The Price is Right

Game 1: Contestants Row

Rules:

- Four contestants are chosen to join “Contestants Row”
- An item is displayed to the contestants and they listen to verbal description of the item
- Each contestant, one at a time and in order, is given a chance to “bid” on the item. Each contestant must use a “different” bid – no repetition is allowed. (Bids are rounded to the nearest dollar)
- The “bid” that is closest to the “actual retail price” of the item “wins” the auction and becomes a contestant in a pricing game that follows the auction.

Notes:

- Since the bids are not given simultaneously and later bidders know what previous players “bid”, later players have an advantage in this game.
- The fact that the goal is to have the “closest bid without going over” rather than just the “closest” bid impacts the strategy of this game.
- A “perfect bid” (rounded to the nearest dollar) is rewarded with an additional cash prize ($100).

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Game 1: Contestants Row

Analysis:

The strategy a contestant should employ depends on four main factors:

- The player's personal estimate of the value of the item
- The player's confidence in their estimate
- The player's position in the game
- The player's "risk tolerance"

Player 1: The first player to bid has no information from previous bids, so this player needs balance two factors:

- Making as accurate a bid as possible (getting close to the actual price) so that other players who bid later will have difficulty getting closer to the actual price.
- Avoiding "overbidding"

One basic strategy to employ is to estimate the price of the item to the best of your ability. Then, subtract off a percentage of your estimated price in order to give a safety cushion against overbidding. The percentage used reduce your bid reflects your confidence in your estimate as well as the amount of risk you are willing to tolerate.

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Game 1: Contestants Row

Players 2 & 3: These players must consider their own estimate item's value and the "bids" of previous players.

We can think of previous bids as "partitioning" the set of all possible remaining bids. When one of these players bids, we can think of this as choosing a bid in one of the remaining intervals in such a way as to maximize the chance that their bid is closest once all players have bid.

These players must consider:

- Their personal estimate of the price of the item
- Their confidence in their estimate
- What the "partition" will look like after they bid

Player 4: If we assume that a perfect bid is unlikely, player 4 has a significant advantage in this game. All player 4 has to do is to use their estimate of the value of the item along with the partition formed by the previous bids in order to choose a bid that maximizes their chance of winning.

Note: An important sub-strategy for Player 4 is the infamous "$1 bid".

The "$1" is not an effective strategy for Players 1-3 (but sadly I have seen it used on TV by player 3!)

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Game 2: One Away

Rules:

- The contestant is usually playing to win a new car. An incorrect 5 digit price for the car (rounded to the nearest dollar) is displayed. The player is told that each digit in the price is either one higher or one lower than the digits in the actual price.
- For each of the 5 digits, the player tells the host to move it either up by one or down by one.
- One each digit has been altered, the true price is revealed. The player wins if every digit chosen matches the true price.

Analysis: If the player were to randomly select direction to modify each digit of the price, the probability of winning would be: $(.5)^5 = .03125$, or 3.125% (here they are chose one from among the $2^5 = 32$ possible “one away prices”.

In reality, the player will use their estimate of a reasonable price for the car to guide at least some of their prices. The better their ability to estimate the price, the more digits they can alter with certainty. Most would grant a near perfect change of predicting the $10,000 digit.

Probability of winning if 1 digit is known:
$(.5)^4 = .0625$, or 6.25%
Probability of winning if 2 digits are known:
$(.5)^3 = .125$, or 12.5%

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Game 2: One Away

Example:

Here is a "One Away" price for a 2008 Toyota Camry XLE sedan with the "hybrid" – gas/electric option

$16,319

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Game 2: One Away

Example: Here is a "One Away" price for a 2008 Toyota Camry XLE sedan with the "hybrid" – gas/electric option

$16,319

Actual Price: $25,200 (Source: Toyota.com, 11/29/2007)

Notes:

- As we discussed, knowledge of the value of the car can be used to improve the probability of winning far above random guessing.

- One aspect we have not yet discussed is whether there is a strategy as to which "One Away" Price to display is the person setting up the game wants to either increase or decrease the chances of a player winning.

  There are $2^5 = 32$ different "One Away" Prices for the 2008 Camry Hybrid ranging from a low of $14,111 to a high of $36,399. It seems plausible that some prices might do a better or worse job of "disguising" the true price, decreasing or increasing the chance of the car being won.

The Price is Right

Game 3: Three Strikes

Rules:

- The contestant is again playing to win a car. 5 green tokens, each with a single digit on them representing the price of a new car along with a single red token with an “X” or “Strike” on it are placed in a bag.

- The player draws a random token from the bag. If it is a green token, the token is removed from play and the corresponding number in the price of the car is lit up on a display screen.

- If the red token is drawn, the player receives a “strike” and the red token is returned to the bag.

- The game continues until either all 5 numbers have been drawn, in which case the player wins, or the strike is drawn 3 times, in which case, the player loses.

The Price is Right

Game 3: Three Strikes

Analysis:
Notice that since the red token is replaced whenever it is drawn but the green tokens are not, the bag starts with 6 tokens, but the total number of tokens is reduced whenever a green token is chosen.

Example:
One possible result of the game is the sequence:
G,G,R,G,R,G,R

This represents drawing a Green token, then a Green, then a Red, then a Green, then a Red, a Green, and finally a Red. The player loses, since the Red token is drawn a third time before the fifth Green token is drawn.

The probability of this result is:
(5/6)(4/5)(1/4)(3/4)(1/3)(2/3)(1/2) = 1/72

To see this, one the first draw, there were 6 total tokens in the bag (5G, 1R) so there was a 5/6 chance of drawing a green first. Then, there were 5 tokens (4G, 1R), so there was a 4/5 chance of drawing a green second. Then there were 4 tokens (3G, 1R), so there was a 1/4 chance of getting a Red third, but since the red token was replaced after it was drawn, on the next draw, there are still 4 tokens (3G 1 R), etc.

Winning Sequences:

P(G,G,G,G,G) = (5/6)(4/5)(3/4)(2/3)(1/2) = 1/6 ≈ .166667
P(R,G,G,G,G,G) = (1/6)(5/6)(4/5)(3/4)(2/3)(1/2) ≈ .027778
P(G,R,G,G,G,G) = (5/6)(1/5)(4/5)(3/4)(2/3)(1/2) ≈ .033333
P(G,G,R,G,G,G) = (5/6)(4/5)(1/4)(3/4)(2/3)(1/2) ≈ .041667
P(G,G,G,R,G,G) = (5/6)(4/5)(3/4)(1/3)(2/3)(1/2) ≈ .055556
P(G,G,G,G,R,G) = (5/6)(4/5)(3/4)(2/3)(1/2)(1/2) ≈ .083333
P(R,R,G,G,G,G,G) = (1/6)(1/6)(5/6)(4/5)(3/4)(2/3)(1/2) ≈ .0046296
P(R,G,R,G,G,G,G) = (1/6)(5/6)(1/5)(4/5)(3/4)(2/3)(1/2) ≈ .0055556
P(R,G,G,R,G,G,G) = (1/6)(5/6)(4/5)(1/4)(3/4)(2/3)(1/2) ≈ .0069444
P(R,G,G,G,R,G,G) = (1/6)(5/6)(4/5)(3/4)(1/3)(2/3)(1/2) ≈ .0092593
P(R,G,G,G,G,R,G) = (1/6)(5/6)(4/5)(3/4)(2/3)(1/2)(1/2) ≈ .0138889
P(G,R,R,G,G,G,G) = (5/6)(1/5)(1/5)(4/5)(3/4)(2/3)(1/2) ≈ .0066667
P(G,R,G,R,G,G,G) = (5/6)(1/5)(4/5)(1/4)(3/4)(2/3)(1/2) ≈ .0083333
P(G,R,G,G,R,G,G) = (5/6)(1/5)(4/5)(3/4)(1/3)(2/3)(1/2) ≈ .0111111
P(G,R,G,G,G,R,G) = (5/6)(1/5)(4/5)(3/4)(2/3)(1/2)(1/2) ≈ .0166667
P(G,G,R,R,G,G,G) = (5/6)(4/5)(1/4)(1/4)(3/4)(2/3)(1/2) ≈ .0104167
P(G,G,R,G,R,G,G) = (5/6)(4/5)(1/4)(3/4)(1/3)(2/3)(1/2) ≈ .0138889
P(G,G,R,G,G,R,G) = (5/6)(4/5)(1/4)(3/4)(2/3)(1/2)(1/2) ≈ .0208333
P(G,G,G,R,R,G,G) = (5/6)(4/5)(3/4)(1/3)(1/3)(2/3)(1/2) ≈ .0185185
P(G,G,G,R,G,R,G) = (5/6)(4/5)(3/4)(1/3)(2/3)(1/2)(1/2) ≈ .0277778
P(G,G,G,G,R,R,G) = (5/6)(4/5)(3/4)(2/3)(1/2)(1/2)(1/2) ≈ .0416777

Total: P(Win) ≈ .624491 or about 62.45%

Losing Sequences:

P(R,R,R) = (1/6)(1/6)(1/6) = 1/216 ≈ .004630
P(G,R,R,R) = (5/6)(1/5)(1/5)(1/5) = 5/750 ≈ .006667
P(R,G,R,R) = (1/6)(5/6)(1/5)(1/5) ≈ .005556
P(R,R,G,R) = (1/6)(1/6)(5/6)(1/5) ≈ .004630
P(G,G,R,R,R) = (5/6)(4/5)(1/4)(1/4)(1/4) ≈ .010417
P(G,R,G,R,R) = (5/6)(1/5)(4/5)(1/4)(1/4) ≈ .008333
P(G,R,R,G,R) = (5/6)(1/5)(1/5)(4/5)(1/4) ≈ .006667
P(R,G,G,R,R) = (1/6)(5/6)(4/5)(1/4)(1/4) ≈ .006944
P(R,G,R,G,R) = (1/6)(5/6)(1/5)(4/5)(1/4) ≈ .005556
P(R,R,G,G,R) = (1/6)(1/6)(5/6)(4/5)(1/4) ≈ .004630
P(G,G,G,R,R,R) = (5/6)(4/5)(3/4)(1/3)(1/3)(1/3) ≈ .018519
P(G,G,R,G,R,R) = (5/6)(4/5)(1/4)(3/4)(1/3)(1/3) ≈ .013889
P(G,G,R,R,G,R) = (5/6)(4/5)(1/4)(1/4)(3/4)(1/3) ≈ .010417
P(G,R,G,G,R,R) = (5/6)(1/5)(4/5)(3/4)(1/3)(1/3) ≈ .011111
P(G,R,G,R,G,R) = (5/6)(1/5)(4/5)(1/4)(3/4)(1/3) ≈ .008333
P(G,R,R,G,G,R) = (5/6)(1/5)(1/5)(4/5)(3/4)(1/3) ≈ .006667
P(R,G,G,G,R,R) = (1/6)(5/6)(4/5)(3/4)(1/3)(1/3) ≈ .009260
P(R,G,G,R,G,R) = (1/6)(5/6)(4/5)(1/4)(3/4)(1/3) ≈ .006944
P(R,G,R,G,G,R) = (1/6)(5/6)(1/5)(4/5)(3/4)(1/3) ≈ .005556
P(R,R,G,G,G,R) = (1/6)(1/6)(5/6)(4/5)(3/4)(1/3) ≈ .004630
P(G,G,G,G,R,R,R) = (5/6)(4/5)(3/4)(2/3)(1/2)(1/2)(1/2) ≈ .041667
P(G,G,G,R,G,R,R) = (5/6)(4/5)(3/4)(1/3)(2/3)(1/2)(1/2) ≈ .027778
P(G,G,G,R,R,G,R) = (5/6)(4/5)(3/4)(1/3)(1/3)(2/3)(1/2) ≈ .018519
P(G,G,R,G,G,R,R) = (5/6)(4/5)(1/4)(3/4)(2/3)(1/2)(1/2) ≈ .020833
P(G,G,R,G,R,G,R) = (5/6)(4/5)(1/4)(3/4)(1/3)(2/3)(1/2) ≈ .013889
P(G,G,R,R,G,G,R) = (5/6)(4/5)(1/4)(1/4)(3/4)(2/3)(1/2) ≈ .010417
P(G,R,R,G,G,G,R) = (5/6)(1/5)(1/5)(4/5)(3/4)(2/3)(1/2) ≈ .006667
P(G,R,G,R,G,G,R) = (5/6)(1/5)(4/5)(1/4)(3/4)(2/3)(1/2) ≈ .008333
P(G,R,G,G,R,G,R) = (5/6)(1/5)(4/5)(3/4)(1/3)(2/3)(1/2) ≈ .011111
P(G,R,G,G,G,R,R) = (5/6)(1/5)(4/5)(3/4)(2/3)(1/2)(1/2) ≈ .016667
P(R,G,G,G,G,R,R) = (1/6)(5/6)(4/5)(3/4)(2/3)(1/2)(1/2) ≈ .013889
P(R,G,G,G,R,G,R) = (1/6)(5/6)(4/5)(3/4)(1/3)(2/3)(1/2) ≈ .009260
P(R,G,G,R,G,G,R) = (1/6)(5/6)(4/5)(1/4)(3/4)(2/3)(1/2) ≈ .006944
P(R,G,R,G,G,G,R) = (1/6)(5/6)(1/5)(4/5)(3/4)(2/3)(1/2) ≈ .005556
P(R,R,G,G,G,G,R) = (1/6)(1/6)(5/6)(4/5)(3/4)(2/3)(1/2) ≈ .004630

Total: P(Lose) = .3755 or 37.55%

Therefore the Probability of winning is about 100% - 37.55% = 62.45%

The Price is Right

Game 4: The Showcase Showdown

Rules:

All the players who win their way onstage (usually three in each “half” of the show) get to try their luck spinning the big wheel. Each player can spin the wheel either once or twice. The wheel has 20 spaces: each with a multiple of 5¢, ranging from 5¢ up to $1.00 (100¢).

The player that reaches a total closest to $1.00 without going over on either one spin, or the sum of two spins wins a place in the Showcase (the grand prize round).

If there is a tie, the players involved in the tie have a 1 spin “spin-off”.

If a player gets exactly $1.00, the player gets $1,000 and the opportunity to win up to $10,000 more by taking a bonus spin. Hitting $1.00 on the bonus spin wins an additional $10,000, and spinning either 5¢ or 10¢ yields an additional $5,000

No bonus money is awarded during a “spin-off”

The Price is Right

Game 4: The Showcase Showdown

Aside: The probability of getting \$1.00 exactly is:
P(\$1.00) = 1/20 + (19/20)(1/20) = .0975 or 9.75%

Notice that there is a 1 in 20 chance of hitting \$1.00 exactly on one spin, 19/20 times (or 95% of the time) you will hit something other than a dollar so you must spin again to get \$1.00 exactly. On your second spin, there is exactly one of the 20 spaces that will get you a total of exactly \$1.00 (for example if you spin 35¢ the first time, you must spin 65¢ the second time), so 5% of the time you take a second spin you will get \$1.00 exactly, or 5% of 95% of the time.

The probability of winning \$11,000 is (.0975)(.05) = .004875 or .4875%

The probability of winning \$6,000 is (.0975)(.1) = .00975 or .975%

The Price is Right

Game 4: The Showcase Showdown

Analysis: Once again, going last is an advantage since you know what total you need to beat. Thus when going last, your strategy is clear: if your total after one spin is less than a sub $1.00 total of a previous player, you must spin again.

Note: The play in the Showcase Showdown is ordered by amount in cash and prizes won in the previous games:
the player with the highest total winnings goes last.

If you are the first to play, after your first spin, you must weigh the probability of hitting a second number that takes you over $1.00 against the probability that one of the later players will beat the amount of your first spin.

The expected value after one spin is: 52.5¢
(The average value of all 20 spaces since we assume each space is equally likely) Therefore, conventional wisdom is that you should almost certainly take a second spin if you get less than 55¢

But what if you spin 70¢?

Does the chance of hitting a number 30¢ or less make it worth continuing? How likely is it that a later player will beat your total?

The Price is Right

Game 4: The Showcase Showdown

In order to think about this situation more carefully, we need to think of this situation as a repeated binomial trial.

If you stop after one spin, your score is a standard that future players must beat. Success for a later player is beating your score (or at least tying your score). Failure is failing to beat your score or going over $1.00

Binomial Formula:
Suppose a binomial experiment consists of *n* trials and results in *x* successes. If the probability of success on an individual trial is *P*, then the binomial probability is: $b(x; n, P) = {}_{n}C_{x} * P^{x} * (1 - P)^{n - x}$

For example: if you get 70¢ on your first spin, there are 6 spaces on the wheel which would beat you after one spin: (75¢, 80¢, 85¢, 90¢, 95¢, and $1.00).

Likewise, there are only 6 spaces which will not cause you to go over $1.00 on your second spin:
(5¢, 10¢, 15¢, 20¢, 25¢, and 30¢)

The probability of you getting a higher total without exceeding $1.00 is only 6/20 = 30%
The total of a single player beating your total on a single spin is also 30%
However, remember that **two** players are tying to beat your score.

The Price is Right

Game 4: The Showcase Showdown

Using the binomial theorem, the probability that one of the other two players beats your score on one spin is:

$b(1;2, .3)+b(2;2, .3) = {}_2C_1\,(.3)^1(1 - .3)^{2 - 1} + {}_2C_2\,(.3)^2(1 - .3)^{2 - 2}$
$= (2)(.3)(.7) + (1)(.09) = .51$ (51%)

If you get 75¢, there are only 5 spaces (25%) which beat you, so the probability that one of two opponents beats you on a single spin is:

$b(1;2,.25)+b(2;2,.25) = {}_2C_1\,(.25)^1(1 -.25)^{2-1} + {}_2C_2\,(.25)^2(1-.25)^{2-2}$
$= (2)(.25)(.75) + (1)(.0625) = .4375$ (43.75%)

This would suggest that one strategy for player 1 is to spin again if your total is less than 75¢

Note: We have not yet taken into account the probability of a player not beating you on the first spin and deciding to try to beat you on their second spin. This situation is a bit more complicated to since we would need to consider the probability that a player's total on *two* spins is greater than 75¢ but less than or equal to $1.00 given that their first spin is less than 75¢.

The Price is Right

Game 4: The Showcase Showdown

To find the probability that a player's total on *two* spins is greater than 75¢ but less than or equal to $1.00 given that their first spin is less than 75¢, notice that if a value less or equal to than 75¢ is spun (there are 15 of these), then there are exactly 5 spaces that would bring the total up to one of the 5 values > 75¢ (80¢, 85¢, 90¢, 95¢, $1.00).

So P(Total >75¢ | First <= 75¢) = (15/20)(5/20) = 18.75%

Hence the total probability of at least one of the two players beating you on their second spin is:

$b(1;2,.1875)+b(2;2,.1875)={}_2C_1\,(.1875)^1(1-.1875)^{2-1}+{}_2C_2\,(.1875)^2(1-.1875)^{2-2}$
$= (2)(.1875)(.8125) + (1)(.03515625) \approx 33.98\%$

This gives a combined probability of one of the two players beating you on either one of two spins is:

43.75% + 33.98% = 77.73% -- That's pretty high!

The Price is Right

Game 4: The Showcase Showdown

So, how high does player 1 need to spin to have a better then average chance of winning?

If you get 80¢, there are only 4 spaces (20%) which beat you, so the probability that one of two opponents beats you on a single spin is:

$b(1;2,.20)+b(2;2,.20) = {}_2C_1\,(.20)^1(.80)^1 + (.2)^2$
$= (2)(.20)(.80) + (.04) = (36\%)$

P(Total >80¢ | First <= 80¢) = (16/20)(4/20) = 16%

Hence the total probability of one of the two players beating you on their second spin is:

$b(1;2,.16)+b(2;2,.16)=2(.16)(.84)+(.16)^2 \approx 29.44\%$

This gives a combined probability of one of the two players beating you on either one of two spins is:
36% + 29.44% = 65.44%

For 85¢, 3 possible totals beat you, or 15%, so
Spin 1: $b(1;2,.15)+b(2;2,.15) =2(.15)(.85)+(.15)^2 = 27.75\%$
P(Total >85¢ | First <= 85¢) = (17/20)(3/20) = 12.75%
Spin 2: $b(1;2,.1275)+b(2;2,.1275)=2(.1275)(.8725) +(.1275)^2 \approx$ 23.87%, giving a total of 51.62%

Deal or No Deal

Rules:

The way this game works is a player is given a choice of 26 different cases – each labeled by a number from 1-26 and each containing a placard with a dollar amount on it from $.01 to $1,000,000 dollars. The producers of the show claim that the monetary placards have been placed at random by a disinterested third party and that all parties directly involved with the game have no knowledge of where each prize is located.

Here is a complete list of the 26 monetary values in the cases:

$.01			
$1.00	$100	$1,000	$100,000
$5.00	$200	$ 5,000	$200,000
$10.00	$300	$10,000	$300,000
$25.00	$400	$25,000	$400,000
$50.00	$500	$50,000	$500,000
$75.00	$750	$75,000	$750,000
			$1,000,000

Once a case is chosen, it becomes the player's case. In most places where this game is played, once this case is chosen, it cannot be switched for any of the other cases.

Deal or No Deal

Rules:
The player chooses 6 of the other cases one at a time and the monetary amount in each is revealed. After the first six cases are opened, the “banker” offers to “buy” the unopened case from the player for a price of his choosing (it is computed based on the combined value of the 20 remaining cases using a proprietary formula)

Once the player has the offer from the banker, the player can either accept the deal or play on.

If the player continues, 5 more cases are opened one at a time (so 15 remain) and a second offer is given. Depending on the value of the cases that remain, the deal from the banker may be higher or it may be lower than previous offers.

The pattern continues: Open 4 cases (11 remain) – offer
Open 3 cases (8 remain) – offer
Open 2 cases (6 remain) – offer

Once the player is down to 6 cases (their case + 5 others), they receive an offer and have the option of selling their case for the offered amount after each case is opened.

The final offer is given when only 2 cases remain. If the final offer is refused, the player opens their case, which they “own” and wins the amount is on the placard inside

Deal or No Deal

Analysis:

If we believe the producers' claim that none of the parties involved have any information about what each case contains, we can assume that all decisions and offers are made considering the monetary amounts still in play and the actions and tendencies of the player revealed in actually playing the game.

This also means that we can assume that any placard is equally likely to be in any case that has not yet been opened.

With this in mind, we consider the initial choice of 1 case by the player and any particular cases that are opened at any point in the game as random events.

Then only real decisions in the game are deciding whether to accept an offer to "buy" a case or to continue playing.

So the question becomes: How do we decide if an offer "worth it"?

This will depend on how we assign "value" to the opportunity to continue playing and/or to the case that we currently "own".

Deal or No Deal

Expected Value:

One way of assigning value in a probabilistic situation is to compute the expected value of a game (or a situation within a game). This is done by multiplying the value of each possible game "outcome" by the probability of that outcome occurring.

In our game, the value of each case is the monetary value if the placard it contains, and each placard is equally likely to be in any case, so at any point in the game, the expected value of the case the player owns is the average of the monetary value of the placards that have not yet been revealed.

At the beginning of the game, the expected value of the player's case is $131,477.5388

(Feel free to check my math!)

After 6 cases have been opened, the expected value will have either gone up of gone down, depending on whether high value cases or low value cases have been revealed.

Deal or No Deal

Many people question whether using expected value is the best way for a player to measure the quality of an offer to "buy" their case.

Expected Value is measures the expected return (or loss) when one is allowed to play a game multiple times. It gives the "average expected return" over the long haul.

However in this game, a player only get's one shot. The player goes home with an amount after playing the game, presumably never to play the game again.

Case in point:

Suppose you have played down to 2 remaining cases. Suppose the two remaining placards are:

$100 and $400,000

The expected value here is $200,050

How much would it take to get you to agree to sell your case?

$100,000?
$50,000?
$5,000?!?

It depends on how desirable $400,000 is compared to $100

Deal or No Deal

Root Square Mean:

Another way of assigning value to a probabilistic situation is to use the root square mean

In the equally likely outcomes case, this statistic takes the sum of the square root of each of the values, divides by the number of outcomes, and then takes the square of the result:

In our two case example, the root square mean is:

$[(1/2)(400{,}000^{1/2} + 100^{1/2})]^2 \approx \$103{,}187.28$

This is slightly better than using expected value, but still may not model the reality of the situation correctly.

In reality, each player brings their own personal value metric to the game – perhaps a sense of how much of a return would, at least in a qualitative sense, be a “good result” of playing or would lead to a significant change in lifestyle.

Each player also has a different willingness to accept risk or potential loss.

Moreover, as the game progresses, initial expectations can be adjusted up or down depending on whether recent game events have been favorable or unfavorable.

Deal or No Deal

Risk Aversion:

Risk Aversion Theory is one attempt that game theory and economics uses to explain situations where expected value seems, in practice, to do a poor job of explaining the decision making process of a player in a game or an investor in a market situation.

The central premise of Risk Aversion Theory is that in many situations, a potential loss of a fixed amount is more undesirable than a potential gain of the same amount.

For Example:

Suppose you inherited $10,000 from a relative.
You are given an opportunity wager this $10,000 in a game where you have a 50% chance of double your money to $20,000 and a 50% chance of losing everything.

Would you take this wager?

Most people would not. The reason for this is that, for most people, the negative economic impact of losing $10,000 is far worse than the positive impact of gaining a total of $20,000

Perhaps this is the source of the saying "One bird in the hand is better than two in the bush"