MATHEMATICS

Thirteen Spades

Your Mathematical Chance of Receiving Such a Hand In Bridge Is One in 635,013,559,600 Deals

By ROBERT D. POTTER

TWO OR THREE times a year one can pick up the morning newspaper and read something like this:

"PARIS, Mar. 4—Samuel Spadoff died here today from a heart attack caused, physicians state, by being dealt the perfect bridge hand — thirteen spades."

Or the story may have a dateline from Pittsburgh, Pasadena, or Podunk, as the case may be. And, to keep the records straight, the lucky bridge player does not always die.

Thirteen spades—or any other suit to serve as trump—is the perfect bridge hand (always providing the opponents aren't clever enough to bid seven no-trump over the seven spades).

Are the stories in the papers about the "perfect" hands mere journalistic imagination, the work of joking friends who stacked the deck, or just plain unadulterated luck? Everyone who plays bridge, and there are something like 10,000,000 bridge players in the United States alone, has asked this question.

What is the mathematical chance of being dealt thirteen spades? Pull down your hat, button your vest, tighten your belt and hold your breath—the answer comes out to be one chance in 635,013,559,600 deals.

Eight Years

All of which means that if every one of the 10,000,000 bridge players in the U. S. dealt twenty bridge hands 365 days in the year it would take the whole group of enthusiasts—or would they be lunatics?—just about eight years, eight months and one week to deal enough hands to get a single one containing thirteen spades.

The two leap years coming in that time, bringing two extra days, will add a mere drop in the bucket—about 40,000,000 deals—but perhaps it may be best to provide two days of rest in eight years for the "bridgers."

No one, not even the bridge "experts," averages twenty deals a night for a year straight. That's why mathematicians and even the laymen, who admit they know little about it, scoff at the frequency with which perfect trump hand stories appear in the newspapers. The world would have to be the maniac-like place pictured to obtain the results by sheer probability alone.

Go ahead and scoff. Charge off 80 or even 90 per cent. to hoaxes on the part of newspapermen portrayed not as they are, but after the fashion of Hollywood; anything for a laugh. Even the 10 or 20 per cent. left is much too high.

Practical Joker?

After questioning the veracity of the newspaper story, consider the chance of the deck being stacked while the potential victim was out of the room. Suppose that once out of a million deals in the world of bridge some practical joker does stack the deck. What then is the chance that an all-spade hand will be dealt by the normal course of play?

Without plodding through the calculations the chance is still only one in 159,000.

Lest one grow dizzy worrying about chances of a million or billion to one, it may be best to explain that the figures cited are all right mathematically, but conditions necessary for perfect calculations by the laws of probability are not completely satisfied in a bridge game as most people play it.

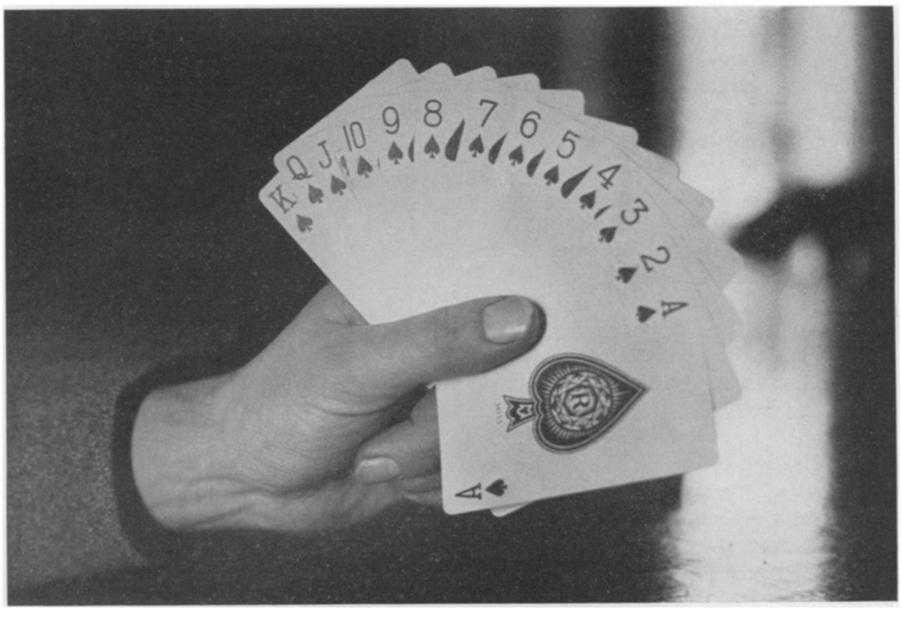
Honestly "Stacked"

Why won't straight mathematical probability apply in a game of bridge? Just because most people are too lazy or haven't time and patience enough to break up the pattern of the cards by shuffling thoroughly after each completed deal.

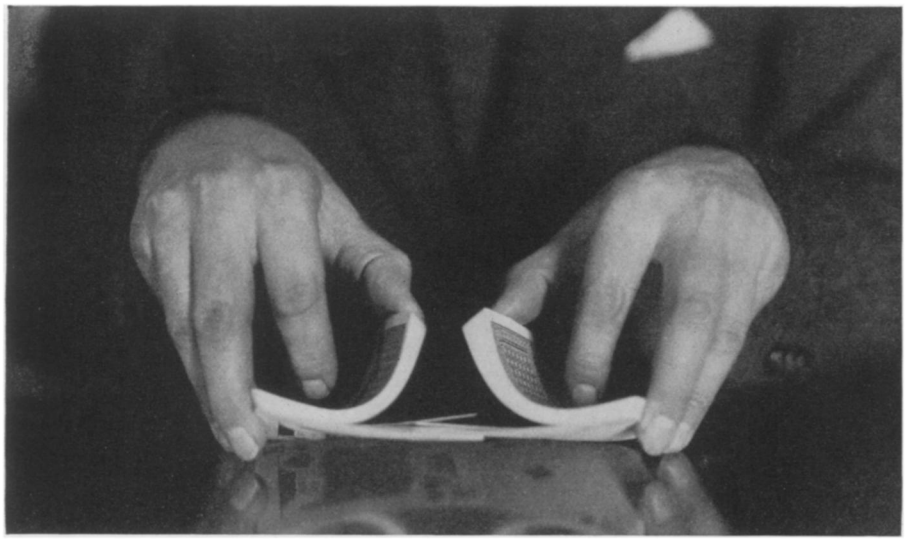
The scoffer's suspicions that some of the "perfect" bridge hands are the result of stacked cards may be right, but not in the way they suspect. Cards have a way of stacking themselves by building up patterns through the necessity of following suit in the course of play.

You lead a spade on the first round. Everyone follows suit. Thus four spades are grouped together. You believe spades will "go round" again so you lead another. They do. That makes eight spades in the group.

If the shuffling on the next hand is lazy, or distracted by postmortems or



THE PERFECT HAND



BUILDING GOOD HANDS

It is only by thorough shuffling that the combinations of the play are broken up and the dull hands of 4-3-3-3 cards, by suits, are prevented.

gossip, one may build up a deck of cards which is partially stacked.

Breaking up the card pattern is real work. In more than half of the thirteen tricks in an average hand of bridge, all players will follow suit. If such a pack were dealt without shuffling, each set of four cards would go out, one to each player, and on the next deal there would be still more tricks in which everyone followed suit. If this were repeated, eventually all four players would be getting hands containing 4-3-3-3 cards, by suits, or similar balanced patterns.

For what few "non-bridgers" there are left in the country, it may be explained that nothing helps more to make bridge monotonous as a game than these balanced hands. There are no thrills of slams and high scores when the cards start running that way.

Relief By Shuffling

Just to get away from this monotony, the pack of cards is shuffled after all the thirteen cards in each hand are played. Only when one has a perfect random distribution of the cards after the shuffle will the factors underlying the mathematical laws of chance enter with fair certainty.

Just as the cards will try to work themselves into the balanced pattern, so too will they build up on rare occasions into more thrilling hands where two and more people will hold seven, eight, or nine cards of a suit. Then the packets of four cards on each trick will often contain only two cards of the suit led. And the chances are better that every fourth card will be of the same suit. This means, of course, that on the next deal chances are better that one player may receive the perfect hand.

Without trying to teach the game of bridge, the matter can be summed up by saying that mere talk of probabilities is one thing, but the game of bridge in practice is something else again.

Remember Combinations

Prof. L. F. Woodruff of the electrical engineering department of Massachusetts Institute of Technology, who has gained an additional reputation for his avocation of bridge and card probabilities, comments on how the master bridge players use their knowledge of chance and card patterns in their methods of play.

Writing in a recent issue of the *Technology Review,* Prof. Woodruff says, "It is almost inconceivable to the average player the number of combinations which some of the leading experts carry in their minds during match play. Not only are the probabilities considered, but at least one player of the writer's acquaintance actually makes use of the combinations that existed in the deck before the shuffle in deciding the play of the hand, on the theory that the ordinary imperfect shuffle fails to break up completely the groupings from the preceding hand."

Most people don't do it, but to start breaking up previous card patterns, four hand shuffles on each deal are necessary. Because of the cyclic nature of the average shuffle and the failure to interleave all the cards properly, an approximate approach to true randomness is hard to attain, Prof. Woodruff indicates.

For players who don't like the evenly distributed hands containing 4-3-3-3 cards in the respective suits, various dealing devices have been introduced which, by a scattered type of dealing, actually shuffle and deal the cards in one operation.

Avoids "One Around"

Such "shuffle dealing" may give two cards in a row to North, then three to East, one to West and so on, until each hand finally has its allotted thirteen cards. The main idea of all of these devices is to get away from the old cyclic method of dealing in rotation from left to right around the bridge table.

Prof. Woodruff, who in his spare moments devised a card "shuffle-dealing" device, has made one of the few tests to determine how the trick-taking value of hands, as measured by their long and short suit values is affected by the number of hand shuffles after each deal.

"A hundred hands of bridge were dealt," explains Prof. Woodruff, "after each of the several procedures for shuffling the cards. Before each shuffling the cards were grouped into tricks of four cards of the same unit. First the cards were given one manual shuffling before dealing, for a hundred hands.

"Then one hundred hands were dealt which had been shuffled manually twice; next three times, and then four times."

Increased Trick Value

Using a popular system of computing the trick value of the hand in long and short suits, each additional deal produced more long and more short suits and increased the trick value in this way:

One shuffle averaged a value of 2.02 tricks per hand.

Two shuffles averaged a value of 2.25 tricks per hand.

Three shuffles averaged a value of 2.47 tricks per hand.

Four shuffles averaged a value of 2.63 tricks per hand. Completely random distribution of the cards, produced theoretically only by an infinite number of shuffles, yields—it can be calculated—an average value of 2.64 tricks a hand.

Similar studies of the trick value in long and short suits for a card dealing

machine showed that an average value of 2.84 tricks for each hand could be obtained. This came about because the greatest number of cards by suits in a bridge hand, dealt for even the ideal case of perfect randomness, are of three cards each. As such they have no trick-taking value based on the long and short suit designations.

With the card dealing apparatus, four instead of three card suits appeared with the greatest frequency, and there was an accompanying increase in two cards and one card short suits. Either length or shortness in a suit is necessary to obtain the trick values being considered in Prof. Woodruff's research.

Moral: If you can't afford a card dealing machine, always shuffle the pack four times.

Science News Letter, February 9, 1935

ARCHAEOLOGY

Uncovers Evidence of Early Mammoth Hunters

A TEXAS county judge, J. A. Mead, turned amateur archaeologist, has unearthed important evidence regarding the most elusive characters of America —the shadowy mammoth hunters.

These ancient Americans are believed to have hunted long-vanished types of big game with stone-tipped spears some 15,000 or 20,000 years ago.

Digging in a farmer's field seven miles northwest of Miami, where he presides over the Roberts County court, Judge Mead unearthed a stone dart point lying directly between two ribs of one of the big mammoths or elephants that once lumbered over Texas plains. Two witnesses, "responsible citizens," watched while the Judge removed from the earth some of the teeth and big bones of the fossilized animal.

Finding a hand-made weapon among bare bones of a long-dead elephant is fairly strong circumstantial evidence that a man slew the elephant. Archaeologists are seeking just such evidence, carefully uncovered, to build up the case for the existence of ancient Americans.

Judge Mead reported his evidence to Floyd V. Studer, director of archaeology for the Panhandle-Plains Historical Society, who at once visited the site.

Announcing the discovery to Science Service, Mr. Studer said:

"While I have personally found several true Folsom or Yuma points in this immediate area, this is the first time one has been reported in direct association with fossil mammals.

"The bones were found in blue-green clay, which indicates a lake bed. There is no evidence of river or stream sand. This blue-green formation lies undisturbed about 18 inches below the present soil level."

The weapon found with the elephant's ribs is described as four and a half inches long. It does not have a groove down its entire center, as the typical Folsom darts do. But in some other respects, such as the smooth edge of the base, it is characteristic of certain weapons ascribed to the age.

The discovery site is not very far from Clovis, New Mexico, where Dr. Edgar B. Howard of the University Museum, Philadelphia, has made notable discoveries indicating existence of early inhabitants in the region. It is also not far from Folsom, New Mexico, where one of the first startling clues suggesting that America was inhabited more than a very few thousand years ago came to light.

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ARCHAEOLOGY

Discovery of Edomite Ruins Dates Coming of Israelites

DISCOVERY of the fortresses of the Edomites, Bible enemies of the Israelites, has given science a new, strong clue to the century when the Israelites marched toward their Promised Land.

An expedition by four institutions, exploring the Arabah Valley of Transjordania by camel and motor car, has traced the boundaries of the ancient Edomite Kingdom, locating important Edomite cities, villages, and fortresses, reports Dr. Nelson Glueck, of Hebrew Union College at Cincinnati, one of the four institutions taking part.

The Edomites, explains Dr. Glueck, blocked the way of the Israelites as they moved northward from Egypt toward their Promised Land. The kinds of pottery found today in the deserted kingdom of the Edomites show that they were established there between the thirteenth and the eighth centuries B. C.

"The date of the Exodus must be assigned to the thirteenth century, B. C.," declares Prof. Glueck on this evidence.

Had the Exodus taken place earlier than that century, it is reasoned, the Israelites would have found neither Edomites nor Moabites to oppose their progress. And according to Biblical account in Numbers 20, the Israelites were compelled to go around Edom. Had the Israelites come earlier, he added, they would probably have occupied the territory of Edom themselves, leaving Palestine farther north for later comers.

The first known fortresses of the Edomite enemies of Israel were large walled enclosures, built of rough flint blocks, and strengthened with revetments and towers. Edom, Prof. Glueck says, was a highly civilized and intensively settled country in the days when it stood in the way of the advancing Israelite forces.

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