PART I: CARD ODDS

CHAPTER 1: BASIC ODDS:

INVERTS OF UNITY

The "product" is the multiplication of "factors." When the product is unity, the factors represent the part (20%) and the number of parts (5). Each factor is the inverse of the other. Since we need to convert back and forth so often, I'll call them "Inverts of Unity." With 10% Percent to win the Pot, you'll win 1 in 10 time: 1/p = 1/.1 = 10. So Percentage becomes a Fraction or Fraction becomes Percentage by inverting. In Math, the inverse of p is 1/p written as p^{-1}. Rather than use the negative superscript p^{-1} for inverting, I'll use an apostrophe p'.

PERFECT WHOLE NUMBER INVERTS

Pennies (1 cent) in a Dollar = 100. So Invert of 1% = 100.
Dollars (100 cents) in a Dollar = 1. So Invert of 100% = 1.
1*100 = 100%. So 1*100 = 100*1 are a Invert Pair of Unity.

Two-Pence in a Pound = 50. So Invert of 2% = 50.
Fifty-Cent pieces in a Dollar = 2. So Invert of 50% = 2.
2%* 50 = 100%. So 2%*50 = 50%*2 are a Invert Pair of One.

Nickels (5 cents) in a Dollar = 20. So Invert of 5% = 20.
Twenties ($20) in a C-Note = 5. So Invert of 20% = 5.
5% with 20 = 100%. So 5%*20 = 50%*2 are a Invert Pair of One.

Dimes (10 cents) in a Dollar = 10. So 10%′ = 10.
10% with 10 = 100%, 10%*10 are a pivot point for Inverts.

Quarters (25 cents) in a Dollar = 4. So 25%′ = 4.
Four-Pence in a Pound = 25. So 4%′ = 25.
4 with 25 = 100%. So 4*25 = 25*4 are a Invert Pair of One.

These Perfect Whole Number Inverts are so convenient that currency is always based on them. It's "Coin Size" * "Invert (Number of Coins)" = 100 cents. Perfect Inverts 100 Pennies, 20 Nickels, 10 Dimes, 4 Quarters, 2 Halves and 5 Twenties in a C-Note. The Nine Perfect Inverts are 1, 2, 4, 5, 10, 20, 25, 50, 100 with all their multiples because they always multiply to exactly 100%.

What limits most people's mathematical ability is not having learned by rote the other Inverts of Unity that do not conveniently multiply to exactly 100%. How many octets in a hundred? 12.5. So how hard is it to learn the Inverts for 6, 7, 8 and 9?

IMPERFECT NON-WHOLE NUMBER INVERTS

The last 5 Invert Pairs produce non-whole results: 1/3 = .3333.

**Precisely, Three-Pences in a Pound = 33.33... So 3′ = 33.33...
And Thirds (33.33... cents) in a pound = 3.
3*33.33... = 100%. Pretty well-known Invert Pair of One. I use:**

**Three-Pences (3 cents) in a Pound = 33. So 3′ = 33
Thirds (33 cents) in a Dollar. 33′ = 3.
3* 33 = 99% with an error of 1% off 100%, pretty good guestimate.**

So 1*100 = 2*50 = 3*33 = 4*25 = 5*20 = 10*10 = 100 are the well-known Inverts of Unity. But many don't know their Inverts for Six-Cents, 7-Pence, 8-Cents nor Nine-Pence in 100! If you don't know or remember them now, you will by the next page. They are as constantly useful as the first five basic Inverts of Unity are.

LESS-KNOWN INVERTS

**"Coins of Nine" cents in a Dollar = 11.1111... So 9' = 11.1111...
"Coins of Eleven" cents in a Dollar = 9.0909... So 11' = 9.0909...
9*11.11... = 11*9.09... = 100%. But I use:**

**"Coins of Nine" cents in a Dollar = 11. 9' = 11.
"Coins of Eleven" cents in a Dollar = 9. 11' = 9.
9*11 = 99%. So it's only an error of 1%. But this extra precision is available when needed for doing very high- or low-chance inverting. Not otherwise.**

**"Coins of Eight" cents in a Dollar = 12.5. So 8′ = 12.5.
"Coins of Dozen" cents in a Dollar = 8.3333... So 12′ = 8.3333...
8*12.5 = 12*8.33... = 100%. You may use:**

**"Coins of Eight" cents in a Dollar = 12. So 8′ = 12.
"Coins of Dozen" cents in a Dollar = 8. So 12′ = 8.
8*12 = 96%. So an error of 4% off 100%. If you can remember 12.5 and 8.3, great, and often useful to know for some guestimates.**

The 4% error for inverts of 8 and 12 are the biggest errors you'll make, four times bigger than mere 1% for 3*33 and 9*11.

Another way to handle the error is to think 8′ = 12+. 12′ = 8+. Why just a plus, because if the number you want to invert is a bit less than a well-known invert, its odds are a bit more. I know 24% is a touch less than 25%, so its invert is a touch more than 4! 47% is a touch less than 50%, so its invert is a touch more than 2. It comes in handy to recognize the inverse relation of inverting when you keep that in mind.

LEAST-KNOWN INVERTS

"Coins of Seven" cents in a Dollar = 14.2857. So 7′ = 14.2857
"Coins of Fourteen" cents in Dollar = 7.142857. So 14′ = 7.142857
7*14.2857 = 14.2857*7 = 100%. But I use:

"Coins of Seven" cents in a Dollar = 14. So 7′ = 14.
"Coins of Fourteen" cents in a Dollar = 7. So 14′ = 7.
7*14 = 98%. So a 2% error low off 100%!

"Coins of Six" cents in a Dollar = 16.666... So 6′ = 16.666...
"Coins of Seventeen" cents in a Dollar = 5.8823. So 17′ = 5.8823.
6*16.666... = 17*5.8823 = 100%. But I use:

"Coins of Six" cents in a Dollar = 17. So 6′ = 17.
"Coins of Seventeen" cents in a Dollar = 6. So 17′ = 6.
6*17 = 102%. So again only a 2% error high off 100%.

TABLE 1 is the whole array with the 4 lesser-known Non-Whole Number inverts: 6*17 = 7*14 = 8*12 = 9*11!

PPT: TABLE 1: Inverts of Unity

p	1	2	3	4	5	6	7	8	9	10	11	12	14	17	20	25	33	50	100
p′	100	50	33	25	20	17	14	12	11	10	9	8	7	6	5	4	3	2	1

Problems

What is the Invert for each Percentage:
[1] 3? [2] 12? [3] 9? [4] 14? [5] 25? [6] 17 [7] 7? [8] 6?
[9] 11? [10] 33? [11] 10? [12] 2? [13] 20? [14] 200? [15] 2,000?
[16] 50? [17] 5? [18] .5? [19] 4? [20] 40? [21] 8? [22] 80?

Answers:

Invert for each Percentage:
[1] 33. [2] 8. [3] 11. [4] 7. [5] 4. [6] 6. [7] 14. [8] 17.
[9] 9. [10] 3. [11] 10. [12] 50. [13] 5. [14] .5 [15] .05.
[16] 2. [17] 20. [18] 200. [19] 25. [20] 2.5. [21] 12. [22] 1.25.

CURRENCY CONVERSION

Problems:

[1] How many Cents is it worth when a Dollar gets 6 Pesos?
[2] 60 Pesos? [3] 7 Dinars? [4] 70 Dinars?
[5] 25 Units? [6] 250 Units? [7] 5 Units? [8] 50 Units?

Answers:

[1] 17. [2] 1.7. [3] 14. [4] 1.4. [5] 4. [6] .4. [7] 20. [8] 2.

INVERTS OF SMALL OR LARGE NUMBERS

Did you notice 2*50 = 20*5 = 200*.5 = 2,000*.05 = 20,000*.005! TABLE 2 shows how the main inverts work for bigger and smaller numbers. Invert Pairs are permanently linked and small percentages (or long odds) stretching to infinity are treated by moving decimal on both sides!! Whatever zeroes you move to get to a workable percentage, you must also move for its invert.

TABLE 2: Bigger and Smaller Inverts Array

p	.001	.01	.1	1	10	100	1,000	10,000
p′	100,000	10,000	1,000	100	10	1	.1	.01
p	.002	.02	.2	2	20	200	2,000	20,000
p′	50,000	5,000	500	50	5	.5	.05	.005
p	.003	.03	.3	3	33	333	3,333	33,333
p′	33,333	3,333	333	33	3	.3	.03	.003
p	.004	.04	.4	4	40	400	4,000	40,000
p′	25,000	2,500	250	25	2.5	.25	.025	.0025
p	.005	.05	.5	5	50	500	5,000	50,000
p′	20,000	2,000	200	20	2	.2	.02	.0020
p	.006	.06	.6	6	60	600	6,000	60,000
p′	17,000	1,700	170	17	1.7	.17	.017	.0017
p	.007	.07	.7	7	70	700	7,000	70,000
p′	14,000	1,400	140	14	1.4	.14	.014	.0014
p	.008	.08	.8	8	80	800	8,000	80,000
p′	12,500	1,250	125	12.5	1.25	.125	.0125	.00125
p	.009	.09	.9	9	90	900	9,000	90,000
p′	11,111	1,111	111	11	1.1	.11	.011	.0011

Problems

What are the Inverts for:
[1] .03? [2] 250? [3] .09? [4] 140? [5] .02? [6] 2,500? [7] 1,200? [8] .0017? [9] 700? [10] .06? [11] 1100? [12] .04? [13] 4000? [14] .008? [15] .00033? [16] 25,000? [17] 10,000? [18] .000007?

Answers:

[1] 3,300. [2] .4. [3] 1,100. [4] .7. [5] 5,000. [6] .04 [7] .08
[8] 60,000. [9] .14. [10] 1,600. 11] .09. [12] 2,500. [13] .025.
[14] 12,500. 15] 300,000. [16] .004. [17] .01. [18] 14,000,000.

INVERTS FOR LARGE PERCENTAGES

So that's handy for small percentages but how about inverting large ones? Want to work out the invert for 98.6% or 99.991%. Pretty tough right? But again, a neat symmetry of inverting is that the odds you need to get for your long-shot are the very same odds he needs to give you for his short-shot! So if inverting 98% is too tough, invert q, 100-98% = 2% and then reverse the odds from get to give!!! Isn't working with unity wonderful? You can skip subtracting 1 from such large odds.

Examples:

98.6 is too tough to invert. So invert the remainder 1.4. Add 1 decimal for 14, invert for 7, add 1 decimal place for 70. 1/70!

How about something that's 99.9991% chance of happening? Rather than work with that, work with chance of miss and then reverse odds. 1 – 99.9991% = .0009. Add 4 decimal places to get 9, invert for 11, add 4 decimal places for 1/110,000.

If we know that 99.75% of the time, a car won't have a broken headlight, what are the odds you'd give? 100-99.75 = .25. Add two decimals, invert 25 to 4, add two decimals for 1/400. If you can get him to take 200:1 odds, it's quite a 50% overlay!

Problems:

What Odds must you give when you win with this Percent?

[1] 99.9983?	[2] 99.967?	[3] 99.991?	[4] 99.994?
[5] 99.9988?	[6] 99.975?	[7] 99.6?	[8] 99.93?
[9] 99.992?	[10] 99.98?	[11] 99.986?	[12] 99.989?
[13] 99.97?	[14] 99.9992?	[15] 99.5	[16] 99.9991

Answers:

Odds must you give:

[1] 100-99.9983 = .0017′ = 17′/10^4: 6*10^4 = 60,000:1.
[2] 100-99.967 = .033′ = 33′/10^3: 3*10^3 = 3,000:1.
[3] 100-99.991 = .009′ = 9′/10^3: 11*10^3 = 11,000:1.
[4] 100-99.994 = .006′ = 6′/10^3: 17*10^3 = 17,000:1.
[5] 100-99.9988 = .0012′ = 12′/10^4: 8*10^4 = 80,000:1.
[6] 100-99.975 = .025′ = 25′/10^3: 4*10^3 = 4,000:1.
[7] 100-99.6 = .4′ = 4′/10^1: 25*10^1 = 250:1.
[8] 100-99.93 = .07′ = 7′/10^2: 14*10^2 = 1,400:1.
[9] 100-99.992 = .008′ =8′/10^3: 12*10^3 = 12,000:1.
[10] 100-99.98 = .02′ = 2′/10^2: 50*10^2 = 5,000:1.
[11] 100-99.986 = .014′ = 14′/10^3: 7*10^3 = 7,000:1.
[12] 100-99.989 = .011′ = 11′/10^3: 9*10^3 = 9,000:1
[13] 100-99.97 = .03′ = 3′/10^2: 33*10^2 = 3,300:1.
[14] 100-99.9992 = .0008′ = 8′/10^4: 12*10^4 = 120,000:1.
[15] 100-99.5 = .5′ = 5′/10^1: 20*10^1 = 200:1.
[16] 100-99.9991 = .0009′ = 9′/10^4: 11*10^4 = 110,000:1.

ASSOCIATIVE PROPERTY OF INVERTING

Another interesting aspect of inverting numbers is their associative property. Inverting 15% isn't hard if you can do long division of 100/15 or reduce it 20/3 = 6+ 2/3 = 6.66666.

But you know 15% is 2% away from 17% and 1% away from 14% so 15′ is closer to 14′=7 than to 17'=6, say 6.6 or 6.7! That's a simple good estimate compared to 6.66666

Yet if multiplying or dividing by 10 works, multiplying or dividing by any other number works too! So a more precise way to guestimate is to find the factors of 15 that contain a known invert: 3*5, here both known. Rather than move the decimal place for 10, divide out whatever number isn't a perfect invert, here, 3, then invert the remaining 5 to get 20 and divide by 3 again. An algorithm to get to 20/3 = 6.6666 that works over the whole range of numbers.

If you divided out the Perfect 5 and inverted the Imperfect 3, you'd introduce the 1% error (3*33=99, not 100%) from the inversion. 3 inverted is 33, divide again by 5 = 6.6, losing .06667 with the 1% error. But dividing out the Imperfect Factor on both sides of the equation cancels the error out!!

People who use fractions regularly may think this trite but think about how impossible decimals and fractions become without knowing the inverts of 6, 7, 8 or 9 that are not learned in people's financial lexicon of numbers. A whole intellectual sub-elite can't do basic fractions because their last few inverts haven't been memorized. Their whole environment has engrained an understanding of the financial inverts they use every day but failure to learn the last few is the only thing keeping them in the numeric dark.

Problems

What is the Invert for each Percentage:
[1] 48? [2] 15? [3] 44? [4] 35? [5] 24? [6] 18?

Answers:

[1] 48′: 48′/12 = 4′ (error 0%) => 25 / 12 = 2.083.
[2] 15′: 15′/3 = 5′ (error 0%) => 20 / 3 = 6.67.
[3] 44′: 44′/11 = 4′ (error 0%) => 25 / 11 = 2.3.
[4] 35′: 35′/7 = 5' (error 0%) => 20 / 7 = 2.86.
[5] 24′: 24′/6 = 4′ (error 0%) => 25 / 6 = 4.17.
[6] 18′: 18′/9 = 2′ (error 0%) => 50 / 9 = 5.5.

PERCENT TO ODDS & ODDS TO PERCENT CONVERSION

We don't say we get back 6 Bets FOR (with) the 1 Bet we put into the Pot, we say we get 5 Bets TO the 1 we put in. For smaller numbers where a difference of 1 bet matters, the Bet Odds you get are the Invert of the chance minus 1. If your 20% chance is 1/5, you win 1, you lose 4, odds are 4:1! p'-1! You must know these 2 equations to convert between Odds and Percentage and back:

PPT: Pot Bet Odds needed from Percent b = p'−1 Equation

Problems:

How many Bet Odds needed for these Percent Chance of Hit?
[1] 25? [2] 6? [3] 2? [4] 14? [5] 20? [6] 17? [7] 8? [8] 9?
[9] 16? [10] 4? [11] 11? [12] 7? [13] 10? [14] 3? [15] 12? [16] 5?

Answers:

Bet Odds Needed for Percent Chance of Hit:
[1] 3. [2] 16. [3] 49. [4] 6. [5] 4. [6] 5. [7] 11. [8] 10.
[9] 5. [10] 24. [11] 8. [12] 13. [13] 9. [14] 32. [15] 7. [16] 19.

The other way, for small numbers, if pot offers 4 bets, you need (4+1)' = 5' = 20% to call.

PPT: Percent from Bet Odds p = (b+1)' Equation

Problems:

What Percent needed for these Pot Odds?
[1] 9? [2] 16? [3] 4? [4] 11? [5] 7? [6] 10? [7] 3? [8] 11?
[9] 5?[10] 25? [11] 6? [12] 2? [13] 13? [14] 20? [15] 1? [16] 8?

Answers:

[1] 10. [2] 6. [3] 20. [4] 8. [5] 12. [6] 9. [7] 25. [8] 8.
[9] 17.[10] 2. [11] 14. [12] 33. [13] 7. [14] 2. [15] 50. [16] 11.

ODDS FOR UNFAMILIAR INVERTS

Problems

What are the Bet Odds Needed for each Percentage:
[1] 48? [2] 15? [3] 44? [4] 35? [5] 24? [6] 18?

Answers:

[1] 48': 48'/12 = 4' (error 0%) => 25 / 12 = 2.083, b = 1.083:1.
[2] 15': 15'/3 = 5' (error 0%) => 20 / 3 = 6.7, b = 5.7:1.
[3] 44': 44'/11 = 4' (error 0%) => 25 / 11 = 2.3. b = 1.3:1.
[4] 35': 35'/7 = 5' (error 0%) => 20 / 7 = 2.86, b = 1.86:1.
[5] 24': 24/6 = 4' (error 0%) => 25 / 6 = 4.17, b = 3.17:1.
[6] 18': 18'/6 = 3' (error 1%) => 33 / 6 = 5.5, b = 4.5.