CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Landon H. Aaker

Project Number
J1201

Project Title
Standard Deviation Comparisons of Population Sizes

Abstract

Objectives/Goals
I am trying to determine how large a survey sample must be to get an accurate representation of a whole population.

Methods/Materials
I rolled a dice 600 times and recorded it then plugged in different sizes of samples of the population into an equation to determine the standard deviation.

Results
15% of the whole population will give you an accurate representation.

Conclusions/Discussion
The smallest sample required for reliable results is 15% of the whole population.

Summary Statement
I am trying to determine statistically how large a survey sample must be to get an accurate representation of a whole population.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Connor T. Ahlbach

Project Number
J1202

Project Title
Parallax

Abstract

Objectives/Goals
I wanted to demonstrate how parallax works in measuring distances on a small scale, and to see if one method was more accurate than the other. My hypothesis was that the tangent method would be more accurate than the radian method.

Methods/Materials
I used a large room with a blackboard at one end. About 20 feet from the wall, I placed a "target," a yardstick taped to a chair so that the top of the yardstick was about five feet off the ground. I then marked on the board, the two points at which the target was viewed from two points equidistant from a midpoint on the baseline. In some cases the two viewpoints were two eyes on a person's face.

I then used a protractor, placed on the target, and a string to measure the degrees those two points on the wall were apart. Using that measure, I then used two methods to measure the distance from the the baseline to the target.

The tangent method is using the right triangle formed by one viewpoint, part of the baseline, and the distance to the target. Knowing the angle of the viewpoints on the board, allows you to find out all three angles in the triangle. You also know the measure on the baseline from the midpoint to one viewpoint. You can then look up the tangent and find out the distance to the object.

To use the radian method, you have to imagine a circle that the target is the center of. The angle of the two points on the board gives you the measure of the arc between the two viewpoints on the baseline. Putting the length of the distance between the viewpoints (the radian) over the arc it cut off in the circle, you can find out the circumference of the circle. You then divide by 2pi to determine the radius, which is the distance to the object.

Results
I found out that using parallax on this small scale was an accurate way to measure distances. However, there was no significant difference in the accuracy of the two methods

Conclusions/Discussion
Parallax works but it requires very accurate measurements of the angles involved. On this small scale, there was not a significant difference between the two methods. On a large scale, my hypothesis might be correct because the difference between the radian and the length of the arc would increase.

Summary Statement
I wanted to demonstrate how parallax works and show which method was more accurate.

Help Received
My dad helped me to measure the angles using the string.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Katherine E. Bathgate

Project Number
J1203

Project Title
Numbers, Numbers, Numbers

Abstract

Objectives/Goals
My objective was to find out if a small population could give me the same information as a large population when collecting data.

Methods/Materials
I used a computer program to simulate card deals. One set of data simulated 100 two card throws from a reshuffled single deck of cards, and was repeated a total of 10 times. Another set of data simulated 100 two card throws from a reshuffled 5 deck set, and was repeated a total of ten times. A comparative t-test was performed among the data.

Results
60% of the one deck tests did not meet the 0.95 confidence interval for the five deck t-tests.

Conclusions/Discussion
The smaller populations did not adequately represent the larger populations at a high confidence of t-testing.

Summary Statement
I am statiscally trying to establish whether smaller populations of data fully represent larger populations with a computer simulation.

Help Received
Brother helped monitor the computer program.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Jennifer A. Beaton

Project Number
J1204

Project Title
On the Flip Side...

Abstract

Objectives/Goals

People have wondered throughout the ages if the simple procedure of tossing or flipping a coin truly was random. All mathematicians and other persons testing this up till this time had proven it was random until professor and mathematician Persi Diaconis used a machine to flip the coins and discovered that if a coin is flipped with heads starting out facing up, then it is more likely to land face up, but in every day life, people will not have a coin flipping machine handy to flip their coins for them.

My testing will attempt to discover if Persi Diaconis' theory applies when humans flip coins, and if it does, does it apply on different surfaces.

Methods/Materials

A. Flip the quarter once starting heads up and over the first surface. Then record the ending position, and repeat 250 times. Do the previous instructions again, except the quarter should start tails up; repeat for all surfaces.

B. 5 different surfaces were used of various density and texture.

C. The quarter was flipped 2500 times in Primary testing and 2500 times in Secondary testing, 5000 flips in all.

D. The same quarter was used each time.

E. The same person flipped the quarter for each flip.

Materials: 1 chart, 1 hard surface to write on, 1 writing utensil, 1 Quarter.

Results

Unfortunately, there were almost no definite results. The average percentage for heads in Primary Testing was 50.56%, and 48.92% in Secondary. The average percentage for tails in Primary Testing was 49.44%, and 51.08% in Secondary. All of these percentages are very close to 50%, so the coin toss was still fairly random, although there were many, many runs of a certain side, whether heads or tails. Six of the ten variables in Primary testing agreed with Diaconis' theory that a coin is more likely to land with the side that started face up, landing face up, and only three of ten in Secondary testing agreed.

Conclusions/Discussion

My conclusion is that although Persi Diaconis found that when a machine tosses a coin, it is more likely to land with the side that started face up, to land face up, when a human flips a coin, they introduce much of the randomness usually associated with coin tosses.

Summary Statement

When a human tosses a coin, is it more likely to land heads-up if it starts out heads-up; does the type of surface the coin lands on change the outcome?

Help Received

Father recorded results on tally chart.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Nina Budaeva

Project Number
J1205

Project Title
An Efficient Strategy for Making a Choice from a Finite Stream of Offers

Abstract

Objectives/Goals
My project deals with an idealized but still realistic situation described as follows. A finite number of offers arrive one at a time. If an offer is accepted, the search ends. All rejected offers vanish. The amount of offers is known. The offers are characterized by a numeric value (e.g. price), but the range of this value is unknown.

The goal of my project is to find an efficient strategy for making a good choice in such a situation and to estimate the chances of getting the top offer with the help of this strategy.

Methods/Materials
I reasoned that a good strategy is to skip the first few offers and then to choose the first offer which beats all that were skipped. To find how many offers should be skipped, I used both theoretical and experimental methods.

In the theoretical part, I computed the probability of selecting the best of N offers after skipping S offers. I found a formula, evaluated it for different N and S, and, analyzing the obtained tables and graphs, found the best amount of offers to skip.

In the experimental part, I verified the prediction by simulating a big number of searches. To imitate each search, I generated N random numbers (I used N=10 and N=50) which were considered as offers, and "ran" several searches skipping different amounts of offers. For reliability, every experiment was repeated 100 times with different random numbers.

Results
The best strategy is to skip about 37% of the total amount of offers and then pick the first offer which beats all of the skipped offers. Amazingly, this recipe gives about 37% chances of getting the top offer, and this predicted rate of success does not decrease when the number of offers increases.

Conclusions/Discussion
My project shows that knowledge and reasonable patience without overcautiousness secures about 37% of success in the search with no additional information about the options. This method may be used in a different situation as well. For example, if you have to make a choice before a deadline, be patient and spend 37% of the available time plainly "observing" the situation.

Summary Statement
To choose the best from a given number of offers, is recommended to skip the first 37% of all the offers and then to pick up the first offer topping all its predecessors --- this strategy gives about 37% of success!

Help Received
My parents helped me with typesetting tables, formulas, and graphs.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Yan Davtian

Project Number
J1206

Project Title
A Wheel Goes Far!

Abstract

Objectives/Goals
To test your eye-hand coordination. The purpose of my project is to create a computer program that tests people's eye-hand coordination and reaction to different environments and circustamces amd help them improve.

Methods/Materials
I said dates that I had to finish one part of my project and another part the other day. So basically I took it step by step so I could see what mistakes I was doing alond the way. The materials or material I used was a computer.

Results
The method i used resulted in very good outcomes because taking it step by step made it easier for me to find out what mistakes i made.

Conclusions/Discussion
My conclusion was that this game was a pretty good game to test your eye-hand coordination and maybe get better if played over and over again. I think it came out almost exactly how I wanted it.

Summary Statement
My project is about making you eye-hand coordination better after many tries of my game.

Help Received
Mr.Sen help me make the game Sam helped me with some problems

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Aaron E. Feuer

Project Number

J1207

Project Title

Which of Three Commonly Used Computer Programming Languages Performs the Fastest?

Abstract

Objectives/Goals

The objective was to determine which computer programming language performs the fastest: Microsoft Visual Basic, Borland Delphi, or Microsoft Visual C++.

Methods/Materials

The two test algorithms were designed and programmed in three of the most commonly used computer programming languages: Microsoft Visual Basic 6, Borland Delphi 2005 (Win32), and Microsoft Visual C++ .NET 2003 (Win32) using functionally identical source code. These algorithms were a soundex-based spell-check program and a prime number sieve based upon the Sieve of Eratosthenes. Another computer program was developed to conduct the thousands of timed tests that would determine the fastest language, and to analyze the mass of data.

Results

The results from both algorithms showed that Visual C++ performed the fastest, Delphi ranked in a relatively close second, and Visual Basic lagged behind as the slowest.

Conclusions/Discussion

From this experiment, I can conclude that Visual C++ is one of the fastest computer programming languages. This information is very useful for the programming community. While there are other factors that determine the programming language to use for a development project, when speed is important, this experiment proves that Visual C++ should be the language of choice.

Summary Statement

My science project tested the relative speeds of three of the most common computer programming languages, Microsoft Visual Basic; Borland Delphi; and Microsoft Visual C++, and determined that Visual C++ is the fastest language.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Matthew S. Golembeski

Project Number
J1208

Project Title
Rollin' on Hoops

Abstract

Objectives/Goals
Wheelchair basketball is nowadays a pretty well known sport and is played by people throughout the world. Many disabled people play on teams for fun or play competitively. This researcher wanted to find out the best defense for his own team to find help his team succeed.

Methods/Materials
Two types of defense were used on this specific team. These defenses were the man to man and the box. THe defenses were tested by seeing how many shots were taken by the offense and if they were made, missed, or blocked. The researcher videotaped teh games palyed to find if the defense was accomplishing its goal.

Results
First the games were videotaped to accumulate data. THen the researcher watched the videotape and determined where each shot as specifically taken and if it was made, missed, or blocked. Then they added the data onto a graph scaled down to the size of a basketball court.

Conclusions/Discussion
Based on the data from the graphs and the videotape, the box defense performed better thant the man to man. The box had a lower scoring percentage and had more shots taken outside the key, which are much longer and harder to make. The man to man had a higher scoring percentage and shots were taken close to the hoop. This information has helped the experimented team find out how to win games and this test can help coaches everywhere to find the correct defense for their team.

Summary Statement
To determine the best defense to use for the experimented wheelchair basketball team.

Help Received
No help provided.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Rebecca E. Jacobs

Project Number

J1209

Project Title

Simplex to Complex: From the Nimber-Simplex Graph to Codes, Lattices, and Groups

Abstract

Objectives/Goals

This project is about the relationship between the Nimber-Simplex graph, error-correcting codes, lattices, and finite simple groups. My previous projects defined the Nimber-Simplex graph (NSG) as a map between finite groups under Nim addition and n-dimensional simplexes, then linked the NSG in n-1 dimensions to n-cubes. The goals of this year's project are to explore coding theory and sphere packing with the specific hypotheses that the NSG can be used to construct binary error-correcting codes, lattices, and finite simple groups.

Methods/Materials

In this project, a relationship between binary linear codes and the NSG is shown, specifically that the NSG retains its fundamental properties when used as the word space and codeword space of a binary linear code. The NSG is shown to be closely related to Hamming codes, and the Ham(3) and Golay G24 codes are constructed using the graph. The relationships between lattices and codes are discussed, and the D3 and E8 lattices are constructed using n-cubes, the Z(n) lattice, and codes. The 24-dimensional Leech lattice is constructed from the G24 code. The NSG is defined as a Steiner system, and a particularly nice isomorphism between the automorphism group of the NSG and GL(n, 2) is shown. Lastly, the structure of the automorphism group of the Leech lattice is described in order to show the relationship of the project to finite simple groups.

Results

This project represents a unique approach to coding theory and sphere packing. Original contributions include the construction of the Ham(k) codes from the NSG, the use of the NSG as the word and codeword space of a binary linear code, the NSG as a Steiner (2, 3, 2^n-1)-system, and the isomorphism between the NSG's automorphism group and GL(n, 2).

Conclusions/Discussion

The three hypotheses of this project were proven: the Ham(k) and G24 codes can be constructed using the Nimber-Simplex graph; the Leech lattice, as well as the E7, E8, and Z(n) lattices, can be constructed using the graph; and certain simple groups associated with the Leech lattice's automorphism group can be constructed using the graph.

Summary Statement

This project links the Nimber-Simplex graph to error-correcting coding theory, lattices, and finite simple groups.

Help Received

My father helped me learn sphere packing and coding theory. My parents assisted with backboard construction and reviewed the report for readability and technical accuracy. My math teacher acted as an advisor.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Brad J. Jensen

Project Number
J1210

Project Title
RNA Alignment Scoring Based on Covariance

Abstract

Objectives/Goals
The objective of my project was to test a new method of comparing RNA sequences. The new method uses covariance to see how similar the 2 sequences are. I will look at the results of the tests, and other aspects such as time needed to make the test (It will be compared using a program I wrote) to see if this new method is valid.

Methods/Materials
The purpose of my project is to test a new method of RNA comparison to see if it#s accurate. My hypothesis was that it would prove to be a very effective method of comparing RNA sequences.
The materials I used for this project were: Fedora Core 3 for 64 bit computers, VI (Which comes with Fedora Core 3), PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi), ClustalW (http://www.ebi.ac.uk/clustalw/), A program written by me for the comparison tests.

Results
When I ran the sequences through my program (for example, Sequence a1 and Sequence a2 I got these results for both comparison methods (The base comparison method results are show first, then the Covariance comparison results are shown):

Sequence A	23.349056%	53.949463%
Sequence B	33.141212%	50.033535%
Sequence C	33.163483%	52.011089%
Sequence D	20.452732%	Failed

Conclusions/Discussion
By looking at the results I have concluded that the new comparison method does not produce the same results and that it is not a valid form of comparison. I have reached this conclusion by observing that the covariance comparison results are all in the same general area when compared to the standard comparison results. Another factor that makes this new comparison method invalid is that it finds every spot the RNA sequence could co vary with itself. So if a sequence like gcgc were used, it would score 100% covariance similarity to the sequence tata, when in reality they have nothing in common (Other than they both only use 2 bases#) This method is also very inefficient in comparing RNA strands because the buffer that holds where the RNA sequence co varies with its self grows cubically. That makes it very hard for a standard computer to compare long sequences (I tried a 30,000 length sequence and it failed.) This method also takes a very long time to compare the RNA sequences. My conclusion is that this new comparison method is invalid in all respects. This goes against my hypothesis which believed that it would have some validity

Summary Statement
I was testing a new way to compare RNA with a program I wrote.

Help Received
Inspiration for the project came from my brother Jeff.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Rachel Levit

Project Number
J1211

Project Title
Looking Out for Number One: Do Random Number Generators Follow Benford's Law?

Abstract

Objectives/Goals
The purpose of this experiment was to test the randomness of multi-linear congruential random number generators, using Benford's Law as a reference. Benford's Law proves that in any set of truly random data, the first digit will be one most prominently, and the likelihood of other digits occurring decreases in chronological order.

Methods/Materials
The only material used was the random number generator inside a TI-83 PLUS graphing calculator.

Results
The random number generator did not generate truly random numbers. In Benford's Law, the range is 35.3%, but for the generator#s data, it only was 5.8%. Also, in Benford's Law, the likelihood of a certain first digit occurring decreases chronologically. However, in these findings, there was no logical order in the likelihood of the digits.

Conclusions/Discussion
This experiment proved that numbers from a multi-congruential linear random number generator do not follow Benford's Law. Either Benford's Law does not truly define random data, or the generator itself somehow guarantees for each first digit to be distributed the same amount of times.

Summary Statement
This experiment seeks to see if the numbers generated by a multi-congruential linear random number generator follow Benford's Law.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
David C. Liu

Project Number
J1212

Project Title
Internet-Based Distributed Computing

Abstract

Objectives/Goals

Distributed computing is the process of using several computers (clients) to solve a complex task. The clients communicate with a central server, which coordinates all computations. In a distributed computing network, clients are rarely all the same speed. It isn't efficient to simply divide the task equally among the clients, as some clients will be significantly faster than others. A system called load balancing allows the faster clients to work more than the slower ones.

The purpose of my project was to explore the relationship between overall performance and the number of clients in an internet-based distributed computing network, as well as investigate the need for proper load balancing. I hypothesized that the more computers participating, the greater overall performance will be. In addition, the effect of load balancing would be most prominent if the computers used vary greatly in speed.

Methods/Materials

My experiment used six of my home computers. One acted as a server, while five others were clients. I designed and created my own distributed computing client and server software. I made two algorithms--one which divides the task equally, and one which incorporates advanced load balancing. For each algorithm, I had the network complete the task with only one client, and then added more clients, one by one. Each client recorded its time to complete its sub-task, and the server recorded the time it took to complete the entire task.

Results

Without load balancing, the network slowed down considerably when a slow client was added. With load balancing, however, adding a slower client would still benefit overall performance.

Conclusions/Discussion

I found that adding more clients to an efficiently designed distributed computing network increases performance. Efficient networks need to incorporate load balancing. Without it, performance is bounded by the slowest client, i.e. slow clients will bog down the entire network. When load balancing is added, all clients work for about the same amount of time, with the faster clients doing more than the slower ones. The net effect is that overall performance will always increase. My results show that distributed computing, when implemented correctly, is an effective system that can utilize massive reserves of computing power to approach complex problems. This confirms my initial hypothesis.

Summary Statement

This project was to investigate how to efficiently design an internet-based distributed computing network, in which adding more clients will result in a performance increase.

Help Received

Mr. Francis Lee, my advisor, guided me through the steps of creating a science fair project, and proofread my report.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Chandan G. Lodha

Project Number
J1213

Project Title
Enlightenment: Creating the Perfect Picture for Scenes with Large Lighting Variations

Abstract

Objectives/Goals
The objective of this project is to investigate which shutter speeds to use and combine to effectively capture a scene with large lighting variations using a digital camera.

Methods/Materials
I used HDR shop software (freely available on the web) to combine images captured at different shutter speeds. I captured the images using a Canon Powershot G3 Digital Camera. In addition, I used a tripod, a computer, a printer, and photo paper.

First take pictures of several scenes with large lighting variations using every f-stop shutter speed from 1/2000 of a second to 15 seconds. Next, load all the images onto HDR shop software. After that, create several new high dynamic range images, by combining the original images obtained at different shutter speeds using HDR shop. Then evaluate images obtained by using several different shutter speed combination options. Lastly, rate each option, on a scale of 0 to 5.

Results
After experimenting with several different scenes and shutter combinations, I finally evaluated seven different shutter speed combination options for four different scenes with large lighting variations. Indoor scenes (such as church and a room with a mirror), outdoor scene (such as a building with lots of windows), and an indoor-outdoor scene (looking out from a window) were chosen. Of the seven options, the perceptually based shutter speed option did the best. The next best option with a single image was created using the HDR shop software.

Conclusions/Discussion
Most cameras provide Automatic Exposure Bracketing (AEB) option. AEB captures three images of a scene, one at the automatically chosen shutter speed and two additional images, one f-stop below and one f-stop above. My hypothesis that high dynamic range image obtained by AEB will be the best, turned out to be false. Instead, images obtained based on perceptual ranking, turned out to be the best.

Current technology available with digital cameras of capturing a scene with large lighting variations using AEB does not do a good job when the intent is to capture details of at least two regions of the scene that are lit differently. My results show that using shutter speeds that are sensitive to the regions of interest create much better pictures.

Summary Statement
It is possible to improve state-of-the-art camera technology, by combining different shutter speeds, to create an excellent photograph of a scene with large lighting variations.

Help Received
Alex D'Angelo (Microsoft) helped interpret some parameters of camera software. Father drove me to various locations to take pictures, suggested initial idea, and helped write project abstract. Lynda Rogers (SF Coordinator) gave display tips. Mrs. Kilkenny gave lots of project advice throughout the project.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Nikolette M. Sanchez

Project Number
J1214

Project Title
The Effect of Number of Sides on the Fairness of a Die

Abstract

Objectives/Goals
The objective of this expermient is to find out if the shape of a die affects it's fairness.

Methods/Materials
I rolled each dice 200 times, and tallied how many times it landed on each face. I used a 6 sided, 8 sided, 10 sided, 12 sided, and 20 sided die.

Results
I found that the eight sided die was the most fair having a range of six. The twelve sided die came next having a range of ten, then the six sided having a range of fourteen. The least fair were the ten sided die, having a range of 15 then the twenty sided die having a range of 18.

Conclusions/Discussion
The results have show that the shape of a die affects its fairness.

Summary Statement
The purpose of this experiment is to find out if the shape of a die affects it's fairness.

Help Received
Mr. Rodman helped put the board together; Mayra Valdez helped put the board together; Mrs. Harris helped with graphs.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Kaelin A. Swift

Project Number
J1215

Project Title
Fibonacci Flowers

Abstract

Objectives/Goals
The growth rate of the Fibonacci sequence is studied using the spreadsheet Excel. The Fibonacci sequence occurs in nature in many situations. The observations are used to answer questions about rates.

Methods/Materials
A spreadsheet was used to study the numerical Fibonacci sequence.

Results
The growth rate is determined for the sequence and shown to be independent of starting sequence values.

Conclusions/Discussion
For some organisms, growth rate does not depend upon size.

Summary Statement
The Fibonacci sequence is studied numerically.

Help Received
Father helped with spread sheet.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Thomas T. Wooding

Project Number
J1216

Project Title
Let's Make a Deal

Abstract

Objectives/Goals
The objective of this project is to determine if the probability of picking the right object is better by switching your initial choice with a variant of the shell game, where one choice that is for sure wrong is removed by the person in charge and shown to you after you make your first guess. My hypothesis is that there is will be no advantage to switching.

Methods/Materials
I built a game based upon the game show "Let's Make a Deal". I knew what was behind all three doors. I then let the subject pick a door, without letting them see what was behind it. Then, I showed them a door that for sure offered a bad prize. They were allowed to stay with their initial choice or switch. This was repeated with more doors, eliminating two of four doors and three of five doors to see if more choices changes the odds. 100 trials each of three, four, and five door variants were conducted by subjects and the results recorded. I also conducted 100 trials with a computer simulation of the three door variant.

Results
Subjects who switched on the three door variant got the right door 68% of the time, while those staying with the initial choice got the right door 31% of the time. With four doors the advantage to switching increases to 73% vs 22%. With five doors, the advantage to switching increased to 79% vs 20%. The computer simulation showed that switching got the right door 65% of the time, while staying got it right 35% of the time.

Conclusions/Discussion
My hypothesis was wrong. The probability of getting the right door with the first pick is one in how many choices you have. When picks that are wrong for sure are removed down to the point that there are only two doors left, the probability of getting the right door by switching is much better, and increases with more doors being added. The trick is that the guy in charge knows for sure which doors to eliminate.

Summary Statement
This project investigates weither there is an advantage to switching your initial choice in variants of the shell game.

Help Received
My mother took pictures & helped test subjects.