# Probability Fair

## A Student-Run Open House Event

# Rick Morris
*Creator of New Management*

*Probability Fair: A Student-Run Open House Event*
Copyright © 2009 by Rick Morris

I.S.B.N. 1-889236-14-4

Other eBooks by Rick Morris

*Stitchery Seat Covers*
*Credit Cards, Level 2*
*Kcons: A Shape-Based Identity System for Kindergarten Classrooms*
*Clip Chart: A Simple Discipline Strategy for Promoting Positive Behavior*
*iPod for Video: How to Use an iPod as a Presentation System*
*Covered Wagon Racing*

Other Books by Rick Morris

*New Management Handbook: A Step-by-Step Guide for Creating a Happier, More Productive Classroom*
*Eight Great Ideas: Simple Ways to Transform Your Teaching*
*Tools & Toys: Fifty Fun Ways to Love Your Class*
*Class Cards: How to Put Your Class in the Palm of Your Hand*

New Management
6512 Edmonton Avenue
San Diego, California 92122

For information, you can call us at:
(858) 455-6000

or send e-mail to:
rick@newmanagement.com

or visit our website at:
www.NewManagement.com

*Not that we are sufficient of ourselves to think of anything*
*as being from ourselves, but our sufficiency comes from God.*
*—II Corinthians 3:5*

*probability:*
*the chance that something will occur*

# Probability Fair

## A Student-Run Open House Event

*T*he Probability Fair is a math event that the students conduct for their parents. For the past ten years or so, we have run the Probability Fair for our second Open House which occurs during the month of May. All-in-all, it promotes a high degree of student involvement and creates a huge parent turnout.

## The Basics

1. Teams of Students Create Probability Games

   *There are enough games demonstrated at the end of this eBook to get you started so that your first PF will be hassle-free. After that, though, you'll find yourself adding your own games to each year's event.*

2. Play Practice

   *Teams learn how to operate their games by having students from other teams act as players. Game jobs are rotated so that each team member knows all of the jobs.*

3. Dress Rehearsal

   *A day before Open House, students from other classrooms are invited to play. This allows for more practice time but also promotes the heck out of the event.*

4. Probability Fair Snack Shop

   *During Open House, points earned from playing the games can be "cashed in" for licorice, Jolly Ranchers, Starburst, etc. Students analyze the Score Cards from the Dress Rehearsal to determine how much to charge for each item.*

5. Open House

   *In addition to all of the parents who show up that night, we always had a hundred students who would return to our room to play again so they could buy some treats. Picture your room as "the place to be" at Open House.*

# 1. *Teams of Students Create Probability Games*

Since each of the five student teams is responsible for building and then running a probability game, I get things started by demonstrating five or six games from previous years. Most teams select games that have been played in the past. This makes the preparation and set-up a bit easier since everyone has a model to follow.

On the other hand, creating a new game is a great thing and is always encouraged. I've learned, though, that students sometimes have a difficult time devising a game that is not only based upon probability but also enables the player to choose the level of difficulty.

> *Case in point:* Having a player choose whether a coin will end up as a head or a tail is one thing. But what if the player was given to the opportunity to guess the outcome of two coins being flipped? In this situation the player is given a choice of how to play. And although the probability of being correct decreases with two coins, the points earned for doing so increases. Consequently, coin flipping suddenly becomes a bit more interesting.
>
> *Visual learners:* The pictoral explanation of what I'm trying to explain can be found on the last five pages of this eBook.

## Game Set-Up

On a 24 X 36 sheet of construction paper, the teams assemble their game components: playing pieces, title display, 5 X 8 cards showing the probability of winning their game, and any decorations they feel would be appropriate without being distracting.

*Reality:* Most of the components can be made from construction paper. However, some teams like to bring in props or other decorations that compliment the theme of the game. The only requirement is that the props or decorations don't interfere with the play of the game. Other than that, the teams are free to embellish their games.

## Initial Layout

Here's a little something I learned the hard way:

> *Don't allow a team to glue down the game pieces until you've had a chance to inspect the layout.*

I've had teams glue down dozens of little game bits only to realize they either: 1) forgot to include some critical piece; or 2) didn't leave adequate room for all of the pieces.

As much as I like students to take on the ownership of a project and be responsible for the decisions they make, it's pretty painful to watch a team having to recreate so much work. A quick check by you could avoid a lot of grief.

## 2. Play Practice

In order for the students to effectively conduct the Probability Fair for their parents at Open House, they're going to need a lot of practice at operating their games. Before any practicing can occur, someone needs to make a Score Card and then xerox a bunch of copies.

### Score Cards

As you can see below, the Score Card is a simple quarter-page piece of paper. On the card are six boxes: one for the player's name and classroom number and five others that will be used to record the player's score for each of the five games.



**FIG. 1**
Shown here are the points Ben earned while playing the games.

*For the record:* Creating the Score Card was something I did each year. Not only was it is easy for me to do, I felt the students were already doing enough to build and operate their games without adding another task to their list.

How many points the player receives depends upon the probability of winning. The higher the probability, the easier to win, the smaller the score. Players who don't win the game end up with a zero in the box. (The zero will prevent someone from trying to play the same game a second time.)

### Team Practice

This initial experience is not much more than the team playing its own game. Score Cards are handed out and the students write their names and classroom number in the first box. The team then selects one of its members to be the first player. The other team members run the game, each one doing a different job.

**Score Card Collector**
1. Welcomes the player to the game.
2. Collects the player's Score Card and hands it to the recorder.

### Game Host
1. Explains how the game is played.
2. Hands the player the game marker(s) if necessary.

### Game Operator
Rolls the dice, flips the coins, shuffles the cards, etc.

### Score Recorder
1. Records the number of points the player earned.
2. Returns the Score Card and says, "Thanks for playing."

Team practice continues until every team member has had a chance to be the player. (It goes pretty fast.) During this time, all team members should have had a chance to try all of the game jobs. After a while, the entire operation can be run by just a student or two.

## Class Practice
After each team has had a chance to practice playing its own game, the teams send a member to play all five games. The teams quickly discover there's a big difference between a player who is familiar with the game, such as your teammates, and someone who has no idea about how your game is played. But that's why we're doing the practice rounds.

It's take a bit of time for the team to develop a routine. Everything from asking for the player's Score Card when he steps up to the game to explaining how the game is played; from paying attention to the outcome of the play so that the proper score is recorded to returning the card with a cheerful "Thanks for playing." It's rough at first but smooths out with time. During Class Practice I do a lot of circulating, supervising, reminding, and modeling.

Adding to the intensity is the introduction of a new element: the Registration Table.

## Registration Table
The registration table is a student desk set up outside our classroom next to the doorway. A student is selected to be the registrar and is given a supply of blank Score Cards and a cup of pencils.



Players step up to the table and receive a Score Card from the registrar. The player writes his name and room number in the first box. After returning the pencil to the cup, the player is allowed to enter the Probability Fair and play each game.

## Practice Wrap Up

Once a team member has played all five games, he returns to his own team and a different team member heads to the Registration Table. After everyone has had a turn as a player, we gather together and discuss how it all went.

Suggestions are made, praise is passed from student to student, minor complaints are delivered, and vague accusations of unfairness are leveled at teammates. You know the drill. It's all a part of the general give-and-take that occurs whenever you engage in group interactions. For the most part, though, they're pretty upbeat and excited about the whole event.

## 3.  *Dress Rehearsal*

On the day before Open House, we allow other classrooms to try our Probability Fair. This not only gives my students more practice at running and explaining their games, it also creates a buzz about the event which results in a large Open House turnout.



*The Dress Rehearsal provides the team with a chance to work out the bugs while also promoting our event to the visiting students.*

In an effort to ensure that classes will be able to fit us into their schedules, we send students to classrooms to announce what we're doing a day or two before the Dress Rehearsal. A sign-up sheet is printed out showing available time slots. (Fifteen minutes per class works out rather well.) The sheet is attached to a clipboard and given to two students. The students visit a couple of classrooms and make the invitation. They either tally a "not interested/not able to attend" or they'll write the room number in the appointment slot. After returning, the clipboard is passed to another pair of students who repeats the process.[†]

On the day of the Dress Rehearsal, we send out reminder notices to the classrooms who had indicated they would be participating.

A few minutes before the first class arrives, I gather everyone together for a little pep talk.

> MR. MORRIS
> Calmly:
>> *In just a couple of minutes, our first group of players will come through our door. Please remember to be friendly and engaging. Keep in mind that you know how to play your game but the visitors won't. Explain things clearly and ask if they have any questions.*
> Pausing as he looks for nods and smiles:
>> *Christina and Eric are the registrars for the first class. After that, just check the schedule at the Registration Table to see which students are next. Any questions?*
> Pausing again:
>> *Alrighty then. Let the games begin.*

And with that, I start the music and head outside to direct traffic.

As students finish playing all five games, they drop their Score Cards in a container we have set on the table being used for the Snack Shop.[††] Fifteen minutes later, the visitors depart.

> *Somewhat Annoying Reality:* Be prepared for some of the visiting players to ask if they can play again. Happens all of the time. What I always did was remind them that they'd be able to play again if they came to our room during Open House.

## 4. Probability Fair Snack Shop

During Open House, players will take their completed Score Cards to the Snack Shop and spend the points they earned on a variety of treats.

**Typically offered items:**
Jolly Ranchers, Starburst, licorice, Tootsie Pops, anything cheap and plentiful,

---

† I've done the Probability Fair for so long at my school that all of the teachers are familiar with it and happy to participate. Since this will be your first one, you might want to do the scheduling yourself so you could answer questions.

†† The Score Card container is placed on the Snack Shop table because I want the students to get a glimpse of what's being offered at Open House. This adds to their desire to return and play which adds to the overall energy level.

and a few "big ticket" items
> I usually had three large candy bars on the table with a high price for the lucky few who scored a lot of points.

Since there were going to be a lot of Snack Shop customers at Open House, we had to do some thinking in order to come up with a reasonable price for each item.

## Deciding on Prices

At the conclusion of the Dress Rehearsal, I picked up the container of Score Cards and gathered everyone together.

**Mr. Morris**
With the container of Score Cards in hand:
> *We need to figure out how much to charge for each of the items we're going to have in the Snack Shop at Open House.*

Pausing briefly:
> *What would happen to the Snack Shop if we sold candy for one point a piece?*

They quickly realize we would run out of candy.

**Mr. Morris**
Nodding in agreement:
> *And what would happen if we charged 20 points for a piece of candy?*

Again, they came to the right conclusions: we wouldn't sell much candy not to mention the fact that the visiting players would leave with a bad feeling.

> Mr. Morris
>> Another nod:
>>> *I agree. So let's look at the Score Cards and see what we can figure out.*

With that, I move to the whiteboard and create a number line.

> Mr. Morris
>> With whiteboard pen in hand:
>>> *If you lost every game, you'd end up with zero points.*
>> Writing a large zero on the board:
>>> *And if you won all five games at the highest odds you would end up with 32 points.*

*Note:* The "highest odds" concept was explained during the Team Practice and Class Practice sessions and is well understood by the students at this point.

I then wrote a large 32 at the other end of the board from the 0.

```
0                                                                    32
```

> Mr. Morris
>> Holding up the container:
>>> *We're going to look at every Score Card in this container and figure out how many points each player earned.*
>> Moving back to the whiteboard to write more numbers between the 0 and 32:
>>> *We're then going to show how many students scored zero points, 1 point...*
>> Writing a 1 to the right of the 0:
>>> *Two points...*
>> Writing a 2 to the right of the 1:

```
0 1 2                                                                32
```

>>> *All the way up to how many students, if any, earned 32 points.*

## Tallying the Results

The Score Cards were then divided among the teams. Teams designated one member to act as the recorder while the others were tabulators.

The tabulators calculated a total for a card and wrote the number on the back of the card.

While they were doing this, I met with the recorders. I quickly demonstrated how to make a record sheet. It was similar to the one on the board but was set up vertically so that it would be easy to record tally marks.

When the recorder had rejoined the team, the tabulators began to read the scores that had been calculated. The recorder repeated the score out loud and then tallied the total with a stick mark.

As soon as a team had finished calculating scores for the cards they had been given, they brought the tally sheet to the white board at the front of the room. They recorded how many students ended up with zero points, how many ended up with 1 point, 2 points, 3 points, etc.

| | |
|---|---|
| 0 | III |
| 1 | |
| 2 | I |
| 3 | IIII |
| 4 | I |
| 5 | II |
| 6 | ⊦⊦⊦ III |
| 7 | I |
| 8 | ⊦⊦⊦ I |
| 9 | ⊦⊦⊦ |

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | ... |
|---|---|---|---|---|---|---|---|---|---|-----|
| 3 | 0 | 1 | 4 | 1 | 2 | 8 | 1 | 6 | 5 | ... |

After the totals had been posted by all five teams, we then totaled each column. The final result was a single number that represented the number of students who had scored that many points during Dress Rehearsal.

From this:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | ... |
|---|---|---|---|---|---|---|---|---|---|-----|
| 3 | 0 | 1 | 4 | 1 | 2 | 8 | 1 | 6 | 5 | ... |
| 5 | 0 | 0 | 1 | 0 | 3 | 10 | 2 | 3 | 2 | ... |
| 2 | 0 | 3 | 5 | 3 | 3 | 7 | 0 | 8 | 0 | ... |
| 4 | 0 | 0 | 6 | 3 | 0 | 5 | 0 | 5 | 2 | ... |
| 3 | 0 | 0 | 2 | 4 | 2 | 7 | 2 | 4 | 1 | ... |

To this:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | ... |
|---|---|---|---|---|---|---|---|---|---|-----|
| 17 | 0 | 4 | 18 | 11 | 10 | 37 | 5 | 26 | 10 | ... |

It was then a relatively simple process to look for clusters and patterns and use that information to determine the snack prices. Something that helped us decide was knowing how many of each item we had. For example, if we had a tub of red licorice that contained 120 pieces, we could calculate how many points the tub would take in. At 2 points per piece, we were taking in 240 points. Seeing the bigger picture of what the pricing levels would do helped produce more realistic and sustainable prices.

*Opportunity:* I always felt that this process of figuring out snack prices was an added bonus to the overall probability knowledge that was developed during the event. Not the actual tabulating of scores from Dress Rehearsal, mind you. That was a pretty simple thing to do. I'm referring to the idea of using math to solve real world problems. Deciding what to do with our score tabulations was a nice way to introduce the students to the beauty of math analysis. Or maybe that's just how I see it because I'm a bit of a math geek.

## 5. Open House

As you can imagine, Open House operates in a similar fashion to the Dress Rehearsal. There are, however, two simples differences.

For one, the parents are present and playing the games. Some parents even ask to play a second time which is fine with us. We're just happy they came to Open House and are enjoying themselves.

The other difference, of course, is that everyone who plays can cash in his Score Card for a treat or two.

The addition of those two elements creates a high-energy, free-flowing crowd. Parents, grandparents, brothers, sisters, and, of course, students from other classrooms who return to play again, move from one game to the next and then to the Snack Shop.

You'll hear groans of disappointment when a game is lost and shouts of joy when a player chooses the option with the lowest probability and wins. You'll see players waiting for their turn as they watch others try their luck. I think the only things missing are the neon lights and the cheap buffet.

> *Recommended:* Due to the fact that everyone is playing for snacks, I realized we needed to come up with a simple way to prevent students from playing more than once. After all, it would be an easy matter for a student to return to the Registration Table and receive a new Score Card. This is especially true since the room is packed with visitors for almost the entire hour of Open House. Our solution was to stamp the back of a student's right hand during the registration process. (We don't stamp adult hands unless they ask.) The little red star helped to keep the students honest.

**Fig. 3**
A little self-inking star stamp I got at Staples does the trick nicely.



What's nice to see are the parents who continue to hang out in the room enjoying the party even though they've played all five games. Almost all of them check out the student items we have set up on the walls for display.

Although a number of parents head to the classrooms of their other children, there will be a hard-core group of moms and dads who just stick around because they like the vibe. A few of them, with permission from the child, will even help run a game or two. That's a sweet thing to see.

My role at Open House is pretty simple. I'm the DJ. I also visit briefly with every parent who paid a visit to thank them for coming. Other than that, I don't do a whole lot except watch the whole show unfold. And what a show it is.

## Consolation Prizes

Anyone who lost all five games and ended up with a zero in each box is invited to drop the Score Card into a plastic container. On the day after Open House, five Score Cards are drawn from the container, glued to a large sheet of construction paper, and posted in the cafeteria. The winners come by the room at some point and are given a handful of treats.

**FIG. 4**
You don't have to do this, but it is a nice gesture of goodwill.

## *Good Enough*

Well, that's it.

Other than the dozens of little things that will come to me later on in reflection, I think this eBook should get you started on producing your own Probability Fair. (Don't forget that there are sample games on the next five pages.)

Should you decide to take on this project with your own students, please feel free to email me and share your success. And if you come up with any nice additions, I'd really like to hear about them. I'll add your ideas to this book and make the whole thing that much better for the next teacher who decides to give it a shot.

## Coin Flip



Object:   Predict which side of the plastic coin will appear when the coin is flipped.

Player decides how many coins—1, 2, or 3—he wants to play. He then places a wooden cube on the pattern that represents his prediction. After the cube has been placed, team members place a hand over the top of the cup, give the coin inside a shake, and then turn the cup upside down. The cup is then removed—one-by-one to build suspense if the player decided to play with more than one coin—to reveal the outcome.

Materials:   3 plastic cups
3 two-color coins (from math kit)
marker to indicate player's choice (wooden cube)
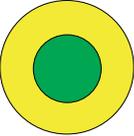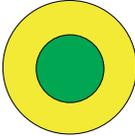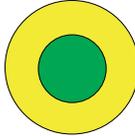


Play one coin, the odds of winning are 1 out of 2.

Play two coins, the odds of winning are 1 to 4.

Play three coins, the odds of winning are 1 : 8.
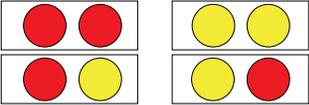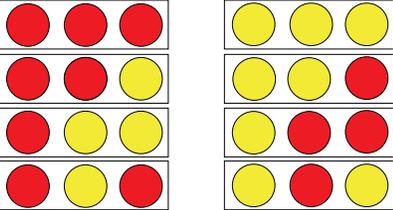
## *Lucky Die*
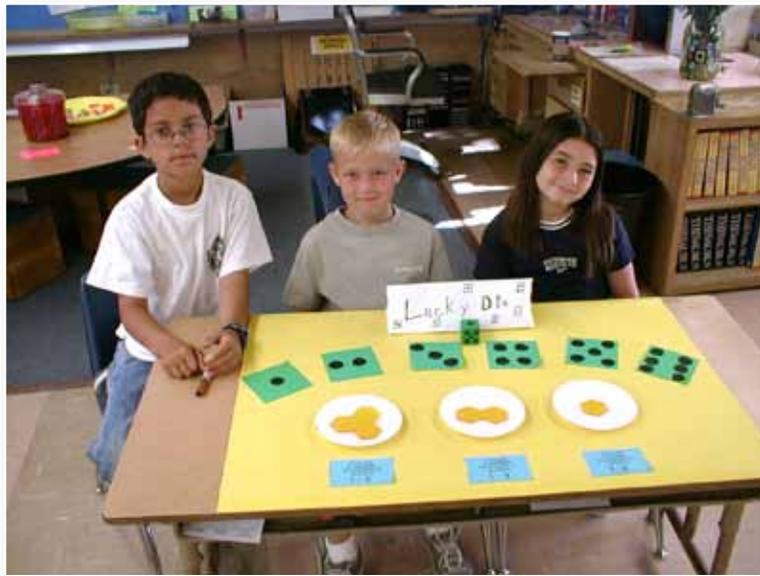


Object:     Predict the number that will appear when the die is rolled.

Player makes prediction by placing 1, 2, or 3 yellow hexagons (as seen on paper plates) on the number(s) he thinks will be rolled. After the player has made his choice, a team member rolls the die to determine the outcome.

Materials:   3 paper plates
             large foam die
             6 markers to indicate player's choice(s)



| Pick 3 numbers, the odds of winning are 1 out of 2. | Pick 2 numbers, the odds of winning are 1 to 3. | Pick 1 number, the odds of winning are 1 : 6. |

## *Indian Sticks*



Object: Predict the pattern that will appear when four tongue depressors—which are decorated on one side and plain on the other—are dropped onto the table.

Player predicts what pattern will appear by placing a brightly colored tongue depressor on the sticks at the front edge of the table. After the player has made his choice, a team member drops a set of sticks on the table to determine the outcome.

Materials: 4 tongue depressors decorated on one side (drop sticks)
20 tongue depressors are glued down to the front edge of the table
1 brightly colored tongue depressor to indicate player's choice

DROP ZONE

Pick these patterns, and the odds of winning are 1 out of 2.

Pick this pattern, and the odds of winning are 1 to 3.

Pick these patterns, and the odds of winning are 1 : 8.
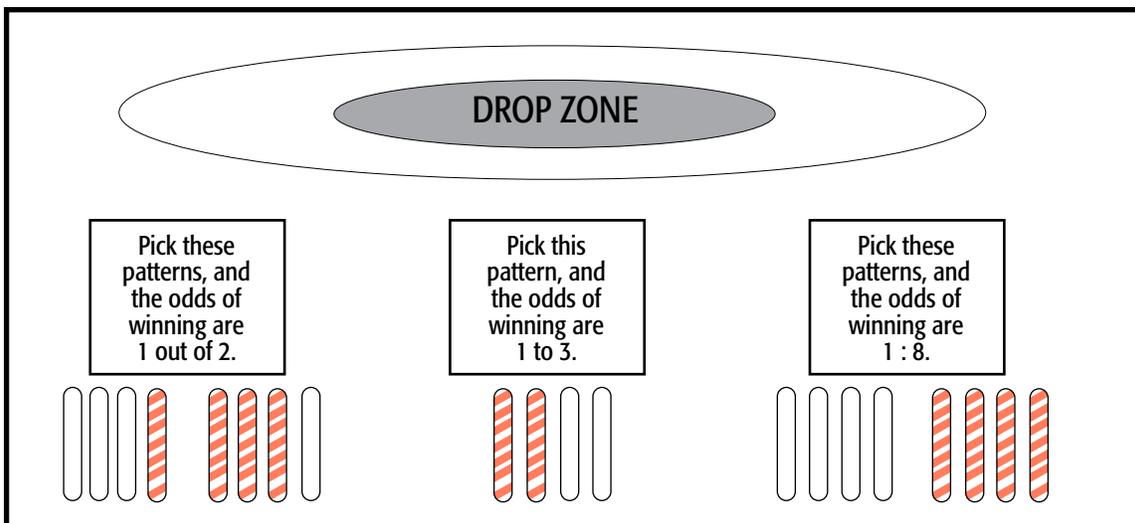
## *Pikachu! Where Are You?*
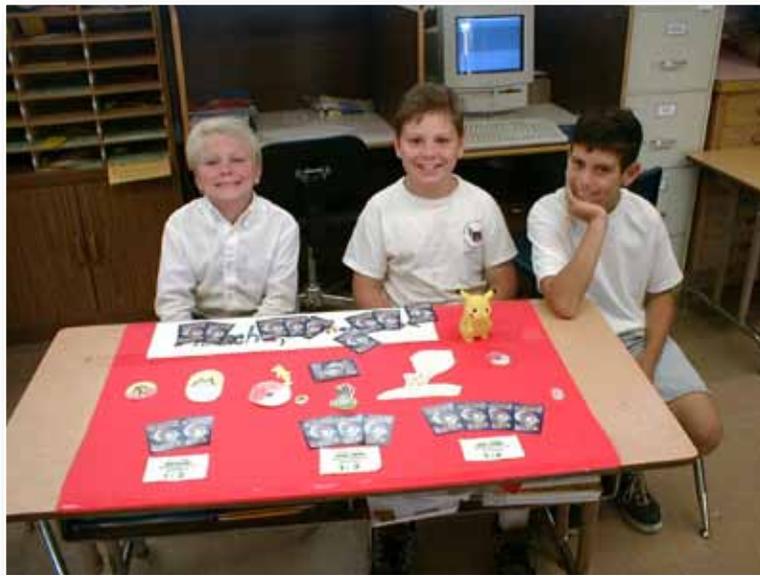


Object:  Find the Pikachu card in a set of cards.

Player announces how many cards he wants to have in the set from which he will try to find the Pikachu card. After he has made his choice, a team shuffles that set of cards. The shuffled set is placed face-down and side-by-side on the white space at the back of the table. The player then points to a card. A team member turns the selected card face-up to determine the outcome.

Materials:  18 Pokemon cards
9 cards are glued face-down
9 cards (3 of which are Pikachu cards) are used for the sets to be shuffled
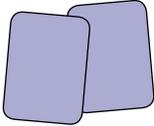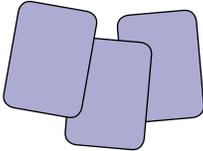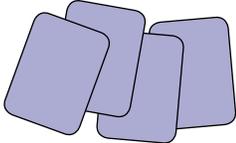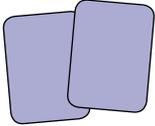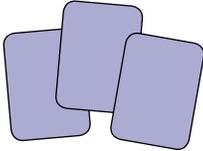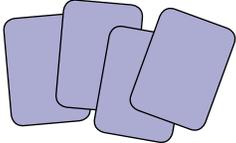
If you use 2 cards, the odds of winning are 1 out of 2.

If you use 3 cards, the odds of winning are 1 to 3.

If you use 4 cards, the odds of winning are 1 : 4.

## *Mini-Cubs*
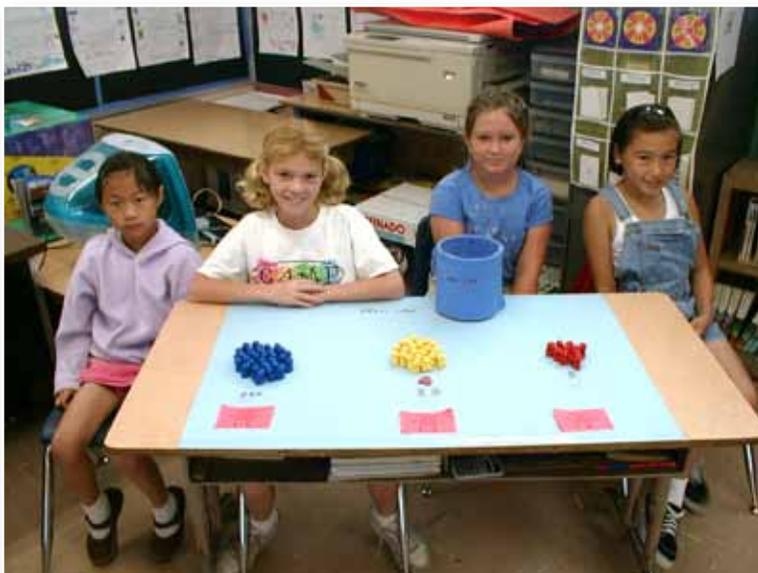


Object:     Predict the color of the plastic lion that you will pull out of the tub of lions.

Player predicts what color will be pulled from the tub by placing the marker—a green lion cub—next to the group of cubs on the table. After the choice has been made, a team member holds the tub aloft (so that the player can't see inside) and asks the player to remove one cub. The cub is then returned to the tub.

Materials:   2 sets of: 30 red lions, 20 yellow lions, 10 blue lions (from primary math kit)
            gallon container for holding them all
            1 green lion to use as a marker



| 30 of the 60 lions are red. The odds of selecting a red lion are 1 out of 2. | 20 of the 60 lions are yellow. The odds of selecting a yellow lion are 1 to 3. | 10 of the 60 lions are blue. The odds of selecting a blue lion are 1 : 6. |