

N/D 3. Richard J. Morgen offers a math problem that stems from a quiz game show on TV in which three contestants get to spin a wheel. Each contestant can choose to spin one or two times. The wheel has 20 equal size segments, marked 5, 10, 15, 20, on up to 100. Each contestant can decide, in turn, whether to stop after one spin or spin again. Anyone who goes over 100 is out. A tie (which could be two way or three way) results in a one spin spinoff.

What is the best strategy? Specifically, what number should you stop on if you spin first? What if you spin second? (Obviously, if you are second, you take a second spin if your first spin does not match or exceed that achieved by the first spinner. But you need more strategy than that.) The third spinner only has to decide whether to stop if he or she ties someone.

Solution:

The first spinner should take a second spin if the first number is 65 or less. On best play, the overall odds of winning are 30.82% if this is done.

The second spinner should take a second spin if either (1) the first number is 50 or less, (2) the first number is less than the result from the first spinner, or (3) the first number ties the first spinner with that number being 65 or less. On best play, the overall odds of winning are 32.96% if this is done.

The third spinner should take a second spin if either (1) the first number is less than value needed to win, (2) the first spin ties both preceding spinners, if the tie is at 65 or less, or (3) the first spin ties only one previous spinner, if the tie is at 50 or less. (More precisely, if tied with only one previous spinner at 50, it makes no difference if a second spin is taken, or not. The odds of winning are 50/50 from that point either way.) On best play, the overall odds of winning are 36.22% if this is done.

Developing the strategy requires working backwards from the situation faced by Spinner 3. This spinner knows a value he must beat, and whether both previous spinners were tied at this value. The choices are whether to proceed or stop on a two-way or a three-way tie.

We first analyze the case where Spinner 3 has a strategy to stop on a tie at Spin 1. Here, a second spin is made only if Spinner 3 hadn't yet won or tied on the first spin.

To Beat	Spinner 3, Spin 1		Spinner 3, Spin 2, Hold on Tie				Total for Spin 2	Hold on Tie		
	Chance to Win	Chance to Tie	Chance to Be Under	Chance to Win	Chance to Tie	Chance to Over 100		Total		
								Chance to Win	Chance to Lose	Chance to Tie
0	1.00	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
5	0.95	0.05	0.0000	0.0000	0.0000	0.0000	0.0000	0.9500	0.0000	0.0500
10	0.90	0.05	0.0000	0.0450	0.0025	0.0025	0.0500	0.9450	0.0025	0.0525
15	0.85	0.05	0.0025	0.0850	0.0050	0.0075	0.1000	0.9350	0.0100	0.0550
20	0.80	0.05	0.0075	0.1200	0.0075	0.0150	0.1500	0.9200	0.0225	0.0575
25	0.75	0.05	0.0150	0.1500	0.0100	0.0250	0.2000	0.9000	0.0400	0.0600
30	0.70	0.05	0.0250	0.1750	0.0125	0.0375	0.2500	0.8750	0.0625	0.0625
35	0.65	0.05	0.0375	0.1950	0.0150	0.0525	0.3000	0.8450	0.0900	0.0650
40	0.60	0.05	0.0525	0.2100	0.0175	0.0700	0.3500	0.8100	0.1225	0.0675
45	0.55	0.05	0.0700	0.2200	0.0200	0.0900	0.4000	0.7700	0.1600	0.0700
50	0.50	0.05	0.0900	0.2250	0.0225	0.1125	0.4500	0.7250	0.2025	0.0725
55	0.45	0.05	0.1125	0.2250	0.0250	0.1375	0.5000	0.6750	0.2500	0.0750
60	0.40	0.05	0.1375	0.2200	0.0275	0.1650	0.5500	0.6200	0.3025	0.0775
65	0.35	0.05	0.1650	0.2100	0.0300	0.1950	0.6000	0.5600	0.3600	0.0800
70	0.30	0.05	0.1950	0.1950	0.0325	0.2275	0.6500	0.4950	0.4225	0.0825
75	0.25	0.05	0.2275	0.1750	0.0350	0.2625	0.7000	0.4250	0.4900	0.0850
80	0.20	0.05	0.2625	0.1500	0.0375	0.3000	0.7500	0.3500	0.5625	0.0875
85	0.15	0.05	0.3000	0.1200	0.0400	0.3400	0.8000	0.2700	0.6400	0.0900
90	0.10	0.05	0.3400	0.0850	0.0425	0.3825	0.8500	0.1850	0.7225	0.0925
95	0.05	0.05	0.3825	0.0450	0.0450	0.4275	0.9000	0.0950	0.8100	0.0950
100	0.00	0.05	0.4275	0.0000	0.0475	0.4750	0.9500	0.0000	0.9025	0.0975

Alternatively, Spinner 3 can continue on a tie at Spin 1.

To Beat	Spinner 3, Spin 1		Spinner 3, Spin 2, Continue on Tie				Total for Spin 2	Continue on Tie		
	Chance to Win	Chance to Tie	Chance to Be Under	Chance to Win	Chance to Tie	Chance to Over 100		Total		
								Chance to Win	Chance to Lose	Chance to Tie
0	1.00	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
5	0.95	0.05	0.0000	0.0475	0.0000	0.0025	0.0500	0.9975	0.0025	0.0000
10	0.90	0.05	0.0000	0.0900	0.0025	0.0075	0.1000	0.9900	0.0075	0.0025
15	0.85	0.05	0.0025	0.1275	0.0050	0.0150	0.1500	0.9775	0.0175	0.0050
20	0.80	0.05	0.0075	0.1600	0.0075	0.0250	0.2000	0.9600	0.0325	0.0075
25	0.75	0.05	0.0150	0.1875	0.0100	0.0375	0.2500	0.9375	0.0525	0.0100
30	0.70	0.05	0.0250	0.2100	0.0125	0.0525	0.3000	0.9100	0.0775	0.0125
35	0.65	0.05	0.0375	0.2275	0.0150	0.0700	0.3500	0.8775	0.1075	0.0150
40	0.60	0.05	0.0525	0.2400	0.0175	0.0900	0.4000	0.8400	0.1425	0.0175
45	0.55	0.05	0.0700	0.2475	0.0200	0.1125	0.4500	0.7975	0.1825	0.0200
50	0.50	0.05	0.0900	0.2500	0.0225	0.1375	0.5000	0.7500	0.2275	0.0225
55	0.45	0.05	0.1125	0.2475	0.0250	0.1650	0.5500	0.6975	0.2775	0.0250
60	0.40	0.05	0.1375	0.2400	0.0275	0.1950	0.6000	0.6400	0.3325	0.0275
65	0.35	0.05	0.1650	0.2275	0.0300	0.2275	0.6500	0.5775	0.3925	0.0300
70	0.30	0.05	0.1950	0.2100	0.0325	0.2625	0.7000	0.5100	0.4575	0.0325
75	0.25	0.05	0.2275	0.1875	0.0350	0.3000	0.7500	0.4375	0.5275	0.0350
80	0.20	0.05	0.2625	0.1600	0.0375	0.3400	0.8000	0.3600	0.6025	0.0375
85	0.15	0.05	0.3000	0.1275	0.0400	0.3825	0.8500	0.2775	0.6825	0.0400
90	0.10	0.05	0.3400	0.0900	0.0425	0.4275	0.9000	0.1900	0.7675	0.0425
95	0.05	0.05	0.3825	0.0475	0.0450	0.4750	0.9500	0.0975	0.8575	0.0450
100	0.00	0.05	0.4275	0.0000	0.0475	0.5250	1.0000	0.0000	0.9525	0.0475

A tie leads to a tie breaker, where each spinner has 50 % odds (on a two-way tie), or 33 % odds (on a three-way tie). From this, we see the chance for eventually winning in both cases, for both strategies. (Optimal strategy in green.)

To Beat	Two-Way Tie (50% Win on Tie Breaker)		Three-Way Tie (33% Win on Tie Breaker)		Chance to Win with Best Strategy		Chance to Lose with Best Strategy	
	Chance to Win on Hold Strategy	Chance to Win on Cont Strategy	Chance to Win on Hold Strategy	Chance to Win on Cont Strategy	Two-Way Tie	Three-Way Tie	Two-Way Tie	Three-Way Tie
	0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000
5	0.9750	0.9975	0.9667	0.9975	0.9975	0.9975	0.0025	0.0025
10	0.9713	0.9913	0.9625	0.9908	0.9913	0.9908	0.0088	0.0092
15	0.9625	0.9800	0.9533	0.9792	0.9800	0.9792	0.0200	0.0208
20	0.9488	0.9638	0.9392	0.9625	0.9638	0.9625	0.0362	0.0375
25	0.9300	0.9425	0.9200	0.9408	0.9425	0.9408	0.0575	0.0592
30	0.9063	0.9163	0.8958	0.9142	0.9163	0.9142	0.0838	0.0858
35	0.8775	0.8850	0.8667	0.8825	0.8850	0.8825	0.1150	0.1175
40	0.8438	0.8488	0.8325	0.8458	0.8488	0.8458	0.1513	0.1542
45	0.8050	0.8075	0.7933	0.8042	0.8075	0.8042	0.1925	0.1958
50	0.7613	0.7613	0.7492	0.7575	0.7613	0.7575	0.2388	0.2425
55	0.7125	0.7100	0.7000	0.7058	0.7125	0.7058	0.2875	0.2942
60	0.6588	0.6538	0.6458	0.6492	0.6588	0.6492	0.3413	0.3508
65	0.6000	0.5925	0.5867	0.5875	0.6000	0.5875	0.4000	0.4125
70	0.5363	0.5263	0.5225	0.5208	0.5363	0.5225	0.4638	0.4775
75	0.4675	0.4550	0.4533	0.4492	0.4675	0.4533	0.5325	0.5467
80	0.3938	0.3788	0.3792	0.3725	0.3938	0.3792	0.6063	0.6208
85	0.3150	0.2975	0.3000	0.2908	0.3150	0.3000	0.6850	0.7000
90	0.2313	0.2113	0.2158	0.2042	0.2313	0.2158	0.7688	0.7842
95	0.1425	0.1200	0.1267	0.1125	0.1425	0.1267	0.8575	0.8733
100	0.0488	0.0238	0.0325	0.0158	0.0488	0.0325	0.9513	0.9675

The third spinner should take an elective second spin on a two-way tie (if the first spin ties only one of the preceding spinners) if the tie is at 50 or less, and an elective second spin on a three-way tie (if the first spin ties both preceding spinners) if the tie is at 65 or less.

The second spinner must take a second spin if the first did not tie or exceed the score from the first spinner. However, when should he elect a second spin otherwise? If we assume for the moment that the first spin exceeded the previous score (which precludes the chance of a three-way tie), we know from the above the chance of Spinner 2 winning (which is the chance of Spinner 3 losing) for all outcomes of one and two spins.

Spin 1	Chance to Win if Stop	Spin 2, Probability to Win over Spinner 3 if Ahead of Spinner 1 After 1 Spin (Not Tied, and Won't Tie)																		Average Chance to Win		
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
5	0.0025	0.0088	0.0200	0.0362	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.3399
10	0.0088	0.0200	0.0362	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.3394
15	0.0200	0.0362	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.3384
20	0.0362	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.3366
25	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.3338
30	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3296
35	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3238
40	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3163
45	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3066
50	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2947
55	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2803
60	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2633
65	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2433
70	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2201
75	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1934
80	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1631
85	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1289
90	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0904
95	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0476
100	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The best strategy, highlighted in green, is to electively spin a second time if the first spin results in 50 or less.

When Spinner 2 ties with Spinner 1 after one spin, it is not enough to just win over Spinner 3. There is only a 50 % chance of ultimately winning over Spinner 1.

Spin 1	Chance to Win if Stop	Spin 2, Probability to Win over Spinner 3 if Tied with Spinner 1 After 1 Spin (Not Tied After 2 Spins)																		Average Chance to Win		
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90		95	100
5	0.0012	0.0088	0.0200	0.0362	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.3399
10	0.0046	0.0200	0.0362	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.3394
15	0.0104	0.0362	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.3384
20	0.0188	0.0575	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.3366
25	0.0296	0.0838	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.3338
30	0.0429	0.1150	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3296
35	0.0588	0.1513	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3238
40	0.0771	0.1925	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3163
45	0.0979	0.2388	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3066
50	0.1213	0.2875	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2947
55	0.1471	0.3413	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2803
60	0.1754	0.4000	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2633
65	0.2063	0.4638	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2433
70	0.2388	0.5325	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2201
75	0.2733	0.6063	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1934
80	0.3104	0.6850	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1631
85	0.3500	0.7688	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1289
90	0.3921	0.8575	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0904
95	0.4367	0.9513	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0476
100	0.4838	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Here, the best strategy, highlighted in green, is to electively spin a second time if the first spin results in 65 or less.

Given these strategies, we can deduce the probabilities of the various possible Total Spin outcomes for Spinner 2, given the “To Beat” value known from Spinner 1.

		SPINNER 2, CHANCES OF SPIN OUTCOME (TOTAL SPIN) WHEN EMPLOYING BEST STRATEGY																			
		To Beat (From Spinner 1)																			
Total Spin Spinner 2	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
15	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
20	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
25	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
30	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
35	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150	0.0150
40	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175	0.0175
45	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
50	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225	0.0225
55	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250
60	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0275	0.0275	0.0275	0.0275	0.0275	0.0275	0.0275	0.0275
65	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300
70	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0825	0.0825	0.0325	0.0325	0.0325	0.0325	0.0325	0.0325
75	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0825	0.0825	0.0850	0.0350	0.0350	0.0350	0.0350	0.0350
80	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0825	0.0825	0.0850	0.0875	0.0375	0.0375	0.0375	0.0375
85	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0825	0.0825	0.0850	0.0875	0.0900	0.0400	0.0400	0.0400
90	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0825	0.0825	0.0850	0.0875	0.0900	0.0925	0.0425	0.0425
95	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0825	0.0825	0.0850	0.0875	0.0900	0.0925	0.0950	0.0450
100	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0750	0.0775	0.0800	0.0825	0.0825	0.0850	0.0875	0.0900	0.0925	0.0950	0.0975
Over	0.1375	0.1375	0.1375	0.1375	0.1375	0.1375	0.1375	0.1375	0.1375	0.1375	0.1375	0.1375	0.1650	0.1950	0.2275	0.2275	0.2625	0.3000	0.3400	0.3825	0.4275
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

For each of these combinations, we also know the chance that Spinner 2 will win, and hence we know the overall probability that Spinner 2 will win for each possible To Beat value from Spinner 1.

		CHANCE OF SPINNER 2 WINNING, FOR A GIVEN TO-BEAT (from SPINNER 1) and SPIN TOTAL (from SPINNER 2)																			
		To Beat (From Spinner 1)																			
Total Spin Spinner 2	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
5	0.0025	0.0012																			
10	0.0088	0.0088	0.0046																		
15	0.0200	0.0200	0.0200	0.0104																	
20	0.0362	0.0362	0.0362	0.0362	0.0188																
25	0.0575	0.0575	0.0575	0.0575	0.0575	0.0296															
30	0.0838	0.0838	0.0838	0.0838	0.0838	0.0838	0.0429														
35	0.1150	0.1150	0.1150	0.1150	0.1150	0.1150	0.1150	0.0588													
40	0.1513	0.1513	0.1513	0.1513	0.1513	0.1513	0.1513	0.1513	0.0771												
45	0.1925	0.1925	0.1925	0.1925	0.1925	0.1925	0.1925	0.1925	0.1925	0.0979											
50	0.2388	0.2388	0.2388	0.2388	0.2388	0.2388	0.2388	0.2388	0.2388	0.2388	0.1213										
55	0.2875	0.2875	0.2875	0.2875	0.2875	0.2875	0.2875	0.2875	0.2875	0.2875	0.2875	0.1471									
60	0.3413	0.3413	0.3413	0.3413	0.3413	0.3413	0.3413	0.3413	0.3413	0.3413	0.3413	0.3413	0.1754								
65	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.2063							
70	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.4638	0.2388						
75	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.5325	0.2733					
80	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.6063	0.3104				
85	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.6850	0.3500			
90	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.7688	0.3921		
95	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.8575	0.4367	
100	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.9513	0.4838
Over																					
Spinner 2 Wins	0.4576	0.4576	0.4576	0.4576	0.4574	0.4570	0.4562	0.4548	0.4526	0.4494	0.4448	0.4382	0.4260	0.4076	0.3828	0.3521	0.3126	0.2635	0.2036	0.1319	0.0472

(The bottom-line totals are the dot product of the corresponding columns from the preceding two charts.)

Similarly, for each “To Beat” value from Spinner 1, we can compute the probability that Spinner 3 wins, and hence the probability that Spinner 1 wins.

		CHANCE OF SPINNER 3 WINNING, FOR A GIVEN TO-BEAT (from SPINNER 1) and SPIN TOTAL (from SPINNER 2)																					
		To Beat (From Spinner 1)																					
Total Spin Spinner 2		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
5	0.9975	0.9975	0.9913	0.9800	0.9638	0.9425	0.9163	0.8850	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
10	0.9913	0.9913	0.9908	0.9800	0.9638	0.9425	0.9163	0.8850	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
15	0.9800	0.9800	0.9800	0.9792	0.9638	0.9425	0.9163	0.8850	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
20	0.9638	0.9638	0.9638	0.9638	0.9625	0.9425	0.9163	0.8850	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
25	0.9425	0.9425	0.9425	0.9425	0.9425	0.9408	0.9163	0.8850	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
30	0.9163	0.9163	0.9163	0.9163	0.9163	0.9163	0.9142	0.8850	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
35	0.8850	0.8850	0.8850	0.8850	0.8850	0.8850	0.8850	0.8825	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
40	0.8488	0.8488	0.8488	0.8488	0.8488	0.8488	0.8488	0.8488	0.8458	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
45	0.8075	0.8075	0.8075	0.8075	0.8075	0.8075	0.8075	0.8075	0.8075	0.8042	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
50	0.7613	0.7613	0.7613	0.7613	0.7613	0.7613	0.7613	0.7613	0.7613	0.7575	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488			
55	0.7125	0.7125	0.7125	0.7125	0.7125	0.7125	0.7125	0.7125	0.7125	0.7125	0.7058	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488			
60	0.6588	0.6588	0.6588	0.6588	0.6588	0.6588	0.6588	0.6588	0.6588	0.6588	0.6492	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488				
65	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.5875	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
70	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5363	0.5225	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
75	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4675	0.4533	0.3938	0.3150	0.2313	0.1425	0.0488		
80	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938	0.3938		
85	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3150	0.3000	0.2313	0.1425	0.0488
90	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2313	0.2158	0.1425	0.0488
95	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1425	0.1267	0.0488	
100	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0488	0.0325	
Over	1.0000	0.9975	0.9913	0.9800	0.9638	0.9425	0.9163	0.8850	0.8488	0.8075	0.7613	0.7125	0.6588	0.6000	0.5363	0.4675	0.3938	0.3150	0.2313	0.1425	0.0488		
Spinner 3 Wins	0.5424	0.5420	0.5412	0.5396	0.5372	0.5340	0.5297	0.5242	0.5173	0.5087	0.4982	0.4784	0.4557	0.4293	0.4016	0.3638	0.3192	0.2666	0.2047	0.1321	0.0472		
Spinner 1 Wins	0.0000	0.0003	0.0012	0.0029	0.0054	0.0091	0.0141	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057		

This allows Spinner 1 to decide on strategy.

Spin 1	Chance to Win if Stop	Spinner 1, Spin 2, Probability to Win																				Average Chance to Win
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
5	0.0003	0.0012	0.0029	0.0054	0.0091	0.0141	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.2059
10	0.0012	0.0029	0.0054	0.0091	0.0141	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.2059
15	0.0029	0.0054	0.0091	0.0141	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.2057
20	0.0054	0.0091	0.0141	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.2055
25	0.0091	0.0141	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.2050
30	0.0141	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2043
35	0.0210	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2033
40	0.0301	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2018
45	0.0419	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1997
50	0.0570	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1968
55	0.0835	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1926
60	0.1183	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1867
65	0.1632	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1786
70	0.2156	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1678
75	0.2842	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1536
80	0.3682	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1352
85	0.4699	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1117
90	0.5917	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0821
95	0.7361	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0453
100	0.9057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The best strategy for Spinner 1 is to elect a second spin if the first is 65 or less.

Knowing that Spinner 1 will spin twice if the result of the first spin is 65 or less, we can compute the probabilities of each possible outcome from Spinner 1. Furthermore, we can compute the probability of each spinner winning.

Total Spin Spinner 1	Chance of Occurring	Chance of Winning
0 (Over)	0.2275	0.0000
5	0.0000	0.0003
10	0.0025	0.0012
15	0.0050	0.0029
20	0.0075	0.0054
25	0.0100	0.0091
30	0.0125	0.0141
35	0.0150	0.0210
40	0.0175	0.0301
45	0.0200	0.0419
50	0.0225	0.0570
55	0.0250	0.0835
60	0.0275	0.1183
65	0.0300	0.1632
70	0.0825	0.2156
75	0.0825	0.2842
80	0.0825	0.3682
85	0.0825	0.4699
90	0.0825	0.5917
95	0.0825	0.7361
100	0.0825	0.9057
Total	1.0000	
Chance Spinner 1 Wins		0.3082
Chance Spinner 2 Wins		0.3296
Chance Spinner 3 Wins		0.3622
	Total	1.0000