday, my sequence would become an innovation others can base their work on.

Summary Statement
I invented a new binary sequence and found many interesting properties.

Help Received
N/A

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Justin R. Jee

Project Number

J1212

Project Title

Harmonic Analysis: Using the Least Squares Method to Analyze Sound Waves

Abstract

Objectives/Goals

My goal was to use a sum of sine functions to accurately estimate sound waves from various musical instruments.

Methods/Materials

I used a Minidisc digital recording device, microphone, computer (with Audioview 32 sound analysis software, Maple computer program, and Matlab computer program), and musical instruments (piano, acoustic guitar, tuning fork, and recorder). I used the Minidisc to record the sounds from various musical instruments. After downloading the sounds onto my computer as WAV files, I used Audioview to extract just a few hundredths of a second of each sound to analyze. Then I rewrote the WAV files as TXT files using Matlab. These TXT files would contain the data amplitude values Maple could read and analyze.

I wrote procedures in Maple using a combination of the least squares method and a loop function to estimate the phase and amplitude of a simple sine function that best fits the data. My hypothesis was that the different frequencies would be integer multiples of a given fundamental frequency. My final equation is a sum of sine functions with different frequencies, amplitudes, and phases. I used the values from these theory equations to produce amplitude values for a TXT file. I converted this TXT file into a WAV file and played back the theory sound.

Results

Using 10 to 20 frequencies, I was able to approximate the data for single tones from a musical instrument quite well (the average root mean squared error was about 1/10th the size of the amplitude of the original wave). For more complex sounds, however, I require a more sophisticated method, as the RMSE of my approximation of a complex sound (such as a human voice LAH) is quite high.

Conclusions/Discussion

Using a combination of loop and least squares methods, sums of sines can approximate tones for musical instruments fairly accurately. However it takes a large amount of computer time (20-30 minutes for one tone) and does not work accurately for sounds from the human voice.

Summary Statement

I analyzed sound and tried to approximate it using a sum of simple sine functions.

Help Received

Dad introduced concept and corrected my programming syntax. Mom helped put board together.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Nimi Katragadda

Project Number

J1213

Project Title

The Fibonacci Theory: The Key to Success in the Stock Market

Abstract

Objectives/Goals

The object of this project was to find if the Fibonaccit Theory combined with the Elliot Wave Theory could accurately be applied in the stock market.

Methods/Materials

The materials used for this project included previous stock charts and knowledge of the Fibonacci sequence and Elliot Wave Theory. I researched information on this theory and concluded a method of concluding predictions. By using this method and multiplying with the Fibonacci Golden Ratio of 1.618 I was able to find the hypothesized price target.

Results

I found that in over 90% of cases the Fibonacci theory could be used to predict retracement levels for individual stocks.

Conclusions/Discussion

The Fibonacci sequence combined with the Elliot Wave Theory can be very helpful in predictions. However, mistakes are easy to make, so precision must be used.

Summary Statement

My project is about the use of the Fibonacci number series in the stock market.

Help Received

Dad helped me research.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Nuri Kim

Project Number

J1214

Project Title

Simple As Pi?

Abstract

Objectives/Goals

The objective is to try to get pi as accurately as possible using only math available to the average eighth grader (i.e.-- Algebra [not much], basic Geometry/Trigonometry, and arithmetic).

Methods/Materials

There are two experiments performed in this project. The first is Archimedes' Theory, where circles, polygon, and other basic Geometry/Trigonometry are applied to a formula credited to ancient mathmatician Archimedes to calculate pi. The second experiment is Buffon's needle experiment, in which needles are tossed as randomly as possible on a grid many, many times. The data (whether the needle lands on a line or not) is recorded and processed through another formula, this one discovered by French mathematician Comte De Buffon.

Results

Archimedes' Theory provided results accurate, though not on the dot. The results were only approximations, but this was expected. As for Buffon's needle experiment, I was surprised with my result, which was remarkably after only 1,500 tosses.

Conclusions/Discussion

Tossing the needles was incredibly tedious, as was drawing the duodecagon for my project. I intend to improve my project's asthetics and improve the project, itself, a bit by increasing the number of tosses. I feel 1,500 tosses may have been enough for county, but will most definitely not be suitable for state.

Summary Statement

The average-minded eighth grader's search for pi.

Help Received

Teacher helped review simple trigonometry, Brother helped toss needles

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Karl J. Lowood

Project Number
J1215

Project Title
What're the Odds? A Lesson in Probability

Abstract

Objectives/Goals
My objective was to figure out and test the probabilities of rolling certain combinations of dice in role-playing games. My hypothesis was that 10 three-sided dice were more likely to roll a sum of at least 18 on the total of the dice than 3 ten-sided dice or 5 six-sided dice.

Methods/Materials
I used 10 three-sided dice, 3 ten-sided dice, and 5 six-sided dice to perform this experiment. Since there is no way to make an actual three-sided die, I rolled a six-sided die and rounded fractions up. I rolled each combination of dice 100 times and recorded my results. Then, I determined the probability of rolling a sum of at least 18 on each combination of dice. For 3 ten-sided dice, I made a chart to determine probability. For the other two combinations, I went online and found charts that helped me calculate the probability distributions. Finally, I checked to see if my results matched these probabilities.

Results
For 10 three-sided dice, I calculated a probability of 4 in 5. For 3 ten-sided dice, I calculated a probability of 2 in 5. For 5 six-sided dice, I calculated a probability of 1 in 2. For the most part, the experimental results matched the probabilities I calculated for rolling a sum of at least 18. For 3 ten-sided dice, I rolled at least 18 thirty-nine times, and for 5 six-sided dice rolled at least 18 fifty-one times. Ten three-sided dice was slightly off -- I rolled at least 18 seventy-four times.

Conclusions/Discussion
The experiment proved my hypothesis, that 10 three-sided dice are the best way to roll a sum of at least 18. It also showed that though probability is a reliable and effective way to determine your chances of rolling a certain sum, your actual experience will not always match the calculated probability.

Summary Statement
I calculated and verified probabilities for rolling dice.

Help Received
Mother proofread, Father checked for math errors

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Kevin P. McManus

Project Number

J1216

Project Title

C vs C++

Abstract

Objectives/Goals

My project#s objective was to determine the speed of C compared to C++ (programming languages). I thought that C++ would be faster, because it was written more recently.

Methods/Materials

I used two books for reference, Herb Schildt's C++: The Complete Reference, and Teach Yourself C++, also by Schildt. I found these the most useful books while I was teaching myself programming. I used three compilers for the C language, and three compilers for the C++ language. I also used a computer. I wrote two programs (one that did math calculations, the other printed to the screen, both repeated the task 100,000 times) in the two languages. I compiled the C++ programs in the C++ compilers, and compiled the C programs in both the C compilers and the C++ compilers. I ran my programs ten times each, and recorded the time they took to run. I used Microsoft Excel to analyze my data using averages, medians, and graphs.

Results

The times varied with the different compilers, but the most significant evidence is the fact that the C programs compiled in the C++ compilers, were faster than the C++ programs I compiled in the C++ compiler. On a very basic level, C is faster than C++.

Conclusions/Discussion

At the basic level, in it's simple, basic functions, C is faster than C++. C is faster at math and printing, but C++ has plenty of advantages. If you look at the actual programs I wrote, the C++ code is a lot simpler. There are a lot of little things that I personally believe make the programmer's life easier. There are also a lot of bigger, more complicated things like classes, which can greatly simplify a large program. They didn't affect these programs, but in a real application or game, these features could make writing the program much easier. I think that when C was upgraded to C++, speed wasn't the only consideration. More important were power and ease of use.

Summary Statement

My project was on the relative speed of programming languages.

Help Received

My mother helped with the board layout.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Kevin G. Mesrobian

Project Number

J1217

Project Title

Determining an Unbiased College Football Division 1A Ranking System

Abstract

Objectives/Goals

My objective is to determine if there is a fair and unbiased way to rank Division 1A college football teams by using an equation that considers objective measures of a college football team#s performance. The goal is for an alternative way from the current system that places too much emphasis on opinion polls rather than objective measures.

Methods/Materials

I first determined the components of the formula. There were five categories of great importance for ranking criteria. These are a team#s record, conference rank, strength of schedule, margin of victory and bonus points. I then determined the weight for each ranking criteria. I obtained text file containing the results of every 2001 Division 1A game played by all of the 117 teams. I inputted the data from text file into Microsoft Excel. I then calculated the points, in each of the five categories, for each team. I plugged the points into the total formula and ranked each team based upon the most points. Finally, I compared my ranking results to the BCS, ESPN/USA Today Coaches Poll, and Associated Press Poll rankings. I used the computer, a spreadsheet, calculator, and the internet to conduct my experiment.

Results

My results showed that my top 10 teams were closely correlated to the Associated Press Poll, the USA Today/ESPN Coaches poll and the BCS rankings. Using my method this past season would have made a difference in who played in the national championship game. It should have been between Colorado and Miami, not Nebraska and Miami.

Conclusions/Discussion

In conclusion, I believe that my results have supported my hypothesis. I have developed a fair and unbiased equation that considers objective measures and by using this equation it is a better way to rank the top college football teams in the nation. I now have a better understanding of how to put formulas into Excel.

Summary Statement

My project is about creating an equation that when used will provide a fair and unbiased method of ranking the top college football teams in the nation.

Help Received

Mother cut letters out at school office, because you have to be older than 18 to use the machine.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Thomas W. Moulia

Project Number

J1218

Project Title

Bob's World

Abstract

Objectives/Goals

There are many different objectives for Bob#s World, though they are all based on evolution. The first objective is to see how the effects of Genetic Drift change with the population size. The second objective is to see how natural selection can affect a population#s genetic information with different environments. The final objective is to see which is more effective: sexual or asexual reproduction.

Methods/Materials

The source code for Bob#s World was created using BASIC. The program is a Monte Carlo simulation of evolution using two gene creatures. These creatures can reproduce sexually, and have four different phenotypes have all different levels of move lengths. There are many different input variables which can be changed.

Results

The results for the first experiment demonstrated that when the population was large the populations for the phenotypes assumed the 9:3:3:1 ratio. When the population was small one of the phenotypes became dominant, killing all the others in the process. The second experiment showed that when there were environments with the food spread out, the long-moving phenotypes would be the most successful. When the food was packed together around certain areas, the short moving phenotypes would be the most successful. In the third experiment asexual reproduction was more successful in a normal environment, while sexual reproduction was more efficient in a changing environment.

Conclusions/Discussion

The results for all of the experiments matched the results the way they were supposed to according to the hypothesis. The reason why the phenotype populations were not stable at a low population is because very easily, due to random luck, one of these phenotypes could die out. Just that would affect all the other phenotypes drastically. The reason why certain phenotypes survived in certain environments is obvious. Some traits are more successful than others in certain situations. Sexual reproduction was more successful than asexual reproduction in a changing environment is because of the fact that sexual reproduction allows for more genetic diversity and adaptability in different situations.

This project relates to evolution in many ways. One of them is just the simulator. It is a powerful tool that can be used to model all kinds of situations. With some minor tweaks to the source code, you could even model such things as effect a sexually transmitted disease has on a population.

Summary Statement

My project is about different aspects of evolution using a Monte Carlo computer simulation.

Help Received

Father taught me how to program; Dr. Bowes and Dr. Stauffer of Humbodt State Univerisity helped me with genetic drift.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Javid K. Pack

Project Number

J1219

Project Title

Rotational Symmetry of Third Order Magic Cubes

Abstract

Objectives/Goals

A project was undertaken to determine how many unique third order magic cubes exist. A third order magic cube is a 3x3x3 array if integers (1 through 27) arranged in such a way that the sum of any row, column, or stack of numbers is the same number.

Methods/Materials

It was proved mathematically that the center cell must contain the number 14. A computer program was written to generate all possible magic cube solutions.

Results

A total of 192 solutions were found. It was evident that many of these solutions are related by symmetry operations. Another computer program was written to determine which of the solutions are related by rotations and/or reflections. Four unique third order magic cubes were found.

Conclusions/Discussion

The 192 solutions can be divided into four distinct groups each containing 48 solutions. The remaining 24 solutions are reflections of the original 24. The second computer program was modified to graphically show how solutions can be transformed into one another by rotations in three-dimensional space.

Summary Statement

The researcher generated all possible third order magic cubes and determined which ones are related by rotational symmetry operations.

Help Received

My dad helped me with the three-dimensional rotations in the computer program.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Nicholas B. Root

Project Number

J1220

Project Title

Can Non-contact Optical Methods Detect "Coning" in Echolocating Beluga Whales?

Abstract

Objectives/Goals

Scientists suspect that beluga whales (delphinapterus leucas) voluntarily change the shape of a part of their head known as the "melon" to focus sound waves that they emit during echolocation. This has not yet been proven, however, because scientists have had no accurate way to measure changes in the melon's shape during echolocation without disturbing the echolocation process itself. This project's objective was to determine if an optical method called "Moire photogrammetry" could be adapted for this purpose.

Methods/Materials

The Mathematica programming language was used to make a .jpg image of a sine wave "transmission grid" that was converted to a 35mm slide and projected onto a white target sphere representing the beluga whale head. Using a digital camera located symmetrically opposite from the projector a .jpg picutre was taken of the grid projected on the target. This .jpg was imported into a PC where Mathematica was used to overlay a sine wave "virtual viewing grid" on the image. If the frequencies and phases of the transmission and viewing grids are correctly matched the Moire pattern formed by the interference of the two grid patterns will form a "topo map" of the target's surface so its curvature can be measured. Comparing the curvature in a sequence of .jpgs captured during echolocation "coning" would allow scientists to determine if there is a correlation between curvature and target range. If there is, then that is more evidence for the hypothesis that in "coning" the beluga uses the melon as an acoustic lens where different amounts of curvature are used to "focus" the echolocation pulses.

Results

By using a reference plane behind the target the experimenter was able to match the transmission and viewing grid frequencies, and a topo map of the target surface was successfully produced.

Conclusions/Discussion

Since the shape of the target surface was determined without having any equipment located directly in front of the target, this same technique could be used when the target is the melon region of an actual beluga whale, without disturbing the beluga's echolocation behavior. The reference plane needs to be near the whale, but can be behind it and to the side where it will not interfere with echolocation. Future work to be done should be to try to write a computer program that matches the two grid frequencies and phases automatically instead of the experimenter having to do any trial and error.

Summary Statement

This project showed that there is a way to measure "coning" in echolocating beluga whales optically from a distance without distrubing their echolocation behavior.

Help Received

The SDSU Media Lab helped me convert .jpg files into slides. Point Loma Camera developed and mounted the slides. My Dad taught me about sine waves and Moire patterns, and how to use Mathematica to make sine wave grid images and do overlays to get the interference patterns.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)	Project Number
Paul J. Watanabe	J1221

Project Title

Behind the HyperText Markup Language

Abstract

Objectives/Goals

My goal was to learn a computer language. I selected the language HTML, which is used to create web pages. I tried to create two series of documents using this language. The first series was to test the commands that I had learned about this computer language and create web pages about this information. For the second series, I decided to make a web site. In the end, I created a web site for my science teacher, Mrs. Reyburn. I chose this project because I wanted to learn more about the growing world of technology, which revolves around computers.

Methods/Materials

I first turned to a book called "Creating Web Pages Simplified" to obtain the knowledge that I needed to create the web pages. Next, I utilized the scientific method of trial and error; I went back and forth between Notepad and Microsoft Internet Explorer to create and check the various HTML tags within the web pages. Then I used the research I had discovered to design my teacher's web site. Soon enough, the documents emerged from my computer to create amazing web pages.

Results

I created eight test screens that tested all of the HTML tags that I learned. Then I created nine screens for a web site that I gave to my science teacher, which has been transferred into my school's web site. This is my first job as "webmaster"! It inspired me to continue to explore the vast field of technology, which is a possible future career choice. Plus, I believe this project was a success.

Conclusions/Discussion

The results I had gotten were astonishing. I had created a plethora of pages for the most perfect web site created by a person my age. I have just recently finished Mrs. Reyburn's web site. The web site I created for her is currently posted within the school's web site. It was a challenge to do this project, but I feel I have mastered the HyperTExt Markup Language.

Summary Statement

I learned a computer language, HTML, to create a web site for my science teacher.

Help Received

My mom helped me lay out the display board.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)	Project Number
Andrew S. Widmer	J1222

Project Title

How Accurate Is the Bell Curve?

Abstract

Objectives/Goals

The objective was to determine if the use of a Gaussian probability device actually follows a repeatable, predictable model of a bell curve.

Methods/Materials

I constructed a Gaussian device by affixing 12 one inch slats equidistant along the bottom edge of a 1 foot X 2 foot piece of pegboard creating 12 compartments to catch falling marbles in. The remainder of the area above these compartments had wooden dowels inserted into the pegboard holes to allow the marbles falling from a centered funnel at the top to strike and fall into the compartments below randomly.

Results

With each release of 200 marbles, 50% would fall into the 2 center compartments, 34% in each of the adjacent 3 sides to the 2 center slots, and 16% would fall into each of the 2 left or 2 right outside slots. These results consistantly repeated within 5% each trial.

Conclusions/Discussion

I have concluded that the use of this Gaussian probability device does allow for a repeatable model of data to construct a bell curve with. I can predict with reliability that each trial of marble drops made will fall under the predicted bell curve.

Summary Statement

A Gaussian probability device can be used to produce a repeatable, predicatable bell curve model.

Help Received

My grandfather helped me construct the Gaussian device. My mother assisted me with the construction of the display board.